5. Listing of 6250 species

Here is referred to the CD

6. Special remarks

6.1. NUCULIDAE

NA1: No global review is available for this difficult family; the data is dispersed in many papers and books. Whereas Hanley (1860) and Sowerby II (1870-71, Reeve's Icon.) accepted less than 40 nuculids, currently approximately 170 species are recognized.

Furthermore, the grouping of Keen in Moore (1969) was not accepted by most subsequent authors. Today, different opinions persist in modern literature. A division in 2 subfamilies, as formally proposed by Maxwell (1988), applied earlier also by Hanley (1860), appears too simplified and was not followed by Coan et al. (2000) or by Beu (2006). Furthermore, *Sinonucula* is intermediate and *Acila* is not to place in this scheme.

Whereas most authors consider *Nucula* non-brooding, Bergmans (1978) and Kilburn (1999) mentioned brooding in a SA and two SAF species. Despite this highly unusual trait, these minute species have been placed in *Nucula* s.s. Overall, the understanding of this group seems to be just beginning.

A number of species do not fit properly in the widely accepted 3 main genera ***Nucula***, ***Ennucula*** and ***Acila***. For these additional genera and subgenera have been proposed, some are disputed, others accepted by authors.

Brevinucula, ***Austronucula***, ***Condylonucula***, all with smooth margins as summarized by Maxwell (1988), appear distinct enough to warrant generic distinction.

Polyodonta Megerle von Mühlfeld, 1811 type, MT *Polyodonta nucleus* is an objective synonym of *Nucula* s.s.

Lamellinucula was synonymized by Villarroel & Stuardo (1998) with *Nucula*, whereas Kilburn (1999) separated it. Following Schenck (1944), Maxwell (1988) and Coan et al. (2000) *Lamellinucula* is considered a useful grouping within *Nucula*; a generic distinction, however, is not justified. Here, *Lamellinucula* is applied as weak subgenus of *Nucula* for species with a strong, often irregular commarginal sculpture; otherwise the type species *nucleus* and *tamatavica* are quite close and anatomically almost identical. A couple of NZ and CAR species are closer to the type species of *Lamellinucula* than to *Nucula* and placed here. The European *sulcata* could be placed with good argument in both subgenera; it is here retained in *Nucula*.

Small nuculids are extremely difficult. Few species precisely agree with the type species of proposed (sub-) genera. Furthermore, the number of hinge teeth usually increases with age (e.g. *nucleus* from 2 to 25 teeth, GOF96); in addition, very minute specimens may even have a smooth margin, turning into crenulations with age. Going through Bergmans' and Thiele & Jaeckel's minute species, easily many new groups could be created. This, together with some intergrading traits in *Pronucula* and *Deminucula* might have led Bergmans (1978) to synonymize these as *Nucula*. Here, the large majority of species is placed in *Nucula* s.s. unless a strong resemblance to the type species of the following groups or the smooth margined *Austronucula* and *Condylonucula* has been found.

Pronucula is applied for minute, thin species with an arched dorsal margin, a small, vertical resilifer, a fine, and predominantly radial sculpture and, as pointed out by Maxwell (1988), with a unique periostracum with radial rows of tubular projections. Whereas Maxwell (1988) and Rhind & Allen (1991) attributed generic rank, Bergmans (1991) synonymized *Pronucula* with *Nucula* s.s. As otherwise the main criteria of *Nucula* (radial sculpture, crenulate margin) are met, *Pronucula* is here recognized as a subgenus. A generic rank seems, in light of Bergmans' arguments, exaggerated. As noted by Bergmans (1978) and Maxwell (1988) many species described as *Pronucula* belong to *Deminucula* or even to *Nucula*. *Pronucula* is here restricted to very few species closely resembling the type species.

Deminucula Iredale, 1931 was placed by McAlester in Moore (1969) as subgenus of *Tindaria*. However, this opinion was not supported by most subsequent authors. Iredale (1939) clearly documented the presence of a small chondrophore. Whereas Schenck (1939, i.e. *atacellana*), and especially Bergmans (1978), Salas (1996) and Lamprell & Healy (1998) considered it to be true *Nucula* s.s. Maxwell (1988) and Rhind & Allen (1992) attributed generic rank, based on weakly reticulate to almost smooth, robust, minute species with a very small chondrophore and a weak resilifer. A generic rank seems in light of Bergmans' arguments exaggerated. As otherwise the criteria of *Nucula* are met, *Deminucula* is here treated as a weak subgenus. Few species are placed here, close to the type.

Rumptunucula *vincentiana* is very close to the pronuculid *decorosa* and shares main traits with *Nucula*. However, it has a unique hinge configuration with a sunken chondrophore. Whereas Rhind & Allen (1992) did not treat it, Bergmans (1978) originally described *Rumptunucula* as a genus of its own, also recognized by Maxwell (1988). Gofas & Salas (1996) considered the teeth configuration as close to juvenile *nucleus*, but considered the deep notch posterior to the ligament as unique. *Rumptunucula* is here considered as further, monospecific subgenus within *Nucula*.

Linucula is also disputed. NZ authors consider it as of generic rank with a rich fossil community and have included here in addition to the NZ *recens* also the S. American *pisum*. Villarroel & Stuardo (1998) placed *pisum* back in *Nucula* and also placed the similar *fernandensis* there. Panamic authors have placed the cognate *declivis* with the same sculpture ever since in *Nucula* s.s. Beu (2006) did not treat *Linucula*. The unique subsurface sculpture is perceived as an easily recognizable trait in this large, conservative group and thus, *Linucula* is recognized as weak subgenus. In addition, all involved species are small, approximately

5 mm, ovate, and rather smooth. Nonetheless, whether the few species included here form indeed a natural group should be verified with modern methods.

N. gallinacea included by Powell in *Linucula* has been removed by Maxwell (1988) due to a quite distinct surface sculpture and *Varinucula* has been created. Modern NZ authors consider *Varinucula* as of full generic rank, whereas Bergmans (1991) considered the hinge as typical nuculid. As in *Linucula*, it is questionable whether the surface feature alone qualifies for generic distinction. As otherwise the main criteria for *Nucula* are met, ***Varinucula*** is included here subgenerically, currently as monospecific.

N. cyrenoides from China and Japan is indeed a special nuculid. Neither the unique, posterior smooth and anterior crenulate ventral margin, the coarse commarginal sculpture, nor the thick shell fits *Ennucula*, where Japanese authors placed it. *Ennucula* is otherwise a quite homogenous group. Xu (1985) created the monospecific *Sinonucula*, as subgenus of *Nucula*, with *cyrenoides* as type species OD. As *Sinonucula* does not fit in *Nucula*, ***Sinonucula*** is kept separate, placed in between *Nucula* and *Ennucula*. However, neither phylogenetic data, nor anatomical details are currently known.

N. pratasensis from China offers another unusual combination; the ventral margin is smooth as in *Ennucula*, but the surface is strongly, regularly commarginally ridged. As such, it is similar in the structural concept to the Jurassic *Nuculoma*, but distinct in shape, whereas the exact dentition and chondrophore in *Nuculoma* are presently not known. Furthermore, the shell is unusual light and very fragile and the posterior teeth very few and small, a clear chondrophore is present and adjacent. Lan & Lee (2001) created for this deep water species ***Neonucula*** and placed it as *Lamellinucula* (*Neonucula*). However, *Lamellinucula* is very close to *Nucula*, whereas *pratasensis* is closer to *Ennucula*. ***Neonucula*** is kept generically separate, placed close to *Ennucula*. Neither phylogenetic data, nor anatomical details are known.

NA2: ***Nucula***: Altena (1971) compared *venezuelana* with the type material of *crenulata* and considered them distinct. Earlier, Weisbord (1964) compared his *venezuelana* with all American *Lamellinucula*. However, neither compared *venezuelana* with *semiornata* known from Brazil to Argentina. Here, *venezuelana* is considered indistinguishable and synonymous to ***semiornata***. Rios (1994, sp. 1109) is *semiornata*. However, ***surinamensis*** (Rios, 1994 sp. 1110) is a distinct smaller species.

N. crenulata as well as ***N. culebrensis*** are both distinct, less oblique, live deeper and northern. Smith (1885) did not compare his *culebrensis* with the earlier *crenulata*. Dall (1890) and Rios (1994) synonymized *culebrensis* with *crenulata*. Rhind and Allen (1992) kept them distinct and mentioned tubercles surrounding the lunule in *culebrensis*. A comparison of the BMNH type material supports Rhind and Allen's view. In addition, the slightly smaller *culebrensis* appears to have a rougher dentition with fewer teeth and rougher sculpture with fewer commarginal ribs.

The Southern *N. semiornata* and the Northern *N. crenulata* and *culebrensis*, as well as the Panamic *N. exigua* are best placed in *Lamellinucula*; *N. surinamensis* with a thin, ovate shell and a virtually absent resilifer is close to *Pronucula*, quite similar to the type species *decorosa*. *Nucula pisum* is a distinct species and occurs further south.

Schenck (1939) renamed ***N. uruguayensis*** Marshall, 1928 non Smith, 1880 described from a single left valve from Uruguay, Maldonado as *N.* (*N.*) *marshalli*; he compared it with *sculpturata* and *crenulata*, and noted closest to *exigua*, but he did not compare with *semiornata*. However, the only shallow lamellinuculid reliably known from this area is Orbigny's *semiornata* which is indeed close to *exigua*. Marshall's OD and picture fit Brazilian and Argentinean *semiornata* studied well. Currently, I see no arguments to keep these two distinct as proposed by Scarabino (2003).

Schenck (1944) synonymized ***N. paytensis*** from N. Peru in the earlier *N. exigua*, a view shared. However, the species illustrated by Keen, (1971) as *paytensis* from N. Peru appears distinct, and seems to represent a Panamic *Lamellinucula*, as yet undescribed.

The rare ***Nucula taeniolata*** from Acapulco has according to its OD a smooth internal margin and should be placed in *Ennucula*.

There is no need to consider the Japanese ***gemmulata*** as subspecies of *torresi*; both are sufficiently distinct in dentition (Lamprell & Healy, 1998 sp. 3). On the other hand, *tokyoensis* appears to be a somewhat variable species in shape and it might well be that *gemmulata* is based on a more trigonal juvenile. At least Habe (1971)'s statement that *gemmulata* does not exceed 3 mm does not conform to Okutani (2000), who recorded it as 6 mm. The type is depicted in HIG01 B4. The largest *tokyoensis* occur in Taiwanese waters (LAN011).

Nolf (2005) described ***Nucula mariae*** from Angola, formerly confounded with the similar *N. sulcata*. Whereas specimens from Mauritania are still *sulcata*, specimens from Central Senegal, Cayar, 100 m fit Nolf's analysis well, enlarging the range of *mariae* significantly northwards.

Nucula nitida was used for a well known small, glossy European nuculid until Winckworth (1930) recognized it as preoccupied and replaced it by *nitidosa*. However, Jeffreys, 1879 named earlier a somewhat more inflated Med species *nitida* var. ***ventrosa***. This name has been validly proposed, the type material is available BMNH 85.11.5.252-258 (WAR80), the name was used after 1899 (CLEMAM, 2006 as syn. of *nitida*) and it is not preoccupied (SHE). However, examination of the BMNH type material revealed identity of *ventrosa* with *N. nucleus*, comparable to specimens known from Italy. As such ***nitidosa*** stands.

N. kerguelensis is an often neglected Antarctic nuculid; the holotype is in MfN (ZMB). It should be compared to *austrobenthalis* and *falklandica*, which are both recorded from Antarctic waters as well.

Nucula striolata has originally been described from the Chinese Sea, as *Nucula* with a crenulate margin, rather smooth surface and the umbones rather acute. Sowerby II (1870, Reeve's Icon.) placed it without argument in New Zealand. It was not recognized by NZ or Chinese authors. 4 BMNH syntypes of *striolata*, up to 7.6 mm are still present. These are perceived as closest to *N. paulula*, but growing larger. The identity of this species and its distribution are at present unknown.

I fail to recognize the differences noted by Jaeckel & Thiele (1931) between their *somaliensis* and the earlier named ***consentanea*** as significant. Admittedly, the picture in Melvill & Standen (1907) is not very accurate, but Oliver (1995 sp. 897) well depicted this species.

Prashad (1932) did not compare his Indonesian species with Thiele & Jaeckel (1931)'s Indonesian records. His *nimbosa* appears to be the same as their ***semen*** and his *rugifera* seems to be their ***papillifera***.

Kilburn (1999 p. 248) approached Thiele & Jaeckel's ***N. sumatrana*** to his *rhytidopleura*, assuming it to be also a *Lamellinucula*. However, the MfN syntypes 70101-2 turned out to be nuculid, having a much stronger radial sculpture than originally drawn. Furthermore, the small specimens from bathyal depths proved to be indistinguishable from Smith's earlier, widely distributed and larger ***donaciformis*** and are here synonymized.

Sowerby's ***rugulosa*** has been described as minute species without locality. Prashad (1933) presented a convincing case that this is a small *Lamellinucula* from the Persian Gulf, fitting Sowerby's OD well. Schenck (1939) considered Prashad's and Melvill & Standen (1907)'s identifications as probably correct. In the Persian Gulf there occurs indeed a small *Lamellinucula*, which is similar to *tamatavica*. It has a comparable sculpture with "rugulose striae" as *tamatavica* and shares the "central elevation" on the shorter side mentioned by Sowerby. However, it remains smaller, not reaching half of the 20 mm Madagascar *tamatavica*. Furthermore, in equal sized specimens, *rugulosa* is more trigonal, than the quite oblique *tamatavica*. The possible type material of *rugulosa* in BMNH is dubious. It is on the same tablet as a Med *nucleus*, and is not marked as holotype; it further bears no indication of origin or locality. Schenck (1939) did not select any type and was insecure regarding relations of *rugulosa*. Prashad (1933) reviewed the Indian nuculids, his fig. 11 from the Persian Gulf and his description are clear and fit the OD of Sowerby precisely. Prashad's action is understood as neotype selection. Thus, *rugulosa* is considered a valid lamellinuculid, found in Arabian waters. It may be that *Nucula* cf. *tamatavica* from the S. Red Sea, mentioned by Dekker & Orlin (2000) is this species. In Arabia (28, MEL07) there is a further small *Lamellinucula* present, which should be described, if indeed distinct from *tamatavica* and *rugulosa*.

Okutani (1975 and 2000) identified thick, stout, 8 mm, abyssal specimens from Izu Islands as Prashad's thin, moderately inflated 4.7 mm, bathyal ***exodonta***. To ascertain identity, a comparison with the type species seems necessary. Prashad (1932 and 1933) did not differentiate between *Nucula* and *Ennucula*.

Nucula nana Hinds, 1843 from Phil, Mindanao is preoccupied by Römer, 1841 (= fossil, Germany, SHE). The type seems lost, but specimens closely fitting Hinds' OD are known from the Philippines. It is a minute, white, oblique nuculid, almost smooth with commarginal striae, margins crenulate, 2 mm, and occurs from about 10 to 40 m. It should be redescribed.

NA3: ***Brevinucula***: Whereas Rhind & Allen (1992) somewhat reluctantly synonymized ***aequalitas*** with *verrillii*, Kilburn (1999) could not find any significant differences and confirmed identity.

Rhind & Allen described a new species ***subtriangularis*** uniquely found in the Brazil Basin. The most significant feature apart from shallower bathymetric range is shape, higher than long, whereas *verrillii* is usually considered longer than high. Bernard's *aequalitas* is also longer than high, but has been found in similar bathyal depths 500 - 1000 as *subtriangularis*. *B. verrillii* is mainly known as abyssal species, with few records below 2000 m. Thus, two options remain, either two similar brevinuculids exist, one broader, the other narrower and usually deeper or *verrillii* is a quite variable species with a large bathymetric range.

Considering Knudsen (1970)'s data for the abyssal *verrillii*, then all combinations, higher than long, longer than high and equal are found. Consequently, the latter option is more likely and *Brevinucula* is here considered monospecific.

NA4: ***Austronucula***. The three related Australian species ***australiensis***, ***brongersmai*** and ***papuensis*** appear close to the type species *A. schencki* and are placed here.

Following Palazzi & Villari (1995) and Repetto et al. (2005), I see no reason to consider Gofas & Salas ***recondita*** other than synonymous to Monterosato's earlier ***perminima***. Palazzi &Villari demonstrated the variability in subtidal Italian caves well. *A. perminima* appears to be an adult species with a maximum size of about 2 mm, a smooth margin, an ovate shape, a trigonal, central chondrophore and prominent umbones. As concluded by Gofas & Salas (1996) it does not fit in *Nucula*, but it shares some traits with *Austronucula* and is tentatively placed here. The type material of Locard's *minutissima* should be compared to ascertain, whether this is a further synonym.

Hayami & Kase's ***insignis***, also from subtidal caves, with a similar size has a crenulate margin, a stronger dentition and a unique prodissoconch. It does not match here. It was originally placed in *Pronucula*, but does not conform well to the Australian type species either. At present, it is considered *Nucula* s.l.

On the other hand, ***Nucula bicornis*** appears in shape, sculpture, smooth ventral margin, size and dentition much closer to Moore's Caribbean *Condylonucula* than to the type species of *Nucula*. Admittedly, the prodissoconch is not identical. On the other hand, I am not convinced that *bicornis* and *perminima* are congeneric as proposed by authors. These small nuculids definitely need much more work.

NA5: ***Ennucula***: *Nuculoma* Cossmann, 1907 is morphologically a quite distinct genus; *Leionucula* Quenstedt, 1930 is somewhat closer, but both appear better applied for extinct taxa only. *Ennucula* is used here for the larger, usually glossy, ovate species with smooth margin, following Iredale (1939), Maxwell (1988), Gofas & Salas (1996) and Beu (2006).

Whereas Schenck (1936 and 1939) and Lubinsky (1980) kept ***bellottii*** distinct from the European *tenuis*, Coan et al. (2000) and CLEMAM synonymized. This latter view is followed. *E. tenuis* appears highly variable in shape, from almost ovate to elongate, widely distributed in arctic and boreal waters. Schenck (1939) has illustrated many types of the involved forms.

In American literature ***N. aegeensis*** is often cited, living from N. Carolina to Florida and the WInd, sometimes to Brazil. However, as mentioned by Rhind & Allen (1992) the characteristics (e.g. in Abbott, 1974) do not fit. *E. aegeensis* is an *Ennucula* with a smooth margin restricted to the MED. Hanley (1860) discussed and depicted a specimen received from Forbes. Salas, 1996 illustrated a further specimen. The Northern US *Ennucula* material should be compared to *E. corbuloides* known from Virg, the Southern material is usually referable to *E. dalmasi* (see REG71, DIA94).

The latter commonly occurs from E. Panama, Colombia, Venezuela, and Suriname to at least Trinidad. Abbott's sp. 4791 with a weak commarginal sculpture and a crenulate margin seems identical to Redfern's sp. 812 from the Bahamas. This appears to represent a rather shallow, fragile *Nucula*, as yet **undescribed**.

Weisbord, 1964 compared his ***N.*** (***E.***) ***mareana*** with some *Ennucula*, but not with the earlier *dalmasi* described from the same locality. Comparing with *dalmasi* I fail to recognize *mareana* as distinct.

Nucula fragilis Thiele & Jaeckel, 1931 is preoccupied by the fossil species of Deshayes, 1829 from the Paris Basin (SHE). Here ***Ennucula jaeckeli*** is proposed as nom. nov., named after one of the original authors. The original type locality is Tanzania, Daressalam, 6.6°S, 39.6°E. 3 syntypic valves are in ZMB 70090. This species has been discussed by Kilburn (1999) and Boshoff's *fragilis* has been synonymized. *Ennucula jaeckeli* is very close to *E. niponica* from Japan to the Philippines. However, as no additional records are currently known from Indonesia or the Central Indian Ocean, these two species are kept distinct.

Prashad's ***E. dautzenbergi*** is considered distinct from *superba*, being smaller, with fewer teeth and living bathyal. *Superba* is a mainly subtidal species and one of the largest *Ennucula* known. Prashad characterized *superba* and found it in also Indonesian shallow waters. On the other hand, Iredale's ***E. compar*** from Qld, Turtle Island is considered within the variability seen in *superba* following here Lamprell & Healy (1998).

E. astricta was originally created by Iredale as nom. nov. *Nucula simplex* A. Adams, 1856 non Deshayes, 1842 (= foss.). However, Beu (2006) has demonstrated that Adam's *simplex* is instead the same as Lamarck's *obliqua* and that Iredale's *astricta* is a distinct species with separate type material; a paralectotype is depicted in Lamprell & Healy (1998 sp. 18).

The OD of ***orekta*** Iredale, 1939 does not match the specimen depicted under this name by Lamprell & Healy (1998 sp. 20) well. Iredale's figure shows a quite distinct shape anterior and less produced posterior, whereas Lamprell's figure approaches a juvenile *astricta*.

Kilburn described ***oliva*** from SAF. The related ***siberutensis*** from Indonesia has a broad dentition as well, but a much smaller resilifer. Exactly this latter configuration is found in specimens known from Hainan and from Taiwan. Furthermore, the Chinese specimens are in size intermediate between the largest *siberutensis* 7 mm and the Japanese type species of *teramachii* 5 mm. Obviously, *teramachii* represents a small *siberutensis*.

Despite Knudsen (1967)'s statement I am not convinced that ***mirifica*** from Hokkaido is the same as *bengalensis*. Modern Japanese authors keep them distinct. The type of *mirifica* is depicted in HIG01 B18. Habe & Ito (1965 pl. 34 figs. 8-10) portray its variability well. The type of *bengalensis* is depicted in Prashad (1933 fig. 1). *E. mirifica* has a quite consistent, very dark periostracum in adults, more solid valves; fresh specimens are glossy bluish inside. ***Bengalensis*** is, as originally described, close to *strangei*. However, it is more fragile, the periostracum olive green and silvery inside. Westwards, *E. mirifica* is restricted to the East China Sea; whereas *bengalensis* is only reliably recorded from the Indian Ocean. *Strangei* is currently known from sublittoral NZ. The latter is well depicted and compared to *obliqua* by Beu (2006). Bergmans (1991)'s enigmatic bathyal *strangei* record from New Caledonia should be compared to Prashad's species (e.g. *dautzenbergi*, *bathybia*).

Hanley (1860) and later Prashad (1933) analysed the small, ovate, inflated ***convexa*** and noted a smooth margin, placing it among ***Ennucula***. Hanley synonymized Hind's *tumida* from the Malacca Strait, but Prashad (1933) removed *tumida* from this synonymy and defined the smaller "*tumida"* less inflated, with fewer teeth and somewhat distinct in shape. However, Prashad's figures do not conform to Hind's OD which fits *convexa* quite well. Thus, Hanley's view is followed. It may be that Prashad's no. 13 is a distinct species, whereas his no. 14 appears to be a juvenile *convexa*. For *convexa* Prashad confirmed the range from Sri Lanka to China. LAN011 depicted a specimen from Taiwan. *Convexa* is a comparatively common shallow water species widely distributed. It is likely that Gulf of Thailand *layardii* records are this species.

Adam's ***layardii*** is close to *convexa*, but thinner, less ventricose and with a stronger dentition. At present, *layardii* seems restricted to the NW. Indian Ocean. It is well depicted in Oliver (1995 sp. 899).

Hinds' ***cumingi*** grows almost twice the size of *convexa* and is less broad and more oblique. *E. cumingii* is well depicted in Lamprell & Healy (1998 sp. 16). It is found from tropical Australia to China. Based on type material Lamprell & Healy synonymized *loringi* from Keppel Bay. Prashad (1933) depicted Preston's holotype of *semiramisensis* and considered it distinct from *convexa* and *layardii*. However, he did not include *cumingii* into his comparison. Preston's oblique, shallow water *Ennucula semiramisensis* from Andaman Isl. is very close and probably synonymous to *cumingii*.

From the various OD's involved and the material depicted by Bergmans (1979) it is not excluded that ***E. flindersi*** is the same as *dilecta*; whereas *diaphana* is a similar, but distinct tropical species, larger, thinner, and with a stronger dentition, but also a smooth margin.

NA6: ***Acila***: Schenck (1936) is important, many types are illustrated. However, Schenck's basic assumption that *divaricata* is a juvenile of *mirabilis* is erroneous, as well argued by Xu (1985). Instead, the type species of *Acila* ***divaricata*** originally described from China is smaller, generally less than 20 mm, with weaker ribbing, less rostrate posteriorly, with a very fine, regular ribbing on the inner ventral margin, as noted by Hinds (1843). *Divaricata* is distributed in Philippine and Chinese waters, not found in Japan, or in Russia. Schenck's *ssp. balabacensis* from the Philippines is a typical *divaricata*. In Japan the much larger, strongly rostrate, internally weakly crenulate ***mirabilis*** is found. *A. mirabilis* is somewhat variable in convexity, thickness and rostration and received many synonyms (e.g. *sculpta*, *schencki*, *submirabilis* Schenck (Honshu), or *archibenthalis*). Usually, deeper water specimens are less solid. Smith (1892) revised *divaricata* and *mirabilis* as distinct as well; Zhongyan (2004) depicted and characterized both species. Yokoyama (1920) and Taki (1951) had it right, but subsequent Japanese authors confused. In central Japan only *mirabilis* is found, in Taiwan both species exist. It further appears that the specimens depicted from Indonesia, Bali Sea (KNU67 fig. 4 as *divaricata* from 1150 m) and from Sulawesi (SCHE36 fig. 8, 14-15 as *submirabilis*, 990-1470 m) are indeed close to true *mirabilis*. However, as far as is known, true *mirabilis* has as yet not been reported from Philippine waters. Thus, a comparison with modern molecular methods would be helpful to ascertain identity of the Indonesian specimens.

The large, biogeographically restricted ***vigilia***, with a strong black periostracum in fresh specimens, appears distinct enough to be considered a valid species. It occurs in Northern Honshu, Russia and northwards. *Vigilia* is indeed somewhat closer to *divaricata* than to *mirabilis* and by far the largest *Acila* known, almost twice the size of *mirabilis*.

Although similar in shape, the strong granulation of Smith's ***granulata*** is not found in Thiele & Jaeckel's *jucunda*. Both are considered rare, but valid *Truncacila* species. The largest ***jucunda*** studied from 800 m, Mozambique Channel measured 20.4 mm. Ray's *N.* (*A.*) *prestoni* from the Indian Ocean is the same as *jucunda*. Ray (1952) gives good differentiating characteristics towards *granulata* and *fultoni*.

Whereas Knudsen (1967) synonymized 5 distinct species as *divaricata*, here 9 *Acila* species are recognized.

6.2 SAREPTIDAE

NB1: Obviously, the grouping presented here is tentative. Many species are poorly known and were never anatomically analyzed. No genetic comparisons are known. However, there are traits shared by *Pristigloma*, *Setiglom*a and *Sarepta* not present in other protobranchs (see OCK98, Coan et al., 2000). *Setigloma* and *Sarepta* have been considered very close by Ockelmann & Warén (1998), whereas Schileyko considered *Setigloma* and *Pristigloma* as related.

Ockelmann & Warén also doubted the former inclusion of this group in NUCULOIDEA. Coan et al. consequently considered PRISTIGLOMOIDEA Sanders & Allen, 1973 as having superfamilial status, clearly distinct from nuculids. Due to the inclusion of sareptids, the older name **SAREPTIDAE** Stoliczka, 1870 (**NOMC**) is here applied, PRISTOGLOMIDAE Sanders & Allen, 1973 is a synonym.

Ockelmann & Warén (1998) concluded, that ***Phaseolus*** Monterosato, 1875, type MT, *Phaseolus ovatus* "Jeffreys" Seguenza, 1877 is fossil only. Consequently, PHASEOLIDAE Scarlato & Starobogatov in Nevesskaia et al., 1971 is considered a fossil family without extant members, related to the nuculanid LAMETILIDAE and SILICULIDAE.

Furthermore, Ockelmann & Warén (1998) removed ***Microgloma***, originally placed here by Sanders & Allen, 1973, and noted a close relation to nuculanids, especially to *Yoldiella*. Following CLEMAM *Microgloma* is very tentatively included in YOLDIIDAE. However, the reproduction mode, monoecious and brooding, is unique in yoldiids and leaves doubts whether this placement is correct.

Smith, 1885 described ***Glomus simplex*** from the West Indies, 715 m, excluded from *Pristigloma* by Sanders & Allen (1973). Indeed, Smith's species fits better in *Setigloma*. Okutani, 1983 described from nearby Suriname *S. surinamensis* from almost the same depth; he did not compare with Caribbean material. Okutani noted close to *japonica*, the type species OD of *Setigloma*. However, biogeography, depth, morphology in shape, umbones and dentition strongly imply that *surinamensis* is the adult form of *simplex*.

P*. *minima: Warén (1980) concluded *Leda subrotunda* Jeffreys, 1874 as n.n. but the same as Seguenza's *minima*. Clark (1962) reported *minima* from 20-2630 m in Norbas, Eurbas, and Canbas. Repetto et al. (2005) depicted a 2 mm species from the Western Mediterranean, which might be a *Pristigloma*. CLEMAM only lists *nitens* from European waters. Whether *minima* is the same, or a distinct species, or only occurs as fossil could not be ascertained. For the time being the Mediterranean form is listed as *minima*.

Sarepta natalensis minute, ovate, with a divided unequal, but robust dentition, a pit under the ligament and an oblique resilifer appears sareptid, but does not fit any of the known genera. However, as anatomy is not known, the definition of a new genus must await further finds.

Pseudoglomus does not belong here, as demonstrated by Ockelmann & Warén (1998). On the other hand, ***Pseudoglomus fragilis*** with a divided dentition, a small resilifer and an ovate shape appears indeed sareptid, but it is not a *Pseudoglomus*. It does not fit any of the known genera. However, a new genus requires additional finds and anatomical analyses.

6.3 SOLEMYIDAE

NH1: ***Solemya***: The number of solemyiids currently recorded is more than 26 species. Many deep water records, especially in the Atlantic (e.g. SAL96, GAR04) indicate, that the number of living species may well be at, or in excess of, 30 species.

Sowerby II (1875) depicted the 5 best known species. Vokes (1955) treated this family and served as base. However, in some of his conclusions and in the number of species, changes became necessary. At present, genetic data and relations are lacking.

The taxonomy in modern literature is difficult, mainly due to a misinterpretation of the type species *togata*. Furthermore, a new subgenus in *Solemya* becomes necessary and is here proposed.

If only the outside morphology is compared, the Med *S. togata* is very close to *S. australis*, but the hinge configuration is distinct. Superspecifically, the position of the ligament is used for grouping, following here Vokes. On the other hand, the presence of internal ridges beneath the chondrophores is deceptive; these are found in two subgenera, and also increase by size/growth.

2 genera are usually differentiated as follows:

- If the ligament is completely external, and the valves are large and anteriorly broad and truncate, with extended marginal fringes, and the species lives bathyal to abyssal, then ***Acharax*** fits perfectly.
- If the species is smaller, the valves ovate and the fringes moderate, the species lives shallower and the ligament is internal, then ***Solemya*** in the traditional view fits.

Within *Solemya* two base conditions can be differentiated. First, the ligament is completely posterior to the umbones

(= opisthodetic) or second, the ligament is divided in an anterior and posterior portion (= amphidetic). The complete posterior ligament position is only found in ***Petrasma***.

The divided ligament is found in ***Solemya*** and ***Solemyarina***. This division is strongly expressed in *S. australis*, and very weakly, with an oblique anterior slit only, in *S. togata* (Cox in Moore, 1969 depicted these two extremes well); the NZ *S. pervernicosa* is in between, with a weak anterior radial ligament portion, but closer to *Solemya*. Iredale, 1939 created *Zesolemya* for the NZ species. However, he also noted (1939, p. 233) the small Australian *Solemyarina* species in ligament structure closer to *pervernicosa* than to *australis*. Virtually, Iredale named the same configuration twice, whereas the most distinct of the 4 involved NZ/Australian species, namely *australis* remained unseparated. However, *australis* shares other traits with *pervernicosa* and a separation does not seem warranted. *Zesolemya* has been synonymized by virtually all authors, especially so by Cox in Moore (1969).

Dall (1908) and Vokes (1955) did not accept a separation of *Solemyarina* and placed all solemyarinids, due to their amphidetic ligament in *Solemya*. However, the justification to accept ***Solemyarina*** here as distinct is the further presence of internal ridges, descending from the chondrophore, not found in typical *Solemya*, and, more importantly, the *Solemyarina*-group is biogeographically restricted to Australia and NZ, whereas *Solemya* is Atlantic only.

This enforcement of the chondrophore by an enlargement into an internal ridge is well visible also in larger *Petrasma* species, e.g. *borealis*, *panamensis* or *atacama*, but it is not, or much weaker, found in the smaller species e.g. *valvulus* or in the cognate *velum*. However, no attempt has ever been undertaken to separte internally ridged and unridged *Petrasma*; there only the posterior position of the ligament is decisive.

Thus, 3 *Solemya* subgenera may be discerned:

Petrasma with internal ligament completely posterior, internally ridged or not;

Solemyarina with internal ligament portion divided and ridged and NZ/Australia;

Solemya with internal ligament portion divided without ridge and E. Atlantic only.

Solemyarina and *Solemya* are biogeographically restricted; *Petrasma* is widely distributed, and is the most common form. At present, a generic distinction proposed by authors is not substantiated. This requires additional anatomical and/or genetic differences.

Solemya* (*Solemya*) *tagiri Okutani et al., 2003 from sublittoral Kyushu described originally as *Solemya* s.s. is a *Petrasma*, with the ligament portion posterior and similar to the small American *Petrasma* species without an internal ridge.

***Solemya* (*Solemya*)** reidi Bernard, 1980 from bathyal Oregon is also a *Petrasma*. No anterior ligament portion appears present, but a radial strengthening rib. Both features are not found in *Solemya* s.s. Furthermore, *reidi* resembles *panamensis*, which is another typical *Petrasma*, originally described so and also placed there by Vokes (1955).

Solemya* (*Petrasma*) *atacama *from* Peru has a similar shape as *valvulus*, but a hinge configuration with a posterior ligament and an internal enforcement as in the larger and broader *panamensis*. As originally described, it appears as valid, sublittoral *Petrasma* from Peruvan waters.

The large SE. African ***S. africana*** was not placed by Vokes (1955). Kilburn (1975) analyzed this species, originally described from S. Mozambique, Querimba Isl., and placed it in *Petrasma*. Specimens studied from SW. Madagascar, Tulear area and SAF, East London conform well to Martens' OD with a posterior ligament and support this assessement. *S. africana* is together with *togata* the largest *Solemya* recorded. Exceptionally, both extend more than 90 mm. Kilburn, gave localities for *africana* from Mozambique to Natal, Durban. Here a range extension West to East London and East to Madagascar is added. Furthermore, another large specimen studied has been labeled Kenya, Shimoni Bay and may indicate an even further northward extension.

Prashad (1932) recorded a 27 mm, shallow water ***S.* (*Acharax*) *winckworthi*** from SW. India, Gulf of Mannar. As indicated by Kilburn (1974) there is no doubt that this species is instead a *Solemya*. Neither ovate shape, small size, living in a depth of 5 m, nor hinge with internal ligament, is similar to *Acharax*. The hinge configuration points into *Petrasma*. As noted by Kilburn the main difference to *africana*, apart from biogeography, is the smaller size, and especially the shape: the more arched dorsal part and the more pointedly rounded anterior portion. Instead, the dorsal and ventral portion run parallel in juvenile *africana*. Furthermore, all *africana* specimens studied have been in deep brown, almost black color, paler umbonally, whereas Prashad's species is olivaceous brown. Oliver (1995 sp. 895) reported *africana* from Arabia. Whereas part of his description (dark perio with faint radial rays) and the shape of the upper specimen point in direction *africana*, the bottom specimen and part of his description (shiny olive brown perio) point to *winckworthi*. It is currently not clear which specimen came from Arabian waters, but *winckworthi* seems more likely.

Kilburn (1994) reported true ***togata*** along the WAF coast to False Bay. In addition, most of Barnard (1964)'s *orientalis* records concern this species. Specimens analyzed from False Bay show indeed the unique base hinge configuration of *Solemya* s.s., a large posterior ligament portion, a slit-like anterior ligament portion. Also in shape and color these False Bay specimens approach the Med *togata*. However, there are differences. The direction of the anterior ligament portion is anterior and not, as typically in *togata* posterior and almost parallel to the chondrophore. The maximum size reported for any SAF «*togata*» is 38 mm (BA64), whereas the Med *togata* grows more than 90 mm. Furthermore, the impression of the muscle scars differs. Unfortunately, WAF *togata*, reported from Mauritania (Nicklès, 1950), Senegal (Marche-Marchad, 1958), Gabon (Bernard,1984) and Angola (Gofas et al., 1986) could not be studied, and SAF material is scarce, thus, for the time being Kilburn (1994) is followed. Nonetheless, it is not excluded that a second true as yet undescribed *Solemya* is present in SAF-waters.

The Australian ***S. velesiana*** and ***S. terraereginae*** are difficult. In 1929, Iredale described and depicted on pl. 30 fig. 13 an 11 mm *S. terraereginae* from N. Queensland, with a «hinge normal». In 1931, he noted the type locality of the depicted species as of Cairns, Green Isl. and located *terraereginae* from Torres Strait to the Capricorn

Group. In 1931, he described the Sydney Harbour shell *S. velesiana* and noted it more like the Queensland shell, than the larger *australis*, but more «dilated anteriorly and more closely ribbed posteriorly». Iredale gave neither size nor picture. In 1962, Iredale and McMichael noted *velesiana* from «Sydney Harbour, NSW. Not figured. Cf. Iredale, 1929 pl. 30, fig. 13 (*terraereginae*, Qld)». Lamprell & Healy (1998) only depicted *velesiana* from NSW and synonymized *terraereginae* with *australis*. However, Allan (1962) and Beesley et al. (1998) considered both as valid species, a course followed here. Comparing Iredale's Qld *terrareginae* with Lamprell & Healy's NSW *velesiana* it appears indeed, that the Sydney species is broader than the northern species. Both seem uncommon and approximately 10 mm. Beesly et al. (1998) reported *terraereginae*, or at least a closely similar species also from WA. The synonymization of the small tropical *terraereginae* with the large temperate *australis* by Lamprell & Healy (1998) is considered erroneous.

In addition, the placement of ***australis*** in *Solemya* by Lamprell & Healy (1998) is not shared. The hinge differences in *togata* and *australis* are quite significant. Furthermore, a Qld or NSW presence of *australis* as noted by Lamprell & Healy (1998) could not be confirmed, nor was it reported by any Australian author before. Their statement is likely due to an erroneous synonymization of *terraereginae*.

NH2: ***Acharax***. In the Magellanic region, 2 species occur (Forcelli, 2000). One is usually named *A. macrodactyla* (Rochebrune & Mabille 1889), the other ***A. patagonica*** (Smith 1885). However, from the original descriptions and pictures, there is little doubt that *A. macrodactyla* is only a larger specimen of Smith's earlier *patagonica*. Both have been described from nearby localities and share the typical broad anterior portion, found in *Acharax*. Soot-Ryen (1959) came to a similar conclusion, and Dell (1995) confirmed this synonymy. I also fail to recognize the *Acharax* sp. of Villarroel & Stuardo (1998) as other than a juvenile *patagonica*. A distribution of *patagonica* in Brazil, as proposed by Rios (1994), could not be verified.

In addition to *patagonica*, a second MAG species occurs. This is illustrated by Forcelli (2000 sp. 450, erroneously as *patagonica*). This second species grows only about half the size of true *patagonica* and lives much shallower. The shape is ovate-elongate, quite equally rounded at both ends, the marginal fringes are shorter and less marked. This Magellanic species is superficially similiar to the typical *Solemya* shape, but not in its hinge configuration. It seems congeneric, possibly even conspecific with Deshayes' *occidentalis*.

S. occidentalis was originally briefly mentioned by Deshayes, 1857 and afterwards described and depicted by Fischer, 1858. The type locality is Guadeloupe. Fischer noted the size as 18 mm, but mentioned a much larger size, concluding from fragments in Schramm's original lot. Indeed, Rios (1994) depicted it as small from Rio, whereas BRASIL illustrate a 38 mm species (erroneously as *patagonica*) from Espirito Santo and indicate a depth from intertidal to 30 m. *Occidentalis* is currently known from Florida Keys (MIK00), Bahamas (RED01), Jamaica (coll. auth.; Humfrey, 1975), Guadeloupe (type locality), Columbia (DIA94), Brazil (Rios, 1994; BRASIL; coll. auth.). Some US-*occidentalis* records, especially if classified as *Petrasma*, may instead represent juveniles of the superficially similar *velum*, which is a true *Petrasma*. However, it is not excluded, that *occidentalis* ranges further down the S. American coast to the Magellan Strait.

S. occidentalis might at first sight be taken as *Solemya*: rounded ovate, small, living shallow. Therefore, many authors placed it in ***Petrasma***. However, Rios (1994) reported the hinge without any teeth and Forcelli (2000) placed it as *Acharax*. The specimens analyzed (Brazil, Jamaica) have a small external ligament. Thus, they do not fit any of the 3 known *Solemya* subgenera, but approach the *Acharax* hinge configuration. A quite similar condition is found in the Japanese *japonica*. This is also a small species with 30 mm maximum size, living also intertidal to 50 m. It has the same ovate *Solemya* shape, but it has also an external ligament. Due to this ligament position, Japanese authors placed *japonica* consistently in *Acharax*.

However, neither *japonica* nor *occidentalis* are true *Acharax*. They are not close in broad anterior shape, neither do they show the typical extended marginal fringes, nor are they large, or do they live bathyally. For these two species a fourth, new subgenus within *Solemya* is here proposed: ***Pseudacharax***. *Pseudacharax* is characterized as follows: Ovate shape and marginal fringes as in *Solemya*, external ligament position as in *Acharax*. Small size, up to 40 mm, but usually approximately 10-20 mm. Specimens live shallow, intertidal to about 50 m. Sandy-mud bottoms, or Thalassia beds are the recorded substrates. The name is composed of pseudo and *Acharax*, meaning false *Acharax*. The better known *Solenomya japonica* Dunker, 1882 from Japan is here selected as type species. In addition to the type species, also *S. occidentalis* is included in *Pseudacharax*. If the MAG species («*patagonica*» Forcelli, 2000, sp. 450) should prove distinct from *occidentalis*, this would then be the third, undescribed member. Furthermore, Nielsen (1976) reported «*Acharax japonicus*» from Phuket. However, the depicted 10.5 mm species shows a posteriorly distinct shape compared to *japonica*. The identification as *Acharax* and the picture may indicate a further undescribed *Pseudacharax* from the Indian Ocean.

A couple of true *Acharax* have been mentioned or described from localities in the NW. Indian Ocean. First, Smith (1895) located a single *A. patagonica* W. of Sri Lanka live taken from approximately 500 m (Station 151, 142-400 fathoms). Smith (1906) reported the same *patagonica* also from the Gulf of Mannar and a 100 mm specimen from Myanmar, these from 767 m and 891 m respectively. Melvill & Standen (1907) reported *patagonica* from Arabian waters, N. Gulf of Arabia from 411 m. Their specimen was submitted to Smith and was declared identical to *patagonica*. Prashad, 1932 recognized that Smith's species is an *Acharax*, but quite distinct from *patagonica* and described it as new species as ***gigantea***. Vokes, 1955 renamed Prashads' preoccupied species ***prashadi***. Finally, Kuznetsov & Schileyko, 1984 described ***eremita*** from the nearby NE. tip off Somalia, comparing it with *johnsoni*, but not with *prashadi*. Apart from biogeography, also depth, shape and measurements of *eremitica* fit *prashadi* as depicted by Prashad well. There are few doubts that Kuznetsov & Schileyko created another synonym. Therefore only one large bathyal species is recognized from the W. Indian Ocean, namely *A. prashadi*.

Kafanov & Lutaenko (1997) treated the E. Pacific ***A. johnsoni*** and their synonymy is followed. This is the best known, quite common *Acharax*.

A. alinae from Fiji is currently only known from 4 specimens. The largest *Acharax* from the Philippines, the 240 mm ***bartschii***, is virtually unknown to science. Both species appear to live below 1000 m.

Dell, 1978 reported a huge, thick 80 mm *Cyrtodaria* fragment from Cape Palliser, NZ. In 1995 he added new material and described it as ***A. clarificata***, adding a further member to this group of rare, large, deep water species.

Another uncommon species is known from the Atlantic. The 30 fathoms for ***A. grandis*** in Abbott (1974) is a mistake for 300 fathoms; the maximum size currently known is still the original 54 mm, but could be excpected to grow larger. It is not known, that this rare, true *Acharax* has been found again in the last 100 years.

6.4 MANZANELLIDAE

NI1: The Placement of MANZANELLIDAE has been disputed. Allen and Sanders (1969), Waller (1998) and Coan et al. (2000) are followed. They based their opinion on anatomy, which is close to SOLEMYIDAE. La Perna (2005) lists the large majority of the extant manzanellids currently known.

Beesley et al. (1998) only accepted 2 Australian species. The earlier ***N. dalli*** is considered the juvenile of ***hedleyi***, smaller and consequently with fewer teeth. Biogeography and depth fit well. Additionally, May (1958) reported the 2nd Australian species ***H. concentrica*** from Tasmania, 40-50 fathoms.

At the World Congress of Malacology, Vienna, 2001 L. Campbell, S. Campbell and M. Gonzalez reported their findings on the W. Atlantic nucinellids. Based on more than 100 nucinellids analyzed, they noted only one, highly variable species found in northern CAR (N.C., S.C., Fla, Texas and Bahamas). This species has been identified as ***N. adamsii***, described by Dall, 1898 from the Florida Strait; the better known *N. adamsii* has been selected to represent this species and the Pliocene Floridan fossil *N. woodii* Dall, 1898 was considered indistinguishable. They further noted a distinct species, less variable from Venezuela, Brazil, Bahia and E.S. This species has been identified as ***N. serrei***, described by Lamy, 1913 from Bahia. Inferring from the available data, the maximum sizes are similar, and the shape may be very close. What remains, apart from biogeography, is the more regular, also weaker dentition in *serrei*, compared to *adamsii* and typically a more ovate form in *serrei*. It also appears that *serrei* lives shallower than *adamsii*. Consequently, the specimen analyzed from N. Carolina by Allen & Sanders (1969) as *serrei* is instead *adamsii*.

As noted by La Perna (2005), the species identified as «*maxima*» by Kuznetzov & Schileyko (1984) from Aden seems indeed distinct from Thiele & Jaeckel's large *maxima* which has a unique angulate («gewinkelte») dentition. The hinge configuration of the minute Aden species is rather «normal» nucinellid. The SAF *N. pretiosa* is distinct, having a much stronger hinge and dentition. Consequently, Kuznetzov & Schileyko's Aden species is understood as **undescribed**.

On the other hand, La Perna's ***boucheti*** appears very close to *maxima*. La Perna's holotype is twice as large as the single *maxima* valve found by the «Valdivia» and has therefore more teeth. However, the arched basal teeth arrangement, as described by Thiele & Jaeckel, 1931 as well as the shape is the same. Material from East Africa should be compared to verify, that *boucheti* is not only the fresh adult form of ***maxima***. Furthermore, the unique size and hinge configuration may, together with anatomical differences, even call for sub-/generic distinction.

It is difficult to accept ***H. pentadonta***, described from the Okhotsk Sea, as distinct from the Japanese ***sulcata***. The Russian species fits well in *sulcata* regarding dentition, size and habitat, only the more rounded shape remains. Additional material should be compared to verify synonymy or substantiate distinctiveness.

Thus, currently less than 20 manzanellids are recognized.

6.5 NUCULANIDAE

NE1: This is another difficult family. Mainly Allen & Sanders (1982) and Coan et al. (2000) are followed. The work of Dautzenberg & Fischer (1897) is virtually not reflected in modern literature. La Perna is working on this complex and his view is largely followed (pers. com. 2008).

Originally, ***Thestyleda*** was restricted by Iredale to a small truncate and commarginally ridged Australian nuculanid, with a ridged dorsal sculpture. Subsequently, *Thestyleda* has been widely applied, especially in Japanese literature for commarginally ridged species. However, Japanese *Thestyleda* show all intergrades to *Nuculana*. Whereas *sagamiensis* is close to true *Thestyleda*, *Thestyleda acinacea* is close to *Nuculana*.

Xu (1984) proposed ***Sinoleda*** for *sinensis*. *N. sinensis* is a nuculanid similar to *Thestyleda*, but with a smooth, rather than ridged dorsal surface, but this condition is also found in *Nuculana* s.s. Furthermore, *N. soyoae* with the same feature was placed in *Thestyleda* by Japanese authors, and *N. jovis* also referred by Xu, was placed in *Nuculana* s.s. by Thiele & Jaeckel, 1932.

Kamaleda has intermediate features of *Nuculana* and *Sinoleda*. Together with the similar *N. silicula*, also the type OD, Smith's *neaeriformis*, has a characteristic ridge inside beneath the rostral teeth, whereas Iredale pointed to the special dentition. However, weak ridges are found in many nuculanids and the dentition does not seem special. The similar NZ *investigator* was placed in *Thestyleda*. *Kamaleda* was not accepted as valid subgenus by any subsequent author. It was synonymized with *Thestyleda* by Dell (1952); whereas Allen & Hannah (1986), not opposed by Maxwell (1988), synonymized it with *Nuculana*.

Coan et al. (2000) synonymized *Thestyleda* with *Nuculana*. This view is shared. *Kamaleda* and *Sinoleda* are considered further synonyms with intergrading characteristics. As such ***Nuculana*** comprises rather compressed, elongate, truncate forms, with a weak to strong commarginal sculpture.

Costelloleda Hertlein & Strong, 1940 is somewhat intermediate between *Nuculana* and *Adrana*, similar in shape to *Nuculana*, but with lamellate ridges and quite fragile, almost translucent, compressed valves, recalling some *Adrana* species. These traits were not accepted as characteristic by Allen & Hannah (1986), Maxwell (1988) did not oppose. However, Beu (2006) considered *Costelloleda* as highly distinctive with generic rank, and

Keen (1971) accepted it as subgenus of *Nuculana*. This latter view is here shared and *Costelloleda* is considered as a recognizable subgenus. Species similar to the type species *costellata* are *marella* and the Caribbean *egregia* (syn. *cestrota* and *chazaliei*). *Saccella* as proposed by Diaz & Puyana (1994) or *Jupiteria* as proposed by Rios (1994) do not match. Furthermore, Beu (2006) analyzed the BMNH-type of ***Leda concinna***, originally described from NZ and demonstrated that *concinna* is a synonym of the Panamic type species *costellata* with an erroneous locality. Guppy, 1882 described ***Leda egregia***, dredged in the Gulf of Paria, off NE. Venezuela. He compared it with large *patagonica* found there, and defined it in between *patagonica* and *tellinoides*. However, the marked lamellar, fewer ribs, the broader, compressed shape, the position of the umbones and the umbonal curvature indicate that *Leda egregia* is not an *Adrana* but rather the earlier name for Dall's *Leda cestrota*. Dautzenberg, 1900 described the same species again as *chazaliei* from Colombia.

Whereas Allen & Hannah applied *Jupiteria* as valid subgenus and *Saccella* synonymous, most modern authors differentiate *Saccella* from *Jupiteria*. Powell (1971), Maxwell (1988), and Kilburn (1994) considered ***Jupiteria***, and Beu (2006) ***Saccella***, as of generic rank. Elaborated also by Maxwell (1988), the two type species are distinct and both are here recognized as subgenera. However, the current state of knowledge and lacking phylogenetic data in *Nuculana* do not support generic differentiation to date. For the time being Puri in Moore (1969) view is shared and both are treated as subgenera.

Jupiteria is subtrigonal, rather inflated, with smooth valves, devoid of sculpture, less acute, rounded posteriorly, with a small pallial sinus. The SAF *isikela* and two NZ species are closely similar to the extinct type species. Iredale's ***Teretileda*** with *oculata* and *fortis* shares the same concept. Globally, *Jupiteria* are scarce and here restricted to just a few species, which are mostly minute.

Saccella is typically small, low, elongate, and strongly acute in shape, with a marked commarginal sculpture and often with a larger pallial sinus. As in *Lembulus* an oblique sulcus is anteriorly present. *N. acuta*, *N. laeviradius*, or *N. electilis* are closely similar to the type species *Saccella*. Iredale's ***Zygonoleda*** *corbuloides* has been synonymized by virtually all authors with *Nuculana*. However, the syntype (Lamprell & Healy, 1998 sp. 23) shares closer affinities to *Saccella* than to *Nuculana*. Iredale (1939), Maxwell (1988) and Lamprell & Healy (1998) considered ***Scaeoleda*** a useful group. At first glance, the type species of *Scaeoleda* seems distinct from *Saccella*. It is larger, glossy, acutely pointed, double carinate, and without sulcus. Typically *Scaeoleda* encompass the type *crassa*, further *tashiensis*, *elenensis*, or *taphria*. However, going through the global nuculanids with *Saccella* separated from *Scaeoleda*, no clear picture resulted. Some species are well attributable, many more share intermediary traits. ***Eptoleda*** was synonymized by Puri in Moore (1969) with *Nuculana*. However, the large, glossy, acute *darwini* depicted by Lamprell & Healy (1998 sp. 24) is not close to *Nuculana*. Beu (2006) considered it synonymous to *Saccella*. Indeed, *Eptoleda* shares even more traits with *Scaeoleda*, but is barely distinguishable from *Saccella*. Thus, *Scaeoleda*, together with *Zygonoleda* and *Eptoleda* are here synonymized as *Saccella*. As such ***Saccella*** is applied for solid, ovate-acute, commarginally ribbed forms. *Saccella* is the most common form in nuculanids encountered globally.

Costanuculana is accepted by most authors as a useful group. It was placed in *Saccella* by Japanese authors. However, the shape is not particularly close to *Saccella*, the valves are higher and rounded not pointed, generally thick, the dentition is strong and the pallial sinus is short, the siphonal opening is small. The type of *soyoae* (= *husamaru*) is depicted in HIG01 B72s, the Chinese form in LAN011 fig. 27. Dall's Panamic *N. lobula* shares more traits with *husamaru* than with *Jupiteria*, where it was originally placed. *N. lobula* has a small pallial sinus and a rounded shape. *N. lucasana* appears as the adult form. The Panamic *N. callimene*, the Peruvian *N. cuneata*, and the Caribbean *N. solida* are closely related species, placed also in *Costanuculana*. *Leda inaudax* Smith, 1885 might be the juvenile form of *solida*.

Lembulus Risso, 1826 is a group with clear diagnostics as characterized by Puri in Moore (1969) and Allen & Hanna, (1986). It is predominantly Atlantic, similar to *Saccella*, but with an oblique sculpture. Following Kilburn (1994), the SAF *belcheri*, *gemmulata* and *lamellata* are here included. The Thailand *belcheri* record of Lynge (1909) affects a distinct, probably orthoyoldiid species as noted by Iredale (1939); *belcheri*, one of the largest nuculanids, is currently only known from SAF. The Uruguayan *decora* is also placed here. Related IND nuculanids are *taiwanica* from Taiwan and *sculpta* from Arabia.

Politoleda Hertlein & Strong, 1940 was not accepted by Allen & Hannah (1986), but recognized by Keen (1971). The type species *polita* is not close to *Nuculana* and considered distinct enough to merit subgeneric distinction. So far, *N. polita* was considered unique in inflated shape, divided smooth and oblique sculpture, and dense striae on the escutcheon. However, the smaller Indonesian *fastidiosa* fits *Politoleda* well.

On the other hand, ***Exocholeda*** was synonymized by Puri in Moore (1969) with ***Nuculana***, whereas Lamprell & Healy, (1998) considered the type OD *dasea* to represent a *Scaeoleda*. However, their *dasea* (sp. 40) has a unique shape and distinct surface sculpture as originally noted by Iredale, 1939. The dentition should be reanalyzed, especially if a resilifer is present and whether *Exocholeda* indeed belongs in *Nuculana*. For the time being, *Exocholeda* is placed as nuculanid subgenus. A species sharing some traits is known from the Philippines, *N. reticulata*.

The uncommon WAF ***Leda tuberculata*** Smith, 1871 appears unique, not fitting any of the known extant subgenera. Nicklès (1955 fig. 12) has it well illustrated. However, a very similar concept is found in the Hungarian fossil *Costatoleda* Roth von Telegd, 1915 and *tuberculata* is tentatively placed there.

Finally, ***Borissia*** has been applied for the characteristically sculptured ANT nuculanid *inaequisculpta* by Villarroel & Stuardo (1998).

The abyssal *Leda parsimonia* from SAF was placed in *Nuculana* by Knudsen (1970). This needs verification, but the type material at SAM could not be studied as yet.

NE2: ***Nuculana***: This is a huge and difficult group of more than 100 species globally, many species are barely known.

The type species ***pernula*** is perceived as wide ranging and quite variable, following here Higo et al. (1999) and Coan et al. (2000). The typical Atlantic form is rather elongate, smooth with a yellowish periostracum; *buccata* from Greenland is stouter, more inflated and ridged; *pernuloides* from Japan and Hokkaido is broader, heavier, weakly ridged with a dark brown periostracum; *kawamurai* from Japan is in shape very close to the typical NE. Atlantic *pernula* but stronger ridged like *buccata*. Matsukuma (2004) even classified it as *Thestyleda*, but Habe's OD does not support this view. The species depicted by Lan (2001) from Taiwan as *kawamurai* could well be understood as *pernuloides*. *Radiata* from Alaska are in shape, inflation and periostracum similar to *pernuloides*, but occasionally strongly ridged and usually smaller. All evidence supports that *pernula* is a common, widely distributed and highly variable species.

N. caudata has originally been described from GB, Kent and has been variously treated. No type could be located. However, from Donovan's OD *N. pernula* and *N. tenuisulcata* do not match. Following Nyst (1848), *N. minuta* is not excluded and *Arca caudata* Donovan, 1801 is placed as junior synonym. This view has also been confirmed by Dautzenberg & Fischer (1912) and Nordsieck (1969). As such the type locality of *caudata* is correct.

Nicklès, 1952 described ***Leda gruveli*** as fossil from Gabon, Port Gentil, but reported living specimens from Senegal, Rufisque and Guinea, Conakry. In 1955, he described ***Leda wolffi*** from central Nigeria. Both are close, but *wolffi* is more pointed, is currently only known smaller and appears to live shallower. All *gruveli* analysed have originated from the Northern part (Mauritania, Senegal, and Guinea). As noted by Nicklès, they show very little variation. Thus, *wolffi* is perceived a distinct southern species. Both have an oblique sculpture and are bicarinate. Together with the larger ***N. montagui***, these are well placed in *Lembulus*.

Dell, 1956 described *Jupiteria wolffi* from Pitt Isl., Chatham Isl. Here both, *Jupiteria* and *Lembulus* are considered subgenera of *Nuculana*, thus, a new name becomes necessary. ***Nuculana* (*Jupiteria*) *delliana*** nom. nov. *Jupiteria wolffi* Dell, 1956 non *Leda wolffi* Nicklès 1955 is proposed; named after the original author. Of course, should *Jupiteria* and *Saccella* once be conclusively divided, then this new name falls in synonymy.

Risso, 1826 described various ***Lembulus*** from the Mediterranean, S. France. *L. rossianus* (= *pella*) is unambiguous from the OD. ***Lembulus deltoideus*** is according to Dell (1955) and Beu (2006) the same as *commutata* and was considered the earlier name. However, Lamarck's *deltoidea* appears also to represent a fossil *Nuculana* and as such, Risso's species is treated as preoccupied synonym of *commutata*, following here CLEMAM. Risso's ***L. sulculatus*** from S. France, Nice may well have been the earlier name for ***illirica***. *N. illirica* is known from nearby NW. Italy. However, Risso's type was neither found in the Risso collection nor in the MNHN type collection in 6/09. The type is considered lost and *L. sulculatus* is best treated as nom. dub.

N. decora was described by A. Adams, 1856 from the West Indies. It has been discussed and depicted in Hanley (1860) and Sowerby II (1871) but not recognized since. Most modern CAR authors treat it as dubious species. However, the BMNH type lot with 3 specimens revealed its true identity. The original type locality proved imprecise and is here corrected to Uruguay, La Paloma, Rocha from where a couple of conspecific specimens where studied. *Decora* is currently only known from Uruguay and N. Argentina in deeper water and has long been confused with *patagonica*. Recently, it was described as ***Nuculana* (*Costelloleda*) *whitensis*** by Farinati, 1978 from N. Argentina (Holocene and living). Scarabino (2003) placed it also in *Costelloleda*. However, *N. decora*, as originally characterized, is much more solid than the fragile *Costelloleda* and also more inflated; the rougher, irregular surface sculpture does not fit *C. costellata*. Substance, solidity and sculpture exclude *Adrana*. In posterior and anterior sculpture, in biconvexity and solid inflated shape *decora* is quite close to the *Lembulus* group and placed there.

The Caribbean *Saccella* are difficult; almost 15 names are available for the 5 species, here recognized. ***N.* (*Saccella*) *acuta*** is an elongated-trigonal species, sharply rostrate with shallow grooves at both ends. The tip of the rostrum is often slightly upturned in adults. Macsotay & Campos (2001) synonymized Weisbord's ***axelolssoni*** with ***karlmartini*** indicating a high variability in the commarginal ribbing and in shape. Despite Weisbord's remarks I fail to perceive any significant differences to *acuta* from Florida, the ribbing is variable in this species. Furthermore, *acuta* has been identified from Suriname (REG71) and is well known from Colombia and Brazil, but was not recognized by Macsotay & Campos (2001). The two Venezuelanean *axelossoni* and *karlmartini* are therefore considered synonymous. In addition, Orbigny in Sagra (1853) did not recognize the common *acuta* in Jamaica, but instead described from there a minute 3 mm ***jamaicensis*** with a quite similar sculpture and shape. Humfrey (1975) only reported *acuta* from Jamaica, but not *jamaicensis*. Furthermore, it is doubtful that Macsotay & Campos (2001)'s 11 mm *jamaicensis* is other than *acuta*, as similarly depicted by Diaz & Puyana (1994 fig. 10) from Colombia or by Weisbord (1964 fig. 15) from Venezuela. Altena (1971) has synonymized *jamaicensis* with *acuta*, based on the syntypes of *jamaicensis*. Altena's view is followed and *jamaicensis* is perceived as based on juvenile *acuta*. As such *acuta* is quite variable in shape and ribbing, widely distributed, usually found within 100 m. It is a comparatively large *Saccella*, specimens studied from Colombia extended to more than 12 mm, but are reported up to 15 mm.

Following Altena (1971) and Diaz & Puyana (1994) ***N.* (*Saccella*) *concentrica*** is a small species. It is similar to *acuta* but straighter pointed, more elongate, and more compressed. The deepest record is 300-340 m off Cedar Keys, NW. Florida. The ribbing is finer than in *acuta*, the extent of ribbing, however, is quite variable; in some, *concentrica* is completely commarginally striate, in others smooth just below the umbones or smooth half way down and only striate above the ventral margin. Brown & Pilsbry's ***obliterata*** from Florida is understood as this species.

However, Brown & Pilsbry's 12 mm ***vulgaris*** from Belize and Guatemala appears as a valid species, confined to the Eastern Central America, extending southwards to Panama (OLS58). It is a comparatively large species, similar in shape to *acuta*, but without grooves, glossier with finer and lower commarginal ridges and more inflated. Specimens dredged off Roatan have also been identified as *vulgaris*.

N. ***vitrea*** appears to remain small and occurs in deeper water. Dall's *cerata* is perceived indistinguishable. This is a comparatively broad, only moderately pointed species. Finally, Dall's ***verrilliana*** is also small, rather broad with a bluntly pointed rostrum. The synonymy of *verrilliana* with *acuta*, proposed by some authors, is not perceived to match.

In the **Panamic** fauna many changes are necessary. In particular, this affects *acapulcensis*, *dranga*, *laeviradius*, *hindsii*, and *lucasana* (Coan & Valentich-Scott, 2010, pers. comm.)

Hanley (1860) analyzed Adams's type of ***inornata***, originally described from New Guinea and considered it identical to Sowerby's *cuneata* from Peru. Adams' OD does not oppose. Therefore, the original type locality of *inornata* is considered erroneous.

The type of ***Leda conradi*** Hanley, 1860 is present in BMNH. This 8.6 mm *Saccella* described without locality seems American but could not specifically be attributed.

Coan et al. (2000) synonymized Dall's *liogona* and *amiata* with the earlier ***leonina*** and gave a range to Kamchatka. Furthermore, I fail to recognize Okutani's ***sagamiensis*** (type HIG01 B63) as distinct. Morphologically no traits were found separating Japanese from Washington specimens. *Sagamiensis* is reported to extend to Hokkaido and Habe & Ito (1965) depicted *liogona* from Northern Japanese waters. Adult size and depth of *sagamiensis* fit *leonina* well. The number of commarginal ribs and the length of the rostrum in *leonina* changes markedly during its growth. This may be seen in *liogona* (type KNU70 pl. 1 fig. 6) which has been described from a juvenile with a few ribs and a short rostrum.

Although Tsuchida & Okutani (1985) demonstrated that some former Japanese *scalata* records (e.g. Okutani, 1962, W. Kyushu) are in fact *tanseimaruae*, they still upheld *scalata* as part of the Japanese fauna, in addition to *subscalata*. In addition, Bernard et al. reported *scalata* from SChi and Taiwan. Larger series of *scalata* and *subscalata* (type HIG01 B60) should be reanalyzed. I am not convinced that these two are distinct. At least specimens dredged off N. Borneo approximately at 100 m are in sculpture and shape intermediate between *subscalata* and ***scalata*** and hard to attribute. At present only *scalata* and *tanseimaruae* are recognized as valid species.

At present, no intermediaries to ***yokoyamai*** are known; consequently ***arai*** is considered a valid Japanese species.

Scott (1994) depicted ***N. mauritiana*** from Hong Kong. Gould, 1861 described *cuspidata* from there (type JOH64 pl.23 fig. 4). Whereas Lynge (1909) and Swennen et al. (2001) reported *mauritiana* from the Gulf of Thailand, Robba et al. (2003) depicted instead *cuspidata* from there. There is little doubt that ***cuspidata*** is a junior synonym. It is likely that ***Nucula analis*** Philippi, 1851 described from China is a further junior synonym.

Leda irradiata Sowerby II, 1870 seems to be an early name for a Chinese species as yet unidentified. The type is present in BMNH. It also appears that more than one species is depicted under ***confusa*** by Chinese and Japanese authors. These specimens should be compared to *irradiata*. The type of *confusa* is depicted in HIG01 B69.

Beu (2006) noted ***Leda micans*** Hanley in Sowerby II, 1860 as erroneously located, not found in NZ. Smith described ***Leda darwini*** from NT, Darwin in 1884; in 1885 p. 236, Smith mentioned *Leda micans* only found in Fiji, Levuka, 12 fathoms, but did not compare Australian material. Beu (2006) indicated that these two might be identical. Smith's Challenger material and fresh material from Fiji should be compared to verify range and identity of these species. Furthermore, the juvenile 8.1 mm BMNH holotype of ***Leda inconspicua*** A. Adams, 1856 described from Australia may even be the earlier name for ***N. darwini***. The complex *darwini-micans-inconspicua* needs more work and material. It can not be excluded that only one valid species, *inconspicua*, is present.

Nucula nasuta Sowerby I, 1833 might have been an Australian *Nuculana* as well. However, the type could not be isolated in BMNH, 3/09 and *nasuta* is treated as nom. dub.

Nucula recta Hinds, 1843 from New Guinea may have been the earlier name for ***N. novaeguineensis*** (Smith 1885) as depicted by Hinds (1845 fig. 15). However, *recta* was not used recently and no type could as yet be located. It is therefore treated as nom. dub.

Fleming (1951) depicted the type of ***Leda fastidiosa*** and stated A. Adams' original type locality NZ erroneous. *Fastidiosa* is elongate, centrally inflated. It has a unique escutcheon, sculptured by dense lines, a polished yellow-olive periostracum and a sculpture which is smooth around the umbones, but commarginal anterior and posterior. These features are found in the Panamic *polita*. *Fastidiosa* is considered the second true ***Politoleda***. *Fastidiosa* has been described as smaller and the umbones positioned almost central, whereas in *polita* the umbones are closer to the rostrum. A lot of 10 beach collected specimens from Sumatra, Bengkulu Province, fits *fastidiosa* well, the maximum size is 21.6 mm.

Hedley's characteristic ***Leda narthecia*** (syntype in Lamprell & Healy, 1998 sp. 47) has been described from the Gulf of Carpentaria, off Horsey River. The generic placement is open. *Narthecia* is not close to *Yoldia*, where Iredale (1939) placed it, albeit reluctantly. *Yoldiella* does not fit either. As noted by Fleming (1951) shape and prominent escutcheon are reminiscent of *Nuculana fastidiosa*, placed in *Politoleda*. However, there the smooth surface does not match. Furthermore, Hanley (1860) placed Adams' ***Leda fulgida*** close to *polita* and *fastidiosa*. The 3 BMNH-*fulgida* syntypes described by A. Adams, 1856 from nearby Darwin, but traditionally neglected by Australian authors, have been compared and proved conspecific. At present *fulgida* (syn. *narthecia*) is placed in *Nuculana* s.l., close to *Politoleda*, but a new subgenus seems indicated for this tropical Australian species.

NE3: ***Adrana***: This genus is confined to American waters only. Lamarck's type species, the preoccupied ***Nucula lanceolata***, is an *Adrana*, but has been variously interpreted. The species depicted by Puri in Moore (1969) is adranid, but not close to Lamarck's type and rather represents *scaphoides* or even *cultrata*. The *lanceolata*-identification of Hanley (1860 p. 167) with the Panamic *taylori* was highly tentative. Dell (1955) firmly concluded *lanceolata* the same as *sowerbyana*, whereas Orbigny (1845 p. 544) noted *lanceolata* identical to *tellinoides* and renamed his former *lanceolata* as *patagonica*.

However, the *lanceolata* types, MHNG 1086/43 a left valve 49.2 mm and a conspecific right valve 45.7 mm have been curated as *electa* A. Adams, 1856 from S. America. Virtually identical to Lamarck's type is indeed ***A. electa*** (A. Adams, 1856) as depicted by Cortés & Narosky (1997 sp. 65) or Hanley (1860 sp. 6, pl. 227 fig. 40-41). These share the elongated shape, approximately 50 teeth on both sides and umbones nearer to the anterior end. ***A. electa*** has a predominantly commarginal, posteriorly almost oblique sculpture with a distinct portion at the utmost posterior part. This portion is virtually smooth, occasionally incised with rougher commarginal ridges. As curated, *Nucula lanceolata* Lamarck, 1819 non J. Sowerby, 1817 (= foss.) is here synonymized with *A. electa* which consequently represents *Adrana* typically. It is possible that Lamarck's specimens originated from Rio de Janeiro.

In *Adrana*, the surface microsculpture is decisive. ***A. gloriosa*** with an impossible IND type location caused problems. Altena (1971) set the issue right and synonymized Rehder's ***notabilis***. *Gloriosa* is a large species with a distinct anterior sculpture, the commarginal ridges are anteriorly more distant than medially; the anterior portion is separated by an oblique sulcus. The utmost posterior portion is smooth (or scissuladranid), separated by a very weak oblique sulcus. Hanley (1860 pl. 227 fig. 13) and Petuch (1987 pl. 26 fig. 4) illustrated it well. ***A. patagonica*** has two sulci as well, but the anterior portion has a similar sculpture as medially, the utmost posterior portion is clearly separated by a strong sulcus and strongly commarginally ridged. REG71 fig. 6 depicted it well; Diaz & Puyana (1994) confounded the numbers, No. 14 is *patagonica*, No. 15 is *gloriosa*. ***A. scaphoides*** is very elongate, translucent and has fine commarginal lines only, no apparent sulci. *A. elizabethae* from Caribbean Costa Rica appears to have exactly the same sculpture, the same shape and the same dentition and seems identical. Unfortunately, no samples from Costa Rica were available for comparison. ***A. tellinoides*** has a scissuladranid sculpture, smooth on the rostrate third, and weak commarginal on the rounded anterior portion. It has a very weak, oblique sulcus anterior. This divided sculpture, ridged and smooth, is well visible in Hanley (1860 sp. 4) from Brazil, Santos and has been clearly mentioned for Angas' *newcombi*. The division between these two sculptures is obliquely cut in juveniles and more confluent in adults. As the smooth posterior structure is similarly found in *gloriosa*, Petuch's ***Scissuladrana*** only highlights a specific pattern in *Adrana* and is without doubt synonymous. The *ludmillae* sculpture is basically identical to *tellinoides*. However, compared to similar sized *tellinoides*, **ludmillae** is broader and the umbones more central and *ludmillae* is perceived as valid *Adrana*.

The Panamic species are even more difficult. ***A. cultrata*** has a scissuladranid sculpture, clearly separated in juveniles. It has the same sculpture as *tellinoides*, but is distinct in shape. ***A. sowerbyana*** is larger, more solid, snowy white, and more acutely expanded, the sculpture is similar to *tellinoides*. *A. suprema* is considered as large *sowerbyana*; Olsson (1961) depicted such specimens.

A. crenifera has a similar base sculpture as ***patagonica***, but is more fragile and the sculpture on the very posterior portion is weaker, in some even smooth. *A. taylori* is considered the same and *tonosiana* seems too close to be separated.

A. penascoensis is a straight form, only known from the Gulf of Mexico.

Leda metcalfii, originally described without locality (HANL60), was later placed as *metcalfei* in the Philippines (HANL602). In BMNH 20030195 a "probable" syntype is present. This species however, conforms in shape, sculpture and size well to the OD and Hanley in Sowerby's pl. 227 fig. 34. It is perceived as one of the two species known to Hanley and as such, a true syntype. *Adrana* are only known from the America's and Hanley's Philippine locality is erroneous. *Metcalfii* has been compared to various American *Adrana*. Finally, specimens identified as *exoptata* from W. Mexico, Manzanillo have been perceived the same, representing a junior synonym. *A. metcalfii* seems to remain smaller and comparatively broader anterior than *crenifera*. The largest specimen measures 19.9 mm.

NE4: ***Ledella***: Allen & Hannah (1989) and Filatova & Schileyko (1984) are important.

The variability in shape and sculpture in ledellids is stupendous. Many are similar to *Portlandia* in shape, some are rather hooked (*jamesi*, *austrocubana*), even pointed hooked (*procumbens*), elongate (*hebes*), "tindariid" (*aberrata*, *acinula*), acutely pointed (*solidula*, *robusta*, *kermadecensis*), tumid, strongly commarginally (*ultima*), or even radially sculptured (*inopinata*); many are almost smooth (*messanensis*, *miliacea*, *elinguor*).

Unfortunately, the type species *ultima* and the similar *kermadecensis* are not typical for the majority of ledellids. This has misled many authors to place ledellids in *Yoldiella*.

All ledellids have solid valves, a strong dentition with comparatively less teeth, a thick hinge plate, all are less than 7 mm, and are generally whitish and live bathyal to abyssal.

The validity of subgenera is disputed. Allen & Hannah (1989) accepted none, whereas Filatova & Schileyko (1984) recognized ***Magaleda***, with a radial sculptural element. Earlier, Maxwell (1988) considered *Magaleda* as synonym of ***Zealeda***, which shares indeed a similar shape and the same base radial sculpture. Filatova & Schileyko further proposed ***Prashadia*** for the acutely hooked, strongly ridged *procumbens* and ***Amphilata*** for *kermadecensis* and *solidula*. However, *kermadecensis* is considered by Allen & Hannah (1989) and Knudsen (1970) as morphologically and anatomically very close to *ultima*. It further appears that Iredale's ***Comitileda*** was too hastily synonymized and may be quite useful for the group of smoother, compressed, elongated ledellids; ***Junonia*** Seguenza, 1877 non Huebner 1819 seems to be a synonym of *Comitileda* but not of *Ledella* s.s. The elongate-pointed *hebes*-group and other special ledellids may require further subgeneric distinction. In addition, various authors (e.g. Kilburn, 1994, Cosel, 1995) included a characteristic group of species in *Yoldiella*. These are rather solid, trigonal pointed, but smooth as well, hinge line and dentition are quite strong; most are found sublittoral-bathyal. Typical are African representatives, e.g. the closely related SAF ***elinguor*** and ***lingulifer***, as well as the closely related WAF ***orstomi***; in both cases, however, it is not excluded that only one species is present. Their affinities to smooth ledellids in the *messanensis* group appear closer than to *Yoldiella lucida*. Consequently, these species are here included in *Ledella*. For this African group a further subgenus may be useful.

Once the whole genus is better known, it seems that subgenera, at least, are well justified. However, the conservative view of Allen & Hannah is for the time being followed, lacking an in-depth global review and genetic data of the approximately 40 ledellids.

If the rare ***Ledella sandersi*** Allen & Hannah, 1989 non Filatova & Schileyko, 1984 should, despite close morphology, biogeography, anatomy and depth prove distinct from *verdiensis*, then it needs to be renamed.

That Knudsen, 1970's unique ***Ledella ultima*** non Smith, 1885 from abyssal Indonesia, Suntre should be conspecific with the Atlantic *sublevis* (ALL89) is also biogeographically doubtful. It is currently treated as an undescribed species.

The rare, elongate NZ ***librata*** with a thin valve is reminiscent of *Yoldiella antarctica* and is placed in *Yoldiella*. On the other hand, the solid ***L. finlayi*** with a strong hinge plate is well placed here, as originally described.

Whereas the Australian type, OD *Comitileda* ***miliacea*** shares traits with the *messanensis* group, other Australian species placed in Comitileda, do not appear to belong here. ***C. remensa*** with a weak dentition and an elongated shape is reminiscent of *Yoldiella* and is placed there; ***C. curtior*** does neither fit well in shape, glossy surface nor dentition. Its closest affinities and the correct placement are unknown. Lamprell & Healy (1998 sp. 32) seem to have depicted two distinct species under ***pala***. The lower figure only seems to represent the ledellid paratype. The top figure 32 closely resembles the NZ *powelli* and seems yoldiellid.

Whereas Filatova & Schileyko (1984) kept ***crassa*** and *ultima* distinct, Allen & Hannah (1989) based on a very large collection synonymized. Furthermore, I am not fully convinced that their ***jucatanica*** is indeed distinct from *ultima*; at least depth, size, biogeography would fit and dentition appears close.

Yoldiella ecaudata of Villarroel & Stuardo (1998) and *Ledella ecaudata* of Filatova & Schileyko (1984), both attributed to Pelseneer, 1903 do not represent the same Antarctic species. Pelseneer's OD fits ***Ledella ecaudata*** of the Russian authors, also Thiele (1912). Villarroel & Stuardo's specimen appears indeed yoldiellid.

Filatova & Schileyko (1984) placed Knudsen's *Spinula* ***tasmanica*** in ***Ledella*** and this course is followed. Shape, size and especially hinge plate are conclusive. Whether the slightly larger and shallower species, named so by Chinese authors (e.g. Zhongyan, 2004 pl. 112 C; XU850) is the same or only a similar ledellid could not be ascertained.

It could not be verified whether the US-Georgia ***bipennis*** is indeed a ***Ledella***, as originally described.

Another neglected species is ***Leda despecta*** Smith, 1885 described from the West Indies, the strong dentition and the commarginal sculpture point in direction of a juvenile *Ledella*.

NE5: ***Bathyspinula***: *B. pelvisshikokuensis* placed by Allen & Sanders (1982) as *Acutispinula* has the shortest rostrum of all bathyspinulids, whereas the type species *calcar* has the most extended. Originally, Dall, 1908 considered *calcar*, the type OD of *Acutispinula* and *calcarella* as quite close, and neither Knudsen, nor Okutani differentiated. This conservative view is followed. It appears that *calcar* is the only true *Acutispinula*, but in this small group the specific level seems to offers enough possibilities for individual features. Thus, *Acutispinula* is not retained subgenerically.

As doubted by Allen & Sanders (1982 p. 27), I am also not convinced that their Atlantic ***filatovae*** is identical to Knudsen's W. Indian Ocean abyssal species. Allen & Sanders' Atlantic species appears more elongate, is more fragile instead of solid, and lives bathyal instead of abyssal; biogeographical intermediaries are not recorded. Thus, the Atlantic "*filatovae*" is perceived as **undescribed**.

Warén (1989) depicted a larger fossil ***excisa*** and Salas (1996) found it living off Huelva, SW. Spain. Dautzenberg & Fischer's ***subexcisa*** is perceived as a distinct, deeper living extant species.

Knudsen (1970) confused *calcarella* with *calcar*. Thus, the less acute ***calcarella*** seems present in the Tasman Sea, instead of *calcar*.

Allen & Sanders, 1982' *Spinula* sp. from the Noabas appears ledellid instead of bathyspinulid.

Thus, currently 16 *Bathyspinula* are recognized.

NE6: **POROLEDINAE**: Allen & Sanders (1973) noted relations to siliculids and placed *Propeleda* and *Poroleda* tentatively in SILICULIDAE. Later, Allan & Hannah (1986) placed *Lamellileda* in SILICULIDAE, *Robaia* as synonym of *Nuculana* and *Poroleda* as synonym of *Propeleda*. Maxwell (1988) considered *Poroleda* also related to *Propeleda*, however, he considered *Lamellileda* the same as *Poroleda* and *Tenuileda* the same as *Propeleda*. Maxwell further considered this group, except *Silicula*, as belonging to NUCULANINAE. However, it appears that no global comparison was made. Maxwell did not discuss a few crucial species, especially Prashad's *parallelodonta*, Barnard's *sandersi* or Hedley's *spathulata*. Allen & Sanders (1996) discussed some less typical *Propeleda* and included them in NUCULANINAE, but they did not discuss *Poroleda*, *Tenuileda*, *Lamellileda* or the Australian species.

On the other hand, Scarlato & Starobogatov (1979) created a separate family **POROLEDIDAE** for *Poroleda* and *Propeleda*. Dell (1955) accepted ***Lamellileda***, ***Propeleda*** and ***Poroleda*** as of full generic rank. In addition, ***Robaia*** Habe, 1958 has little in common with *Nuculana*, although Allen & Hannah synonymized it. Whereas Japanese authors consider it at least subgenerically distinct from *Nuculana*, Russian authors place *Robaia* as separate genus within NUCULANIDAE (e.g. SCARL81, EVS06, p. 31). However, *Robaia* shares many traits with *Propeleda* and their relations should be studied with modern methods.

If each genus is studied separately, then *Propeleda*, *Tenuileda* or *Robaia* could be placed in NUCULANINAE, as adopted by most authors. However, seen as a group, the dentition is only superficially similar to *Nuculana*, the resilium at least in some species quite distinct, pointed posteriorly. Furthermore, fragile shape and texture do not fit well in *Nuculana*. Especially in Australian waters, there seem to be close relations between *Lamellileda*, *Poroleda* and *Propeleda* and, to cut these apart seems premature.

Overall, this complex is not settled. It is open, whether convergence took place or a common ancestor is present. Phylogenetic data is not available. Much more work is necessary to achieve a satisfying picture and to substantiate whether POROLEDINAE is a synonym of NUCULANIDAE or of SILICULIDAE or whether *Silicula* is only a special nuculanid genus.

At present, Scarlato & Starobogatov's view is perceived most fitting, but in a subfamilial sense within NUCULANIDAE. *Robaia* is also placed here. As such, POROLEDINAE encompasses fragile, elongate, smooth species, with a lamellate or at least a fine dentition. The four genera are placed as a whole under POROLEDINAE in NUCULANIDAE; SILICULIDAE and LAMETILIDAE are perceived as related to NUCULANIDAE. Poroledinids are considered intermediate between NUCULANIDAE and SILICULIDAE.

A further difficulty in this complex arises as many species have been misidentified in modern literature, which of course burdens their correct understanding.

In this group, one extreme is represented by ***Lamellileda***. *L. typica* is depicted in Cotton (1961) and erroneously in Moore (1969 as *Propeleda ensicula*); Lamprell & Healy (1998 sp. 33 *Nuculana* (*Poroleda*) *spathulata*) is instead also *typica*. The type is in shape almost identical to *Poroleda*, but has anterior and posterior lamellar teeth, very close to the condition in *Silicula*. Quite similar species are the Japanese *soyomaruae*, originally placed in *Poroleda* by Okutani, 1962, and then by Okutani (2000) in *Propeleda*; Xu (1985 fig. 4) depicts the dentition. *Lamellileda sandersi* Bernard, 1989 has a similar shape and dentition and seems correctly placed here. *L. sandersi* is perceived closer to *Lamellileda typica* than to *Silicula fragilis*. Prashad's *sibogaensis* fits well in shape. On the other hand, Prashad's *parallelodonta* has a similar structural dentition as *Lamellileda*, but a distinct, pointed shape close to *Propeleda*. It is tentatively placed in *Lamellileda*.

The type ***Poroleda***, MT Hutton, 1893 is the NZ *lanceolata* with an enlarged, almost straight posterodorsal part, almost parallel ventral margin, a bluntly truncate rostrum and an enlarged pallial sinus. The teeth are on the expanded posterior side lamellar, almost parallel to the dorsal margin and anterior chevron shaped. The type is precisely depicted in Hedley, (1906, i.e. *pertubata* Iredale, 1924), also Powell (1979) and Moore (1969). *Lanceolata* is in shape close to *Lamellileda* but has a distinct dentition. ***Poroleda spathulata*** (Hedley, 1915; Cotton, 1961 p. 39 fig. 20; Macpherson & Gabriel, 1962 fig. 311 top; Lamprell & Healy, 1998 sp. 34 as *ensicula*; Beesley et al., 1998 fig. 5.6 B as *Nuculana* sp.) has the same structural dentition as *Poroleda lanceolata*, anterior chevron shaped, posterior lamellar, but the shape is quite distinct, pointed, very close to *ensicula*. Despite these differences in shape, *spathulata* has been consistently placed in *Poroleda* where originally described, by most Australian authors (Iredale, Cotton, Macpherson & Gabriel, May, and Allen).

In this group, the other extreme is represented by ***Propeleda***. The type *Propeleda*, OD is *Leda ensicula* Angas, 1877 from Sydney. This species is distinct in dentition with many stronger, chevron shaped teeth in both series, the dorsal part is curbed and the shell is pointed "sickle-shaped". The dentition is well depicted in Macpherson & Gabriel (1962 fig. 311 bottom); Lamprell & Healy (1998 sp. 35 is also *ensicula*, not *typica*). The PAN *extenuata*, the ANT *longicaudata*, the CAR *carpenteri*, *platessa* and *fortiana* are close to the type. *P.* sp. non *carpenteri*, *P. louisae* and *P. paucistriata* are less typical, but these have been included here by Sanders and Allen (1996).

Specimens studied from Caribbean Panama are identical to the minute *N. carpenteri* depicted in Diaz & Puyana (1994 sp. 8). On the other hand, the similar sized "*carpenteri*" depicted by Allen & Sanders (1996 fig. 41) is perceived distinct. Also their larger specimen, 15.3 mm does not seem close to the syntype of *carpenteri* on the same page. From biogeography, depth, size and the short anterior portion it appears that Diaz & Puyana got the sublittoral *carpenteri* right and Allen & Sanders depicted instead a distinct bathyal species from the Argbas, presumably **unnamed**.

Fortiana appears much wider distributed. At least a specimen off Louisiana, 200 m, 15.8 mm fits well. *Fortiana* grows larger than *carpenteri*, the anterior portion is enlarged, the posterior portion slightly broader, and the teeth finer and more numerous. *Fortiana* appears to live also sublittoral.

Maxwell (1988) considered ***Tenuileda*** the same as *Propeleda*, an opinion not shared by Coan et al. (2000). Instead they considered *Tenuileda* as subgenus of *Nuculana*. *Tenuileda* appears closer to the type species of *Propeleda* than of *Nuculana* in size, texture and hinge. However, the dorsal margin in *Tenuileda* is straighter and the typical propeledid ridge from umbones to the posterior margin is absent; instead a ridge enlarges the teeth line towards the posterior margin. *Tenuileda* is here considered a subgenus of *Propeleda*.

Three species are referable to *Tenuileda*: ***Leda conceptionis*** from the Bering Sea to California, ***Nuculana ikebei*** from Honshu and ***Poroleda uschakovi*** from the Sakhalin, Okhotsk Sea to Kamchatka. Coan et al. (2000) compared *conceptionis* with *ikebei* and considered them "perhaps identical". Scarlato, 1981 compared his *uschakovi* with *ikebei*. Specimens from Japan, Kii have been compared to specimens from Washington. The most significant difference is that American specimens grow twice the size of Japanese. However, *uschakovi* intermediates here in size and, additionally, also in biogeography. Although *ikebei* and *uschakovi* are occasionally found sublittoral, both are typically bathyal species as is *conceptionis*. In shape no clear features could be detected to justify recognition of three distinct species, dorsally slightly curbed and straight specimens are found in Japan and in the East Pacific, the shape of the rostral tip is variable. Thus, *Tenuileda* is perceived monospecific.

Leda lanceta from SAF proved instead to represent a *Nuculana* s.s, similar to *tanseimaruae*.

NE7: ***Robaia***: Usually 2 species are differentiated. Scarlato (1981) considered the distributional range of ***robai*** and ***habei*** largely overlapping, but the *robai* interpretation of most Japanese authors erroneous. He described an elongated *habei* against a shorter, higher and smaller *robai* with more acute umbones. However, his *habei* (especially figs. 90) is virtually identical to Kuroda's type (HIG01 B66). Consequently, *Robaia* is considered monospecific, encompassing a variable species in shape. Neither biogeography, nor habitat offer strong enough arguments for differentiation.

6.6 SILICULIDAE

NJ1: ***Silicula***: currently 5 bathyal to abyssal, mostly American species are here placed.

Silicula mcalesteri has been described from the Argentine Basin. *Patagonica* has been described from SW. Chile and was in 1973 only known from broken valves. Therefore, Allen & Sanders hesitated to consider them conspecific. However, in the meantime *patagonica* has been found and depicted again (DELL90, VIL98, 63). It is most likely that these two are indeed conspecific.

6.7 YOLDIIDAE

NF1: Whereas some authors doubted familial status, Coan et al. (2000) arguments are followed.

Scissileda has been erected by Kilburn, 1994 for IND species formerly placed in *Yoldia* or in *Nuculana* with a deep instead of a small pallial sinus and a scissulate instead of a smooth sculpture. Kilburn did not recognize a family YOLDIIDAE and placed his new genus in NUCULANIDAE, close to *Yoldiella* and *Orthoyoldia*. The species, attributed by Kilburn to *Scissileda*, surpass the yoldiellid size and live generally shallower. *Scissileda* is perceived to fit well in YOLDIIDAE.

Originally, ***Adranella*** has been introduced by Verrill & Bush, 1898 as subgenus of *Yoldia* for a minute species with a yoldiid dentition with a large triangular chondrophore, but a strong commarginally sculpture. Thiele & Jaeckel (1932) confirmed the placement in *Yoldia* and added a second IND species. The anatomy of both species is unknown. However, *Adranella* does not particularly well fit in YOLDIINAE or in YOLDIELLINAE. The correct placement was not discussed by modern authors. Overall, it shares traits of both and appears intermediate between *Yoldiella* and *Yoldia*.

Parayoldiella is differently treated; as subgenus of *Yoldiella* (originally, FILA71), as full genus in a separate subfamily close to *Ledella* (FILA, FILA85), still as subgenus of *Yoldiella* (HIG99), as synonym of *Portlandia* (ALL86), or even as synonym of *Yoldiella* (KNU70). Overall, the species identified as *Parayoldiella* appear closer to *Yoldiella* than to *Ledella*; *Portlandia* appears quite distinct. However, the anatomical features as outlined by Filatova et al. (1984 and 1985) or by Knudsen (1970) for *hadalis* do not completely fit in YOLDIELLINAE, or in YOLDIINAE as defined by Coan et al. (2000).

Whereas Allen & Hannah (1986) placed ***Portlandia*** in their newly erected subfamily YOLDIELLINAE, Coan et al. (2000) placed it in YOLDIINAE and restricted YOLDIELLINAE to *Yoldiella*.

Overall, it appears that a subfamilial distinction between YOLDIINAE and YOLDIELLINAE should be reconfirmed. However, PARAYOLDIELLINAE appears distinct enough from both. Thus, here only 2 subfamilies are discerned.

NF2: ***Yoldia***: Cowan (1968) separated ***hyperborea***, *amygdalea* and *limatula*. However, the evidence presented and also admitted by him, is slim, and the localities of *hyperborea* and *amygdalea*, as well as the shapes are intergrading. Coan et al. (2000) synonymized *amygdalea* with *hyperborea* and this course is followed.

Even the NE. American ***limatula***, described from Massachusetts and currently restricted from Nova Scotia to N. Carolina is at least very closely related. Modern methods should be applied to verify, whether the NE. American *limatula* is indeed distinct, or instead the oldest name for this widely distributed, common colder water species.

The species named *limatula* by Japanese authors represents instead the broader *hyperborea* form, whereas the "Japanese" *amygdalea* (e.g. Okutani, 2000 pl. 419) is the slender form. These two extremes in shape are also found in the N. Atlantic. Lubinsky (1980) depicted two "*hyperborea*" from Canada Atlantic, one pointed, and one broader. Hanley (1860 pl. 1) presented two *amygdalea* varieties from Kamchatka (dark brown periostracum, light yellow-greenish periostracum, slender or broader forms) which he considered also the same.

The type of ***Yoldia labiata*** Sowerby II, 1871 described from unknown locality, 15.7 mm, is still present in BMNH. However, the central radial grove is perceived as accidental and *labiata* most closely resembles juvenile *hyperborea* from W. Canada.

On the other hand, ***Yoldia bartschi*** Scarlato, 1981 seems to be a valid species, more rostrate and the umbones less central (SCARL81, EVS06 p. 33).

From its OD, ***Nucula gouldii*** DeKay, 1843 described from a single New York specimen does not fit *sapotilla*. As noted by Hanley (1860) it appears closer to *myalis*. On the other hand, the published pictures show a distinct shape. As the type does not seem to be present at ANSP, it is currently considered a nom. dub.

Dell (1964) demonstrated the high variability of ***eightsii*** and the impossibility to create two MAG/ANT ***Aequiyoldia*** species. Villarroel & Stuardo (1998) came to the same conclusion and further synonymized Thiele & Jaeckel's *kerguelensis* which has the same dentition and is intermediate in shape between the very elongated *woodwardi* and the shorter *eightsii*. Most likely, Sowerby's ***Y. abbreviata*** from the Falklands belongs here as well; but the BMNH type could not be located as yet. This subgenus was originally spelled *Aeqviyoldia* by Soot-Ryen, 1951. It was also used as such by him in 1959, and so accepted by Puri in Moore (1969). However, Soot-Ryen also spelled the type species *subaeqvilateralis*, and Lamy's species *inaeqvisculpta*. Thus, the Norwegian v can definitely be assumed to represent the usual **u**, as done so by most modern authors.

Cnesterium characterizes yoldiids with oblique streaks. The number of valid species in ALE is disputed. Whereas Coan et al. (2000) synonymized *keppeliana* and *johanni* with ***seminuda***, Evseev & Yakovlev (2006) depicted all three species and recognized these as valid. However, at least their *keppeliana* and *seminuda* appear identical. Their *johanni* has the same shape but a weaker coverage with oblique lines. As noted by Coan et al. (2000) this trait seems variable and their view is followed. On the other hand, the more inflated, centrally rostrate ***toporoki*** with a broader posterior shape appears distinct. It seems that Evseev & Yakovlev (2006 p. 33 "*pseudonotabile*") is instead *toporoki*. Scarlato's true ***Y***. (***C***) ***pseudonotabilis*** with a rather straight dorsal line, a rough oblique sculpture and a comparatively broad shape may be also valid.

Nucula aeolica Valenciennes in Dupetit-Thouars, 1846 appears to be another validly proposed, very early name for a Russian *Cnesterium*. It was synonymized with *arctica* (= *seminuda*) by Hanley (1860) and would as such precede. However, the name was not found to have been applied recently and no MNHN type material could be located to confirm Hanley's view. *N. aeolica* is best treated as nom. dub.

The similar ***Yoldia glauca*** and ***similis*** have both been described by Kuroda & Habe in Habe, 1961; *similis* as *Cnesterium* No. 12, and *glauca as Yoldia* No 13. *Similis* is the smaller, highly polished species with weak distant oblique threads. The structural criteria of *Cnesterium* apply. *Glauca* grows much larger. It is smooth as adult, whereas smaller shells have a regular, fine commarginal sculpture medially, also visible on the type (HIG01 B27). It is correctly placed in *Yoldia* s.s. Nevertheless, these two demonstrate that *Cnesterium* is a rather weak subgenus.

NF3: ***Megayoldia***: The large size, the smooth surface, many acute teeth on both sides and especially the large chondrophore seem to make ***Nucula limosa*** described from a single, damaged right valve from Hudson Bay a *Megayoldia*. However, at present, no living *Megayoldia* is known from there; only fossil *thraciaeformis* records (1500-4000 years) from Baffin Bay are known. As the *limosa* type seems lost and Philippi's ovate-elliptical shape does not fit perfectly, *limosa* is best treated as nom. dub.

Though ***M. lischkei*** and ***martyria*** are close, these are distinct. The Asian species is generally larger than the American. It is significantly stronger inflated and usually more elongate. In all specimens studied the periostracum in the Asian form was consistently darker. Furthermore, the distribution seems disjunct and from Alaskan waters neither was ever seen. Kamanev (1995) reported *lischkei* from the W. Bering Sea, Commander Isl., which is the furthest Eastern extension currently known. Coan et al. (2000) reported *martyria* to 50.2°N.

As *lischkei*, also ***P. japonica*** with an enlarged chondrophore and the similar ***P. toyamaensis*** are better placed here, than in *Portlandia*, where surface sculpture and shape are marked distinct. Habe (1964, 1971) and Kira (1962, 1972) used for *toyamaensis*, *japonica* and *lischkei* subgenerically *Portlandella* within *Portlandia*, whereas Russian authors use ***Portlandella*** subgenerically within *Megayoldia*. However, Coan et al. (2000) demonstrated that *Portlandella* is a synonym of *Portlandia*; Puri in Moore (1969) placed it also synonymous to *Portlandia*. *Japonica*, *lischkei* and *toyamaensis* are considered sufficiently close to *Megayoldia*, as also proposed by Scarlato (1981).

NF4: ***Orthoyoldia***: Whether indeed two closely related species occur in the Western Atlantic is open. It is not excluded that the type species ***scaphania*** from Brazil is instead a large end of range ***solenoides*** with more teeth than the smaller, earlier described Northern species. The type species is currently only known from a single find from Brazil, Rio, 108 m, whereas *solenoides* is widely distributed and not particularly uncommon. ***Nucula crosbyana*** has been described by Guppy, 1882 from Trinidad. It is well depicted in Altena (1971 fig. 5) or Rios (1994 fig. 1330). However, Dall's (1890) comparison for *solenoides* fits the characteristics of *crosbyana* precisely and the latter is here synonymized. *Solenoides* is known to occur from N. Brazil (Rios), through Suriname (REG71), W. Trinidad (GUPPY), Colombia (DIA94), W. Panama (coll. auth.), Roatan (coll. auth.) to at least Louisiana. Dall (1908) placed both Atlantic species together with *panamensis* in *Orthoyoldia*.

A large *panamensis* from N. Peru is well depicted in Paredes & Cardoso (2001 fig. 4), a smaller Panamic specimen in Keen (1971 fig. 59).

The rare ***Yoldia liorhina*** is tentatively placed here as well.

This genus is not confined to the Americas. Specimens very close to the type species have been dredged off N. Borneo, 72-94 m. From there two closely related species have been described ***Nucula tenella*** Hinds, 1843 from nearby Singapore and ***Yoldia lepidula*** A. Adams, 1856 from Borneo. Hanley (1860) discussed them. Whereas *tenella* is completely smooth and white, *lepidula* has weak, but commarginal striae stronger anteriorly. It has been described as pale brown; but whitish specimens occur in the same lot. Both have a similar dentition and a small trigonal resilifer. Whether *tenella* records from the Indian Ocean (e.g. MEL07, PRE161, and Subba) refer indeed to the same species could not be verified.

O. serotina fits least in this group with its stronger umbones, comparatively inflated and relatively solid valves and stronger commarginal sculpture. However, it is elongate, rounded, also white and subgeneric distinction appears premature. Lynge (1909) included it together with *tenella* in the same group, and *serotina* is closer to the type species of *Orthoyoldia* than to that of *Yoldia*. Also here, the Indian Ocean records of Melvill could not be verified; analysed were topotypic specimens from the Singapore area.

Yoldia belcheri of Robba et al. (2002) from Gulf of Thailand appears instead to represent *serotina*, whereas their *Portlandia japonica* appears close to *tenella*. *Yoldia serotina* of Xu (1985) from China is a quite distinct species, similar to *glauca*, whereas his *lepida* from China is closer to *tenella*.

NF5: ***Scissileda*** has been erected by Kilburn, 1994 for species formerly placed in *Yoldia* or in *Leda* with a deep, instead of a small, pallial sinus and a scissulate, instead of a smooth, sculpture. As noted by Kilburn *Scissileda* appears closest to *Orthoyoldia*, but with a distinct surface sculpture. Shapes, sizes and colors are close. The gaping is in both genera present but weak, the resilifer and the dentition are quite similar. After comparison of anatomical features and phylogenetic data, it may well be that *Scissileda* becomes to *Orthoyoldia*, what *Cnesterium* is to *Yoldia*.

S. nicobarica is a large specimen, extending up to 29 mm (Ganges Delta, EAS96). Compared to *S. tropica* from Arabia, it is higher, more rounded on both sides and currently only known from Indian waters. Just a few specimens are present in BMNH. Even larger is the huge, finely obliquely striate 45 mm ***Y. anatina*** Smith, 1896 (ANA09 pl. 8 fig. 1, ZSI). ***Yoldia vicina*** Smith, 1906 described from the Persian Gulf from about 75 m, 20.5 mm, closely approaches Melvill's earlier *tropica* and seems to be conspecific. Smith gave the same distinguishing marks towards *nicobarica*, but did not compare *tropica*. Nonetheless, Smith's type at ZSI should be compared to confirm this tentative conclusion.

NF6: ***Portlandia*** is perceived as highly inflated genus in two respects: First, it is misused for smaller megayoldiids, especially so in Japanese literature. Second, it is misused for smaller, elongate, glossy deep water species, originally often described as *Yoldiella* and better placed there.

The type species *arctica* is very characteristic in its obliquely truncate posterior shape, solid shell and in irregular commarginal sculpture under the lens. Very few species are close. Warén (1989) depicted juveniles and discussed the differences to *Yoldiella*. The ANT *isonota* is the Southern cognate; Lubinsky (1980) demonstrated that *sulcifera* Reeve is another valid species from high Canadian Arctic. Finally, Coan et al. (2000) included here *aestuariorum*.

Thus, Warén (1989) is followed. *Portlandia* is here restricted to 4 colder water species only. All closely resemble the type species *arctica*, all measure more than 16 mm, and all live exclusively or mainly sublittoral.

All other species are removed from *Portlandia*. It appears more appropriate to define subgenera within *Yoldiella* than to overload *Portlandia*.

Thus, *lenticula*, *fora* and *minuta* are removed and placed in *Yoldiella*, all three are not particularly close to the type species of *Portlandia*, but admittedly also not to the type species of *Yoldiella*.

Knudsen's *Y. kermadecensis* with unknown dentition is tentatively placed in *Parayoldiella*.

The larger Japanese species are placed in *Megayoldia*.

Taiwannuculana is placed in MALLETIIDAE.

NF7: ***Yoldiella***: Important are Warén (1989) and Allen, Sanders & Hannah (1995). Both depict many type species. Warén demonstrated that in many instances Jeffreys confounded distinct species. Thus, Jeffreys' original stations and distributional records have to be considered with care.

Warén's ***Yoldiella messanensis*** and ***pustulosa*** (ALL95) are considered ledellids.

Ledella tamara Gorbunov, 1946 as understood by Coan et al. (2000 p. 96) and ***Yoldiella tamara*** (Gorbunov 1946) as understood by Richling (2000 p. 24) do not appear to refer to the same species. Richling's interpretation is perceived fitting. Coan et al.'s species appears as **undescribed** ledellid, similar to the Caribbean *hebes*. It is open, whether Lubinsky's *tamara* from 400 m Arctic Canada was identified correctly. Bernard's *tamara* record with either a wrong depth or erroneous coordinates (RICHL) is also doubtful.

Compared to *Ledella*, *Yoldiella* are fragile, more ovate, the posterior end rounded or subrostrate, usually glossy often with greenish-brownish periostracum, and slightly larger. The large majority is deep water.

Surprisingly, for the approximately 80 global yoldiellids no subgenera have been proposed. Nonetheless, at least 3 quite distinct groups exist. The large majority matches the type species well. Some of the more robust, deeper water species however, e.g. *abyssorum*, *dicella*, *intermedia*, *lenticula* and *pachia* are disputed and all have been placed in *Portlandia* by at least one renowned author. *P. fora* and *minuta* were even originally described as *Portlandia*, but they do not fit the large, sublittoral *Portlandia* type species with a unique sculpture. For this group a new subgenus within *Yoldiella*, or possibly even a new genus is considered the better way; robustness, lunule, escutcheon, subumbonal rounded resilium, open inhalant siphon, or hindgut may be decisive characteristics. Another group is centered on *sabrina*. This group closely resembles *Malletia*, but has a yoldiellid instead of a malletiid dentition (DELL72).

Here, the discrepancy between the high number of Atlantic species and the very low number of Indo-Pacific and Japanese species is remarkable.

Even the best experts are not in accordance, whether ***obesa*** is valid or a synonym of ***lucida***. Warén (1989) considered *obesa* a synonym of *lucida*, *inflata* was not included in his *lucida* synonymy. Usually, American authors consider *inflata* as valid, whereas Allen et al. (1995) considered it synonymous to *obesa*. Thus, Allen et al. recognized a shallower, rather elongate *lucida* (syn. *iris*) and a deeper, rather rounded *obesa* (syn. *inflata*). However, the original authors Verrill & Bush, 1898 reported several live *inflata* found in 137 m at station 2079, and as such within the bathymetric range of *lucida* (38–811 m) and not of *obesa* (1254–2886 m). The length of the largest *inflata* reported by the original authors in 1898 has been 6 mm, or about the same as found in *lucida* by Allen et al. (1995), but larger than their *obesa*. Coan et al. (2000) noted a high variability in shape at least in some E. Pacific *Yoldiella*. It appears that the type species *lucida* is another example for this; typically ovate in shape, but also found markedly compressed-elongate (= *iris*) or short-inflated (= *inflata*). Thus, the more robust view of Warén (1989), shared by CLEMAM, is followed and *obesa* is considered conspecific. It also appears that the variety *Y. obesa incala* is too close to be separated. The Med presence of *lucida* has been confirmed by Warén (1989).

Yoldiella capensis should be compared to Thiele & Jaeckel's earlier ***Y. exigua***; juvenile *bilanta* appear distinct.

Nowadays, *Nucula lata* Hinds, 1843 is considered an Australian *Yoldia*. However, Hidalgo's action to rename Jeffreys' later *Leda lata* took place before 1899 and no ICZN-decision to the reverse is known. Warén's remark (1980) to retain *lata* has been corrected by Warén (1989) himself. As concluded by Warén (1989) and confirmed by CLEMAM, as a replacement name, ***Yoldiella jeffreysi*** Hidalgo is an objective synonym of the replaced *Leda lata* Jeffreys. The action of Allen et al. (1995) to differentiate a *Yoldiella lata* and a *Yoldiella jeffreysi* based on two "lectotypes" in invalid. Warén (1989) depicted earlier a syntype USNM 199701 which is accepted to represent *jeffreysi*. It has a comparatively strong hinge line and thus, rather equals Allen et al. (1995)'s *jeffreysi*, less so their *lata*. However, the depicted syntype surpasses with 4.04 mm the maximum size indicated for Allen et al.'s *jeffreysi* and equals their *lata*. The bathymetric range for this syntype 1092-1993 m would exclude the deeper *jeffreysi* of Allen et al. and conform to their shallower *lata*. Whether the differences mentioned by Allen et al. "more inflated, more hinge teeth, smaller and more elongated anterior muscle scar" hold firm in this group of variable specimens seems doubtful. Thus, a new name for Allen et al.,'s species is not deemed necessary and *jeffreysi* considered a variable species with a bathyal-abyssal range.

Yoldiella inconspicua profundorum Allen, Sanders & Hannah, 1995 (Argbas) is preoccupied by *Yoldia profundorum* Melvill & Standen, 1912 (= *Yoldiella*, DELL90). Whereas *Y. i. africana* appears too close to *inconspicua* to be specifically separated, *Y. i. profundorum* seems recognizably distinct. It is here renamed ***Yoldiella alleni*** after one of the original authors; the type locality is Argbas, 37.7°S, 51.3°W. This species is currently only known from the Argentine Basin; the holotype is BMNH 1992038.

According to Warén (1989 p. 235) the type material of ***Leda subaequilatera*** Jeffreys, 1879 contained 4 *Yoldiella* and 1 *Neilonella species*. Warén selected and depicted a syntypic specimen from a station mentioned by Jeffreys fitting his OD. This species is 4.67 mm from the southwest of the British Isles, bathyal 910-1256 m. It does not fit well *propinqu*a or *intermedia*, as tentatively proposed by CLEMAM. *Y. jeffreysi* is also perceived as distinct, broader, and with a distinct dentition. *Subaequilatera* appears closest to the *lucida-obesa* complex, especially approaching some *obesa* forms and is tentatively placed under *lucida*.

Y. folini Warén, 1978 with thin valves and a rather weak hinge appears closer to yoldiellids, where originally described and also placed by CLEMAM; LaPerna (2004)'s placement in *Ledella* is not shared.

Y. expansa is a bean shaped species. Warén (1989) depicted a specimen closely fitting Jeffreys, 1879' picture and removed it from the European fauna. The understanding of Verrill & Bush (1898 pl. 97 fig. 3) does not match and their shallow Newfoundland presence, copied by Abbott, 1974, seems therefore erroneous. The only locality currently reliably known is Midatlantic 56.2°N, 37.7°W abyssal 2639 m. *Y. expansa* was not treated by Allen et al. (1995). However, their newly described *fabula* should be compared to the *expansa* type.

According to Warén (1980), no type locality for ***Leda insculpta*** Jeffreys, 1879 was originally given. Jeffreys only mentioned 4 stations without selecting any. In 1989, Warén gave the type locality as off Portugal and depicted one of the specimens from the stations mentioned by Jeffreys, fitting also Jeffreys, OD. This must be interpreted as lectotype selection and the later selection of a distinct lectotype with another type locality by Allen et al. (1995) is considered invalid. The specific interpretation is the same.

Despite a certain similarity, I doubt that the Japanese ***kibi*** is conspecific with the restricted NE. Atlantic *philippiana*. The shape does not fit particularly well, nor is any biogeographical connection recorded. Unless genetic data would prove the contrary, these two are considered distinct, following here Scarlato (1981). However, *kibi* should be compared to Hinds' ***retusa*** from the Philippines.

The species depicted by Forcelli (2000 p. 144) as huge *indolens* with 11 mm, seem instead true ***chilenica*** (type: DELL72 fig. 12-13). *Indolens* has a somewhat stronger dentition with fewer teeth and is less elongate in shape; Dall, 1908 noted that in small, same sized specimens, *chilenica* is much less inflated. Thus, the proposal of Forcelli that *chilenica* is a synonym of *indolens* is not shared. Based on the type material Dell (1972) demonstrated that *chilenica* is very close to *sabrina* and that neither belong to *Malletia* due to the internal resilifer. Especially *sabrina* is a quite untypical *Yoldiella*; subgeneric distinction may be indicated.

Sarepta? squamaeformis was placed in *Sarepta* by Okutani (2000 p. 839), and in *Ledella* by Higo et al. (1999). The type is depicted in HIG01 B73. However, the compressed elongated shape, the posterior subrostration and the very thin, polished valve is reminiscent of *Yoldiella*. Size and depth also fit.

NF8: ***Microgloma***: Ockelmann et al. (1998) removed ***Microgloma***, originally placed in pristiglomids by Sanders & Allen, 1973, and remarked a close relation to nuculanids, especially to *Yoldiella*. Following CLEMAM this genus is tentatively included here.

However, the reproduction mode monoecious and brooding is unique and leaves doubts whether this placement is correct. Needless to reiterate, phylogenetic data for a more solidly based relation is lacking.

The deep water Italian record of *M. guilonardi* has subsequently been confirmed by Hoeksema (2000). In contrary *M. pusilla* might also live much shallower (HOE02).

6.8 MALLETIIDAE

ND1: All evidence points that **NEILONELLIDAE** (= *Neilonella*, *Pseudotindaria*, *Neilo* and *Protonucula* as defined by Sanders & Allen, 1985 and 1996) is an artificial group, not separable from MALLETIIDAE. The basic idea of McAlester in Moore (1969) is perceived more appropriate.

Of course, the two name giving genera *Neilonella* and *Malletia* are morphologically easily distinguished and induce, at first glance, separation. However, the other criteria necessary and all the other genera involved, intermediate this first impression.

The large, commarginally ridged *Neilo* has been placed with good arguments in NEILONELLIDAE or in MALLETIIDAE. *Neilo* has been most in-depth analyzed by Marshall (1978) who placed it in MALLETIIDAE, followed by modern NZ authors (Otago). Prashad's *M. humilior* even appears somewhat intermediate between *Malletia* and *Neilo*. Allen & Sanders (1985 and 1996), though not discussing a species, placed *Neilo* in NEILONELLIDAE. The definition of Coan et al. (2000) for malletiids obviously excludes *Neilo*. *Neilo*, reaching 53 mm in length, does not match their size-understanding of NEILONELLIDAE and the *Neilo* hinge line does not have the neilonellid gap. *Clencharia* was considered a malletiid genus, even a synonym of *Malletia* by Sanders & Allen (1985), but placed in NEILONELLIDAE by Coan et al. (2000); both opinions have good arguments. *Carineilo carinifera* was originally described as *Malletia* (*Neilo*) and subsequently placed in NEILONELLIDAE by Japanese authors. Allen & Hannah (1986) even synonymized it with *Neilo*. However, *Carineilo* is closer to *Malletia* than to *Neilonella*, as originally noted by Kuroda & Habe. Some species understood as *Austrotindaria* could easily be placed in MALLETIIDAE and indeed *gibbsii* was originally described as *Malletia* by Dall. *Austrotindaria* was originally described as a malletiid genus by Fleming. *Protonucula* with an uninterrupted hinge line was placed by Cotton (1961) in MALLETIIDAE, whereas Allen & Sanders (1996) placed it in NEILONELLIDAE. However, *P. verconis* is neither a solid species, has it a dull periostracum, nor is it otherwise close to *Neilonella* or to *Neilo*; it is oval, thin and polished (COTT). *Pseudoglomus* could with good argument be placed in either family.

Sanders & Allen (1985 p. 196) and Allen & Sanders (1996 p. 102) based NEILONELLIDAE on a morphology focused on *Neilonella*, which holds for the genus, but not as distinctive of two families. Substantial other arguments, such as anatomy, feeding, reproduction, phylogeny or habitat were not presented. Coan et al. (2000) noted smaller size and lacking conspicuous gaps as main differences between these two families. However, going through all above mentioned genera the gaping is continuous from stronger to absent, the hinge dentition from continuous to clearly interrupt. If *Neilo* is included in neilonellids, then NEILONELLIDAE grow over 50 mm, larger than any malletiid, except *gigantea*.

Furthermore, the basic hinge type of malletiids and neilonellids is considered close by Ockelmann & Warén (1998 p. 5), but quite distinct from NUCULANIDAE and YOLDIIDAE.

From biogeography, mode of life, depths, feeding, reproduction, and anatomy no substantial differences are known.

As no criteria were found holding firm, these two families are here **resynonymized** as proposed by McAlester in Moore (1969). The older MALLETIIDAE takes precedence.

Compared to nuculanids and yoldiids all malletiids lack a resilifer. Compared to tindariids, all malletiids have siphons and often a large pallial sinus.

ND2: Due to overlapping criteria ***Pseudomalletia*** Fischer, 1886, ***Minormalletia*** Dall, 1908, ***Maletiella*** Soot-Ryen, 1957 and ***Bathymalletia*** Kuroda & Habe, 1971 have been resynonymized with *Malletia* by Coan et al. (2000). *Pseudomalletia* was not recognized by Verrill & Bush (1898) and also synonymized by Sanders & Allen (1985).

Bathymalletia, though more inflated, has also a deep pallial sinus and is similar in shape to *Malletia*. Here, *Malletia* is treated without subgenera.

Whereas Forcelli (2000) differentiated 2 MAG species, namely *cumingii* and *chilensis*, Villarroel & Stuardo (1998) recognized 4 ***Malletia*** from Chile. However, it appears that a 5th species is present.

The well known ***chilensis*** mainly occurs on the West side, grows largest, is somewhat more elongate, the pallial sinus is shorter and more detached from the ventral margin (S0059) compared to *subaequalis*.

As depicted by Soot-Ryen (1959 p. 17 fig. 1a) and Dell (1972, = type) ***M. inequalis*** seems close, but distinct from *chilensis* in ovate, anterior expanded shape, position of umbones and pallial sinus, as also recognized by Villarroel & Stuardo (1998).

The 2 BMNH syntypes do not allow synonymization of ***M. magellanica*** (Smith, 1875) with any other species. The smaller as well as the larger specimen are acutely pointed, as depicted by Smith (1881) or Reid & Osorio (2000) from S. Chile, and distinction has been accepted by Villarroel & Stuardo (1998).

The fourth species ***Solenella subaequalis*** was first published October, 1870 in Reeve's Icon. *Solenella*; Australia was given as locality. However, from there nothing similar is known. In November, 1870 the PZSL article was published, which was orally presented before the board in April, 1870. There, the same picture and description from a specimen in the Museum Leckenby was given; but this time with the correct locality Rio de Janeiro. As far as is known, the type is lost. However, from Brazil only one easily accessible species is known. Specimens precisely fitting Sowerby II's picture, olive green with commarginal bands, ovate, anterior and posterior portion about equal, posteriorly truncate have been analysed from various locations in S. Brazil. Scarabino (2003) lists only one species from Uruguay and Dell (1964) depicted *subaequalis* from Argentina. *M. subaequalis* fits also the concept of Villarroel & Stuardo's *patagonica* well and is undoubtedly the species depicted as "*cumingii*" by authors (e.g. Rios, 1994 or Forcelli, 2000). Here, *M. subaequalis* (Sowerby II, 1870) is considered the valid name for this rather common coastal species from Brazil to the Magellan Strait. The type locality of *subaequalis* is herein **corrected** to Brazil, Rio de Janeiro and *patagonica* is considered synonymous. In the specimens analysed, the pallial sinus is broad, equally rounded and the lower leg very close to the pallial line.

On the other hand, Hanley's ***cumingii*** from the Falklands does not fit any of above species; Hanley in Sowerby II, 1860 pl. 226 fig. 2 shows a shape not as yet seen in the coastal area between Brazil and Magellan Strait. Sowerby II, 1870 illustrates *subaequalis* from Brazil, *cumingii* from the Falklands and *norrisii* (= *chilensis*) from Valparaiso. The specimens analyzed, labelled Falklands, are compared to *subaequalis* in shape lower, stronger expanded, the anterior portion the larger, and rounded posteriorly. The two white bands mentioned by Sowerby II, 1870 however, do not exist, but are angle enforcements by the drawer. *Cumingii* is in shape closest to *inequalis* as elaborated by VIL98 p. 155. Referring to SOO59 p. 17 fig. 2, the pallial sinus is distinct, more rounded umbonally and stronger detached from the pallial line ventrally. It appears that true ***cumingii*** is a misrecognized, but valid species only reliably known from the Falklands.

Nucula dilatatae Philippi, 1844 from Sicily, Pleistocene is according to Salas (1996) a malletiid characterized by a very sharp postero-dorsal angle and an external sculpture of commarginal ridges. Philippi's picture approaches *Neilo*, however, currently no Atlantic specimens are known close and *dilatatae* is considered a European fossil only. The bathyal Cuban species named so (e.g. Dall, 1886 p. 255, Abbott, 1974, Sanders & Allen, 1985 fig. 21) is not close and seems to represent an undescribed Caribbean ***Malletia***.

Whether the Amami-Oshima and Taiwan species identified as Prashad's ***M. humilior*** (Okutani, 2000 sp. 4, LAN011 sp. 15) is indeed conspecific with the type material and whether true *humilior* is indeed a malletiid instead of a *Neilo* should be verified.

It appears that ***M. neptuni*** Thiele & Jaeckel, 1931 from EAfr was described one year earlier than Prashad's possibly identical *erronea* from Indonesia. However, fresh material and the types need to be compared to justify this presumed synonymy.

Pseudomalletia taliensis was compared by Tan & Lee (2001) with the two clearly distinct *inaequilateralis* and *humilior*. However, Prashad's *encrypta* might be the same and the type should be reanalyzed.

ND3: ***Katadesmia*** is recognized by Warén (1989) and Coan et al. (2000) as genus of its own. Warén (1989) elaborated the differences between the Atlantic *cuneata* and *kolthoffi*. Coan et al. (2000) discussed the distinct Pacific *K. vincula*.

As accepted by most modern authors, *cuneata* is an Atlantic species only, confounded by Knudsen (1970) and Sanders & Allen (1985). The species named so in Japanese literature (e.g. Okutani, 1975; Okutani, 2000 pl. 416 from 6000-6200 m) is instead *vincula*, which, additionally, lives deeper than *cuneata* (OKU051). Okutani's reference (Knudsen, 1970 fig. 42) from the Gulf of Panama is instead also *vincula*. It is likely that the NZ *cuneata* records (i.e. Otago) are instead referable to *vincula* as well.

Sanders & Allen (1985) further synonymized Thiele's *pellucida* with *cuneata*. However, from the known distribution range and shape this action is not shared. Instead *pellucida* is reminiscent of Dall, 1908's *Minormalletia* species and is here understood as abyssal ANT *Malletia*.

ND4: Whereas Sanders & Allen (1985) synonymized ***Clencharia*** with *Malletia*, Coan et al. (2000) characterized it as valid genus and included the thin, abyssal *abyssicola* and *abyssorum* with a smooth gap separating the subequal teeth. This latter view is followed.

Morphologically and especially anatomically ***surinamensis*** shares many traits, but lives shallower and has a more robust shell. It is understood as *Malletia*, where originally described.

ND5: The smooth polished, but inflated, at both ends slightly gaping, sharply double carinate ***Carineilo*** is somewhat in between *Malletia* and *Neilo*, but does not fit in the quite homogenous *Neilo*-group. Whereas Habe originally described it as *Malletia* (*Neilo*), Okutani (2000) placed it in NEILONELLIDAE. However, the periostracum is glossy, the valves are slightly gaping, the dentition is continuous, weak centrally, but without a gap under the beaks and a pallial sinus is present. *Carineilo* is here understood as valid malletiid genus, closer to *Malletia* than to *Neilonella*. The Japanese ***carinifera*** is usually approximately 10 mm, whereas in the EChi they attain almost twice this size.

A congeneric species is ***M. angulata*** from the Bay of Bengal, well depicted in ANA09 pl. 2 fig. 6; KNU67 pl. 1. Most likely Bernard et al. (1993) and Higo et al. (1999) confounded the EChi *carinifera* with the Indian *angulata*. The larger and somewhat more rectangular *angulata* is currently only known from some Bay of Bengal specimens. 2 BMNH syntypes from there are present.

ND6: ***Taiwannuculana***: Okutani & Lan, 1999 described *Taiwannuculana* as subgenus of *Portlandia*. The type, OD *T. exotica* is a quite unique species, the shell is light and fragile, the surface sculpture obliquely, densely incised somewhat similar to *Cnesterium* for approximately 3/4, smooth at the pointed end. The periostracum is thin, polished, strongly adherent. The ligament is strong, external and opisthodetic. However, the dentition shows an uninterrupted line of dense, acute teeth. There is a slight indentation centrally, beneath the thinner teeth line, but no resilium was seen. The inside is porcellaneous glossy whitish. The absence of a resilium and a chondrophore excludes YOLDIIDAE and NUCULANIDAE. Shape, fragility and dentition seem to place *Taiwannuculana* between *Malletia* and *Neilonella*.

Portlandia nigromaculata Okutani, 1983 from off Suriname is another species with almost identical constellation in shape and dentition. The type locality for the holotype 54°72'W is not possible and here assumed at approximately 54.5°W; all other records are between 54 and 54.6°W. It is a rare species, not reflected in recent Caribbean literature (e.g. MALAC). However, 2 specimens are available from E. Panama, about 250 m which match the OD well. The surface sculpture is weaker and more regular than in *exotica*, a deep pallial sinus is well visible. Also here, no resilium was seen, the dentition is uninterrupted with a very shallow depression centrally as in *exotica*. This condition fits neither *Portlandia*, nor *Megayoldia* with marked chondrophores. Furthermore, surface sculpture and shape are quite distinct from *Portlandia arctica*.

An apparently cognate species, likely **undescribed** is known from Panama Bay. However, it is only present from a single, small specimen, 6.7 mm, live taken, said from 40 m. Further specimens are required to substantiate its characters and distribution.

ND7: Usually, ***Austrotindaria***, ***Pseudotindaria*** and ***Pseudoneilonella*** are placed close to ***Neilonella*** or have even been synonymized by authors.

Neilonella has been created for *corpulenta*, which is solid, with a strong commarginal sculpture and an amphidetic ligament. However, Allen & Hannah (1986) and Coan et al. (2000) noted *Neilonella* as opisthodetic ligamented and placed here species closely resembling, but opisthodetic.

Originally, ***Austrotindaria*** was created as malletiid genus, for species without chondrophore, rounded, not rostrate, with an opisthodetic ligament only and a neilonellid, interrupted hinge plate with an edentulous gap. Fleming, 1948 described *Austrotindaria* against *Neilonella* which he perceived as close, but differing in ligament position.

The congeneric *A. flemingi* has a sculpture of commarginal ridges and approaches *corpulenta* in rostrate shape. Furthermore, in *Austrotindaria wrighti* the ligament is not completely opisthodetic, but continues at least beneath the umbones (FLE48 fig. 1). In addition, the base hinge configuration in *Austrotindaria* is the same as in *Neilonella*, no chondrophore, no resilium, but an edentulous gap centrally. McAlester in Moore (1969) considered *corpulenta* and *wrighti* congeneric. However, apart from biogeography, a difference in shell robustness and strength of sculpture compared to *Neilonella* has to be noted for *Austrotindaria*.

Originally, ***Pseudotindaria*** was created as genus of uncertain affinities for ovate species similar to *Tindaria*, but siphonate, with a neilonellid hinge. It has a similar concept as *Austrotindaria*, also ovoid, hinge plate with a weak gap centrally as well, the ligament was said amphidetic; but in the 3 specimens of the type species depicted by Sanders & Allen (1977 fig. 30) this condition is not that clear and approaches the condition in *Austrotindaria*. Furthermore, *Malletia gibbsii* shares the ligament type of *Pseudotindaria*, but the rather smooth sculpture and shape of *Austrotindaria wrighti*. Coan et al. (2000) even synonymized *Pseudotindaria* with *Austrotindaria*. Allen & Sanders (1996) defined as difference "hind gut single loop to the right of the body" (*Neilonella*) vs. "complex series of loops and coils to the right and left of the body" (*Pseudotindaria*). However, whether the same condition is met in all comparable species and whether this criterion is sufficient for generic distinction is open.

Saturnia and its nom. nov. *Pseudoneilonella* Laghi, 1986 were variously treated. McAlester in Moore (1969) considered it synonymous to *Neilonella* and depicted *corpulenta* as typical representative; Warén (1989) followed and depicted a species somewhat similar, but not necessarily identical to Philippi's *pusio*. Allen & Sanders (1996) noted *pusio* as rostrate and not a neilonellid, but a ledellid. Coan et al. (2000) considered *Pseudoneilonella* synonymous to *Austrotindaria*. The type, MT is *Nucula pusio* Philippi, 1844 and it is lost. Whereas most of Laghi's pseudoneilonellids are conspecific to *Neilonella salicensis*, the type species *Nucula pusio* is not. Philippi, 1844 noted a dentition with two series, medially obsolete; the OD shows an acutely rostrate species, which does not fit *Neilonella* well. A strong pallial sinus is not detectable and was not mentioned by Philippi; the position of the ligament is not clear, a minute resilifer might be present, but was not mentioned by Philippi. Obviously, the features of the lost type species do not convincingly conform to *Neilonella*, or to *Ledella*. No neotype was selected. Thus, *Saturnia* (= *Pseudoneilonella*) must be considered as fossil genus of uncertain position only. It is here treated as gen. dub.

At present, a clear picture of the involved groups is lacking. Consequently, species with various ligament positions are placed in *Neilonella*. Unless genetic data solve these disputes it appears best to understand *Neilonella* in a wide sense.

The distinction from *Neilonella* to *Malletia* is obvious; important towards *Tindaria* are the presence of siphons/pallial sinus and the interrupted hinge line.

Neilonella salicensis (syn. ***striolata*** auctt.): The highly complex history has been recorded by Warén (1989) and later enlarged by Allen & Sanders (1996). According to the latter view the type of *striolata* is lost, but was presumably a *Yoldiella*, whereas *salicensis* is a *Neilonella*. However, it is possible that *salicensis* is fossil only and *latior* the correct name for the extant species.

Neilonella schepmani appears not particularly close to *salicensis*. Furthermore, no intermediary records to the Atlantic species are known, thus, it is here considered as valid Indonesian species. Okutani & Kawamura (2002) reported similar specimens from abyssal depths off NE. Honshu.

The common S. American ***Nucula sulcatula*** has been variously placed by Rios (1994) and Forcelli (2000) as *Tindaria*, by Villarroel & Stuardo (1998 as *Tindariopsis*), by Dell (1971 as *Nuculana s.l.*). However, the pointed, solid shape, the clearly interrupted dentition and the medium sized, well expressed pallial sinus exclude *Tindaria*. Shape and dentitions exclude *Tindariopsis*, as also concluded by Dell (1971) after comparison with the type of *agathida* (= ALL96, fig. 26-28). The missing internal resilifer excludes *Nuculana*. Despite the somewhat more irregular commarginal sculpture, *N. sulcatula* fits well in *Neilonella*. The earliest name *Nucula striata* King & Broderip 1832 is preoccupied by a Lamarckian, 1805 fossil.

Neilonella hampsoni is confusing regards locality. It was originally described from the Sierra Leone Basin. However, the coordinates give 0°0.3'S, 27°48.0'W, the second location is 10°59.0'N, 45°15.0'W which both are Caribbean. It is assumed that instead of Sierra Leone Basin, Sanders & Allen meant Guyana Basin, making *hampsoni* a Caribbean species.

Nuculana indica Smith, 1895 was synonymized by Knudsen (1967) with *N. fumosa* which is a nuculanid. However, Smith clearly stated for *indica* a hinge without resilifer, close to *lugubris* (= *Neilonella sulculata*), a broad pallial sinus and an amphidetic ligament. Thus, *Indica* is removed from this unwarranted synonymy and placed in *Neilonella*. Two syntypic valves are in ZSI. The two types are depicted in Annandale & Stewart (1909 pl. 1 fig. 1 (*indica*) and fig. 2 (*fumosa*)) and show the distinct dentition.

T. rodent has an ovate-elongated shape, an amphidetic ligament, a pallial sinus and a strong dentition with an edentulous slit in between. It does not fit *Tindaria*, but is instead placed here.

T. similis Okutani, 1962 was considered close possibly even conspecific with Thiele & Jaeckel's WAF *Neilonella guineensis* (= *salicensis*) by Okutani (1975). However, even closer to *similis* appears to be Thiele & Jaeckel's *aequatorialis* from EAfr and Indonesia: rounded shape, commarginal sculpture, strong almost not interrupted dentition with comparatively few teeth. Okutani's type as well as Thiele & Jaeckel's syntypes at MfN should be compared to verify distinctness. For the time being *similis* is listed separately.

Neilonella delicatula does not belong here. However, without analysis of the type no firm conclusion can be drawn; sareptids should be included in a comparison.

ND8: Whereas Coan et al. (2000) placed *Pseudoglomus* reluctantly in PRISTIGLOMIDAE, Ockelmann et al. (1998) questioned the inclusion of ***Pseudoglomus*** there, depicted the type and noted a nuculanid hinge without resilifer, close to MALLETIIDAE/NEILONELLIDAE and TINDARIIDAE, but quite distinct from true pristiglomids. McAlester in Moore (1969) included it in MALLETIIDAE. The anatomy of *Pseudoglomus* is unknown, but at least a slight pallial sinus is present. Inferring from the other features, the type species *pompholyx* appears closest to certain neilonellids and to *Protonucula* and is tentatively placed here. Obviously, Beesley et al. (1998) came to the same conclusion and placed *Pseudoglomus* also in MALLETIIDAE. However, without a genetic comparison the best placement must stay open.

However, ***Pseudoglomus fragilis*** with a small resilifer and a distinct shape is considered a true sareptid, not a pseudoglomid.

Smith's enigmatic Caribbean ***Glomus inaequilateralis*** was not found discussed in modern literature. It appears malletiid instead of pristiglomid and is tentatively also placed here.

6.9 TINDARIIDAE

NC1: ***Tindaria***: The missing pallial sinus would exclude Dall's ***salaria*** from *Neilonella*; however, the resilium, obsolete or none, is special. Villarroel & Stuardo (1998) kept it in *Tindaria*, where originally described. As far as is known, this species has never been depicted. The type should be reexamined.

Tindaria thea with an almost uninterrupted series of teeth, but a "semi-internal resilium", polished, attenuate should be also reexamined. The outside is depicted in Knudsen (1970 pl. 3 fig. 9). It may instead even belong in *Katadesmia*.

Neilonella weberi appears closer to *Tindaria* (e.g. *lata*) than to *Neilonella*. Xu (1990) placed it in *Tindaria* as well, stating his *jinxingae* similar.

6.10 MYTILIDAE

NV1: This is a huge and important family, treated by many authors, notably Hanley (1843), Reeve (1857-58), Küster & Clessin (1840-90), Ihering (1900), Lamy (1936-37), Soot-Ryen (1955). Modern authors contributed mainly to *Mytilus*, *Bathymodiolus*, *Lithophaga* and *Dacrydium*; Russian authors treated the systematic.

The phylogeny in MYTILIDAE is not completely resolved and many genera were never included in a genetic analysis. However, recent studies (e.g. HAMM01, DIST, CHICH or EVS501) support monophyly of MYTILIDAE. Furthermore, many of Scarlato & Starobogatov's base views appear to fit reality better, than Soot-Ryen's and Newell in Moore's "classical" approaches, notably:

- a conventional group around *Mytilus*, and following Coan et al. (2000) also *Perna*, included in **MYTILINAE** Rafinesque, 1815 with mytiliform, large, byssally attached species, often intertidal and gregarious

- a group around *Musculus* and *Gregariella* included in **MUSCULINAE** Iredale, 1939. These are related to MYTILINAE and to CRENELLINAE (65, DIST, EVS501, MATSU) ovate-elongated, smaller species, with dysodont teeth and a tripartite sculpture, general sublittoral.

- a group around, *Musculista* (= *Arcuatula*), *Xenostrobus* (= *Limnoperna*) and *Mytella* included in **ARCUATULINAE** Scarlato & Starobogatov, 1979. Many genera of ARCUATULINAE and LIMNOPERNINAE appear closely related, others, e.g. *Fluviolanatus*, *Pergrinamor* do not belong to MYTILIDAE, modioliform-elongate, thin, most with a large anterior adductor, estuarine-freshwater

- a group around *Crenella*, *Solamen* and closely related genera, included in **CRENELLINAE** Gray, 1840 (SCARL84), with rather small, rounded, dorsoventrally-elongate, inflated, radially sculptured, sublittoral to bathyal species

- a conventional group with *Dacrydium* included in **DACRYDIINAE** Ockelmann, 1983 (OCK83) with minute, translucent, deep water species.

- a group around *Septifer*, *Mytilisepta* and *Ciboticola*, including *Urumella*. For this group **SEPTIFERINAE** Scarlato & Starobogatov, 1979 matches (SCARL84, EVS501); mytiliform, with a septum, shallow water; *Urumella* is unique, but has obviously closest genetic affinities to *Mytilisepta* (MATSU).

- a group around *Hormomya* (= *Brachidontes*) and *Geukensia*, not closely related to *Mytilus*, but to *Septifer*. For this group **BRACHIDONTINAE** Nordsieck, 1969 fits (DIST, demonstrating a close relation between *Hormomya* and *Geukensia*; SCARL84, EVS051) with solid, triangular, mostly radially ribbed species with dysodont denticles, intertidal, often gregarious.

- a group around *Lithophaga*, including *Botula*, *Adula* and *Fungiacavca*, included in **LITHOPHAGINAE** H. & A. Adams, 1857. BOTULINAE and ADULINAE are considered synonymous (KLE901, 65, EVS051); mostly elongate, largely chemically or mechanically boring species, mainly subtidal.

- a group around *Modiolus*, included in **MODIOLINAE** G. & H. Termier, 1950 (**NOMC**). This group is not closely related to *Mytilus* or to any other group, except LITHOPHAGINAE (DIST, EVS051, MATSU), with modioliform, medially inflated, rather large species, generally edentate, with or without siphons, sublittoral.

- a group around *Bathymodiolus* and closely related modioliform deep water genera, included in **BATHYMODIOLINAE** Kenk & Wilson, 1985 (HAMM01; COS03).

The true affinities of ***Trichomya*** (variously placed, here tentatively in SEPTIFERINAE), ***Amygdalum*** (variously placed, here tentatively in BATHYMODIOLINAE), but also ***Semimytilus*** (here still in MYTILINAE), or ***Modiolula*** (here still in MODIOLINAE) are currently unknown.

Certainly, more work is necessary to achieve a well equilibrated picture of one of the largest bivalve families with more than 50 genera and approximately 400 species.

NV2: ***Mytilus***: Many genetic analyses exist. The Californian species is most easily distinguished morphologically, and also genetically (HAMM01). Kafanov, 1984 separated it as ***Pacifimytilus***. Also quite easily separable is the Japanese *coruscus*, for which Scarlato & Starobogatov, 1979 created ***Crassimytilus***.

On the other hand, *M. edulis*, *M. galloprovincialis* and *M. trossulus* are not only morphologically, but also genetically very close (HAMM01).

Overall, biogeography seems the easiest way to differentiate within *Mytilus*. The distinction between *edulis* and *galloprovincialis* is particularly difficult. Here, Gosling (1984) gave some hints.

M. chilensis and ***M. planulatus*** are valid species with genetic differences and a long fossil record.

On the other hand, whether the St. Helena species is indeed the same as *galloprovincialis*, as proposed by Smith (1890) is open.

Lamarck, 1819 described 2 huge *Mytilus* No. 14 ***zonarius*** and No. 15 ***canalis***, both approximately 130 mm. Both types have been well curated present in MHNG for 150 years. Lamy (1936), instead of studying these holotypes in Geneva, discussed them in length and arrived at erroneous conclusions. The type of *zonarius* MHNG 1087/42 ink marked 14 inside is a large, thick, elongated species with a slightly expanded dorsal margin. The color is dark purplish, anteroventrally whitish. The strong, somewhat ridged commarginal sculpture is still well recognizable. *Zonarius* was originally described from unknown locality, the label reads "Amerique?". From size, shape, sculpture, but also from the condition of the pallial line, muscle scar and position of the ligament there is no doubt that *Mytilus zonarius* is the earlier name for the well known Californian ***Mytilus californianus*** Conrad, 1837. Similar sized specimens, personally collected in Monterrey have been compared as identical. The **type locality** of *Mytilus zonarius* is here clarified as San Diego. The MHNG 1087/45-type of ***Mytilus canalis*** still bears inside the ink number 15; the label bears the erroneous original type locality "Jamaique". However, *canalis* is in all respects the same species as *zonarius*. The only difference is that in *canalis* the surface is polished smooth and the commarginal sculpture almost vanished. The **type locality** of *Mytilus canalis* is here corrected to San Diego and *canalis* synonymized with the earlier named and better preserved *zonarius*. *Mytilus zonarius* has been validly proposed; the name is not preoccupied, the type is unambiguously present and is without doubt identifiable. It is a Lamarckian species and its name has been discussed after 1899. *M. zonarius* is also contained in many listings, but always erroneously understood. A reversal of precedence is not possible. Thus, to save *californianus*, an ICZN request would have to be launched.

The holotype of ***Mytilus latissimus*** Clessin, 1887 is one of the few Clessin types still present in MfN 112621. The old label reveals its true identity "*Mytilus dunkeri* Rv. Phlpn.". Shape, dentition and margin confirm that this is also *Crenomytilus grayanus* with an erroneous type locality.

NV3: ***Perna***: The type species displays a stunning variability in shape and colors which mislead Chemnitz into 3 distinct species. Linnaeus type locality Magellan Strait is erroneous. As far as is known, ***P. perna*** does not occur further south than Uruguay. Beauperthuy (1967) depicted the impressive variability in Venezuelan specimens.

Born's type of ***Mytilus pictus*** (NHMW 14.132) equals Chemnitz 739 and represents specimens typically found in Morocco or Senegal. Also, recent genetic analyses do not support a distinct species. Thus, *perna* occurs widely in the W. and E. Atlantic and is also well known from SAF. Furthermore, Lamy (1936) and Oliver (1992) accepted *perna* in the southern part of the Red Sea.

Additionally, in S. India, Kerala and in Indonesia, S.W. Java *Perna* specimens have been collected. These are usually termed "brown mussels" or ***P. indica***. However, morphologically no differences to *P. perna* have been detected and modern Indian authors synonymize *indica* with *perna*. This gives *Perna perna* a stunning range from Uruguay to Java.

NV4: ***Aulacomya***: Gosling (2003), as many specialists before, accepted only 1 species.

However, Beu (2004) recognized the NZ species as distinct from ***ater*** and gave the criteria. Similarly, the SAF ***capensis*** and also the Kerg ***regia*** can be separated. Powell (1957) elaborated the criteria for distinction. Thus, unless genetic results prove otherwise, 4 *Aulacomya* species occur in the Southern hemisphere.

As noted by Lamy (1936), there is little doubt that Mörch's Norwegian ***M.*** (***A.***) ***diliculum*** was an accidental import, most likely from S. America.

NV5: ***Semimytilus***: In general, this rather fragile, in adults toothless genus is considered monospecific. However, Lamy, 1931 described ***Modiola pseudocapensis*** from Namibia, Walfish Bay and from "plage de Ponta Gea". Lamy (1936) reviewed *Modiola dactyliformis* (= *algosus*) as close.

Specimens collected in Swakopmud, Namibia proved identical to Lamy's MNHN-type series. Here Namibia, **Walfish Bay** is selected as **type locality**. A presence in Mozambique or in central SAF could not be confirmed. Kensley & Penrith (1970) reported "*algosus*" (= *pseudocapensis*) from SW. Africa.

These two are close. *Pseudocapensis* is often stronger lilac internally and the anterior retractor muscles somewhat smaller with divided scars, it also seems to grow larger. However, this may be due to limited material. The biogeographic distance combined with a lacking W. Atlantic presence recommends keeping these two separate for the time being. The currently lacking genetic analysis could easily clarify their relations.

NV6: ***Musculus***: Fleming, 1959 introduced ***Ryenella*** based on Soot-Ryen's ***Lanistina*** non Gray, 1847 with the type ***M. impactus***. However, Lamy (1937 p. 5) and Iredale (1939 p. 423) had clarified before, that the type MT ***Modiolarca*** Gray in Dieffenbach, 1843 is *Mytilus impactus*. Gray (1843 p. 259) applied *Mytilus* (201), *Modiola* (*202-3*), *Lithodomus* (*204*) and afterwards introduced for Hermann's species (205) *Modiolarca*. *Ryenella* is without doubt an unnecessary nom. nov. However, the underlying concept is strong enough for at least subgeneric distinction. *Modiolarca* is quite easily separated from the ovate, compressed, not ascidian affine *Musculus* with a distinct musculature.

Fabricius, 1788 described 3 *discors* varieties. According to Sherborn, all have been validly proposed and recently confirmed by the authors of Sherborn's Internet version and by the authors of animalbase, University Göttingen. These names have been accepted by Hanley (1843), Dautzenberg & H. Fischer (1912) and Lamy (1937). ***M. d. arcticus*** is *laevigata* (= *discors*); ***M. d. australis*** is the same as Chemnitz 768 (= *impactus*). However, Fabricius third name ***Mytilus discors var. svecicus*** is the earlier name for Gray's well known, flat ***Modiola nigra*** (= Chemnitz 767) as recognized by above authors. *Musculus svecicus* indeed occurs in Swedish waters. As this name has been used, a reversal procedure is not possible. Unless an ICZN-petition would be successfully filed, the use of Fabricius earlier name for the well known *nigra* is unavoidable.

Coan et al. (2000) synonymized ***laevigata*** with ***discors*** and gave the reasons. This view is followed. It is unlikely that Scarlato's *filatovae* and *incurvatus* are other than forms of the same variable and widely distributed species.

Coen, 1929 described the small, compressed, reddish ***Modiolaria rufa***, from the Venice Lagoon, rarely reflected in European literature. He correctly excluded it to be the same as the well known *marmorata* (= *subpicta*) found in the same locality. However, from biogeography, habitat, size, shape, especially also from sculpture and color I fail to recognize it other than a junior synonym of *M. costulatus* which is known from the Mediterranean.

Musculus nanus has been described by Dunker, 1857 from SA, Port Lincoln. From all data available, this species is restricted to S. Australia. The species named so from the Philippines to Japan is distinct (= *viridulus*). The length given for this SA-species by Lamprell & Healy (1998 sp. 201) of 27 mm is copied from Cotton (1961). However, Cotton's size refers to species 121 which is instead *impactus*; Cotton's fig. 122 *paulucciae* is *nanus*. *Nanus* has been described as minute species, less than 4.5 mm and seems to reach approximately half an inch (ALLAN). Identity of ***paulucciae*** and *nanus* has been concluded by Iredale (1924) and Lamy (1937). From the OD, it is most likely, that Dunker, 1871 described this species again as ***Crenella*** (***Modiolaria***) ***adolphi***; but this time from a larger, 13 mm specimen. The type in Godeffroy Museum was destroyed during WWII.

M. cumingianus Reeve, 1857 from S. Qld and the preoccupied ***M. cuneatus*** from SAF (type BAP15 pl. 42 figs. 5-6) are both widely distributed. The former grows twice the size, is more solid, usually whitish or white and purple streaked inside, the latter is thinner, has comparatively broader umbones and is usually more vividly rose colored often also inside. Both species occur in SAF, Red, Arabia, Australia and China. The smaller, preoccupied *cuneatus* has been renamed ***M. chinensis*** by Bernard, Cai and Morton, 1993 with a range "Indian Ocean, South Africa, Indo-Pacific, Philippines, South China Sea, Hainan". In doing so, they assumed *coenobitus* synonymous to *cumingianus*. However, as demonstrated by Oliver (1992, Red Sea, pl. 5) and (1995, Arabia, sp. 956 and 957) and confirmed by Dekker & Orlin, 2000 these two are distinct. All evidence points to the fact that *chinensis* is an unnecessary nom. nov. and ***Musculus coenobitus*** instead applicable to the smaller widely distributed species.

Laseron (1956) and Iredale & McMichael (1962) did not recognize ***M. impactus*** in NSW. Instead they listed *cumingianus* and *ulmus*. Jansen (1995) and Lamprell & Healy (1998) recognized *M. impactus* and *cumingianus* in NSW. ***M. ulmus*** is the same as *cumingianus*, as concluded by Lamprell & Healy. Inside, *impactus* has purplish ribs; it is also less inequilateral and grows higher and larger. The anterior and posterior ribs are stronger expressed and fewer. Thiele's comparatively high and short, inflated, greenish, 6 mm ***M. inflatus*** from SWA, Fremantle appears as juvenile *impactus*. The single holotype at MfN should be compared to specific growth series. Biogeographically, *impactus* is understood as temperate SAU/NZ species and *cumingianus* as tropical species, extending south to Perth and NSW.

In addition, there are sparse records of *impactus*-like specimens with a greenish periostracum from W. Thailand, Indonesia, Timor (PRA), WA (SLACK). Whether these are adventitious or indicate an undescribed species is currently open.

Furthermore, Oliver (1995 sp. 958) reported a greenish ***Musculus cf. costulatus*** from Arabia. On the other hand, Dunker, 1857 described an ovate, rather compressed 15 mm ***Lanistina concinna*** with a green periostracum from the Philippines, which is a true compressed *Musculus*. Hidalgo (1905) reported it from the Philippines, but obviously had no additional material. The Arabian and Philippine species seem to be conspecific. The type of *concinnus* was studied in BMNH, but the lack of fresh material hinders a firm conclusion.

Musculus nanulus Thiele, 1930 has been described as fragile, ovate, compressed, minute species from WA, Shark Bay. The syntypes are in MfN. It is not excluded that Lamprell & Healy (1998 sp. 205 *Musculus* sp.) from Arafura Sea is conspecific. However, lacking material hinders here progress.

Modiola strigata Hanley, 1843 p. 243 has been described from the Philippines, oblong, fragile, approximately 13 mm; in colors "pale green with chocolate ziczac". Reeve (1857 sp. 33) is instead *Mytilus strigata* Hanley, 1843 (= *Mytella falcata*). Based on Smith (1885), Lamy (1937) synonymized Hanley's *strigata* with the NSW *varicosa*. However, this does not match and was never accepted by Australian authors. Hanley clearly noted "not unlike *discrepans* [= *subpictus*] in outline", but obviously more oblong. *Strigata* is perceived as moderately inflated species, as elongated *Modiolarca*, with a strong ribbing. It is uncommonly found in the Philippines, Masbate Isl., also in N. Borneo, 22.6 mm and in the Andaman Sea, He Isl., off Phuket, 13 mm. All three records have been marine; the only depth record was 20 m, coral reef area. Whether Lamy's brackish water records from Madagascar are indeed referable to this species is questionable. Under the yellowish green periostracum *strigata* is cream with its brownish zigzag marks and longitudinal streaks. White (1949) described a typical *Modiolarca*, ***Musculus lebourae*** on ascidians from the Indian Ocean, oblong, fragile, 13 mm, cream with an irregular pattern of light brown, under a pale yellow periostracum. Most likely these two represent the same species. Unfortunately, neither type could be located at BMNH 11/08.

Adams' 8 mm ***viridulus*** from the Red Sea has been described as small greenish species. As indicated by Oliver (1992) this species is widely distributed. Indeed, Lamy (1937) reported *M. viridulus* from the Red Sea and from Japan. ***M. mirandus*** has been described from N. Australia. This is the same minute, ovate, compressed, fragile species. It is often found in reddish and brownish colors, but whitish, reddish or greenish specimens occur side by side. There is no doubt that these two are conspecific. Lamprell & Healy (1998 sp. 203 *mirandus*) indicate 6 mm, the largest seen from the Philippines has been 7.3 mm, from Borneo 9.3 mm; Japanese authors (e.g. Okutani, 2000 sp. 56 "nanus") report 5.1 mm, the largest seen from Kii has been approximately 6 mm; Oliver (1992 pl. 5 fig. 7) illustrates an 8.7 mm specimen from the Red Sea. *M. viridulus* occurs from the Red Sea to tropical Australia, Philippines to Japan, but is smaller than 10 mm.

The rare SA ***M. semiradiatus*** and the E. Austr. ***M. perstriatus*** do not belong in ***Musculus***. *M. perstriatus* appears as *Rhomboidella*. *M. semiradiatus* might even represent an undescribed genus.

In addition, Coan et al. (2000) noted for the brooding E. Pacific ***phenax***, ***pygmaeus*** and ***taylori*** the necessity of a new genus.

NV7: ***Gregariella***: Apart from *Trichomusculus* and *Tiabialectus*, it also appears that Iredale's ***Propetilus*** represents a *Gregariella* devoid of periostracal hairs. ***Propetilus nubilis*** should be compared to juvenile *coralliophaga*.

In addition to the Med type species *petagnae*, 2 further species have been described to occur in WAF, ***C. multistriata*** and ***M. obermulleri***. Lamy (1937) did not recognize the latter as distinct from *petagnae*, but was obviously not aware of the former. Ardovini et al. (2004) did also not recognize the latter, but listed the former as distinct.

From the material at hand, at least one other large species occurs in WAF in addition to *petagnae*, marked distinct also from *semigranata*. It has a rougher and stronger radial sculpture and the marginal denticles are larger. It is also more rounded dorsally. *G. petagnae* is not known from the Med larger than 18 mm. As such *obermulleri* is with 33.4 mm (MNHN syntype) also peculiar in size. *G. obermulleri* offers further special features in shape and sculpture, making it a distinct species. Unfortunately, only very sparse material is available, the exact habitat is not known.

The BMNH type series of Smith's *multistriata* does not fit *petagnae* either. The yellowish color with brownish streaks, a very fragile texture and very sparse bristles make it a valid species. The type material contains also one specimen in situ, nestling in a dead valve. Here, *petagnae*, *obermulleri* and *multistriata* are recognized as WAF gregariellids.

The 5.5 mm type of ***G. semigranata*** from unknown locality is depicted in HIG01 B122. *G. subclavata* has been depicted and discussed by Palazzi (1981). From the material studied, there is little doubt that *semigranata* is indeed a MED species, as concluded by CLEMAM and modern European authors.

The closely similar Japanese to Australian species is instead referable to Reeve's (not preoccupied) ***G. barbata***. Reeve, 1858 gave the distinguishing mark, ***semigranata*** is "grain-striated only on the posterior area", whereas the Japanese-Australian species has "radial ribs present in anterior and posterior regions" Okutani (2000 p. 869 sp. 36), as also noted by Reeve for his ***Lithodomus barbatus***. The type of the synonymous ***arcuata*** Gould, 1861 from Kyushu is depicted in HIG01 B122s. *G. barbata* is a small species, rarely more than 10 mm with strongly branched periostracal hairs.

Without doubt Dunker, 1857's OD of *Volsella splendida* from "California" (= *Lioberus*) is marked distinct from Reeve, 1858's ***Lithodomus splendidus*** from Sydney (REV582 sp. 31), as recognized by Lamy (1937) and Iredale (1939).

Reeve's species has been recognized by Australian authors from Sydney as *Trichomusculus* (LAS561 fig. 19-20, IRE62) or as *Gregariella* (Lamprell & Healy, 1998 sp. 196), erroneously as of Dunker, 1857. Despite Reeve's erroneous reference, *splendidus* has been validly proposed, clearly localised, not preoccupied and is considered a valid name. Compared to the co-occurring, smaller *G. barbata* the periostracal hairs are unbranched.

The true identity of the rare, 17 mm "*Gregariella splendida* (Dunker, 1856)" Zhongyan (2004, Fujian) or Bernard, Cai & Morton (1993, Fujian, Taiwan) is currently unknown. The name is erroneous, but the existence of a further, undescribed species is likely.

Say's famous 12 mm ***Modiola opifex*** non Dall, 1889 (= *coralliophaga*) on a *Pecten nodosus* from Minorca is still a riddle. Minorca or Menorca is one of the Baleares, an Island group in the Western Med. From there, however, neither *Nodipecten nodosus* nor *gabonensis* are known. The confoundable *Bractechlamys corallinoides* is not known from the Med either, it is an Atlantic species. It is unlikely that Say should have misidentified *Pecten maximus* or *jacobaeus*. This leaves salient doubts regarding locality and carrier shell. Furthermore, the characteristic constricted shape centrally, the lacking hair in a fresh specimen and the habitat leaves doubt on the generic position in *Gregariella*. Palazzi (1981) doubted *opifex* to be a *Gregariella*. Kleemann (1983) concluded ?*Gregariella* and resolved the *opifex*-interpretations of authors. Palazzi's approach to *Musculus* does not match any species close. *Vasconiella jeffreysiana* has a marked ventral constriction and may occur in the Baleares but remains much smaller and has a distinct sculpture. CLEMAM did not accept *opifex* as valid European species and this course is followed. Thus, Say's enigma remains unresolved for almost 200 years.

In CAR indeed two closely similar *Gregariella* are found, as depicted by Philippi (1847, *Modiola* 2 figs. 7 and 8), confirmed by Lamy (1937) and by Garcia & Lee (2002), and depicted by Lee from Florida (jaxshells). The larger, umbonally ridged ***coralliophaga***, which is similar to the PAN *coarctata* and the smaller, more ovate ***chenui***, which is similar to the PAN *denticulata*. The distinction is easiest internally on the slope which is rounded in *chenui* and rather straight in *coralliophaga*. Both, *M. chenui* and Orbigny's synonymous ***M. fontaineanus*** date as of 1842. Sherborn gives October for Récluz' *chenui*, Coan et al. (2000) noted 1842 for Orbigny's pl. 85 which is taken as end of December. In 1846 p. 649, Orbigny therefore correctly synonymized his pl. 85 *fontaineanus* with Récluz's species, erroneously referred to as *chenuanus*. Both, *chenui* and *coralliophaga* occur in Florida and in Brazil. In the Caribbean *coralliophaga* grows larger (22 mm) than *chenui* (17 mm, seen 14.5 mm).

Originally, ***G. coralliophaga*** has been described from the W. Atlantic and the Indo-Pacific. This rare cosmopolitan distribution is accepted by virtually all modern authors. However, a genetic confirmation is at present lacking. Under the assumption that this wide distribution holds, there are not many arguments to keep Iredale's ***Tibialectus otteri*** from tropical Australia distinct.

Obviously, in SAF two *Gregariella* occur. The common, larger one, with a brownish periostracum with simple, unbranched hairs (= ***rietensis*** Turton, 1932, = ***simplificilis*** Barnard, 1964, = ***opifex*** Steyn & Lussy, 1998) could not be separated from the European *petagnae* which usually also shares the same, comparatively weak radial sculpture. In addition, WAF authors indicate *barbatella* (= *petagnae*) along the WAF coast (e.g. Benin, Gabon). Kensley & Penrith (1970) identified specimens from S. Angola/N. Namibia as identical to SAF specimens and concluded synonymy to *barbatella* (= *petagnae*) as well.

The other SAF species is uncommon and has branchiate hairs. Kilburn (1972) demonstrated that Turton's ***albanyana*** is marked distinct from *petagnae*, where erroneously synonymized by Barnard (1964). However, Bartsch, 1915 earlier described the same species, though from a smaller specimen, as ***Modiolaria africana***. Consequently Steyn & Lussy (1998 sp. 812) depicted this second species as *Gregariella africana*. However, Odhner (1919) found ***M. difficilis*** in Madagascar and concluded Bartsch's *africana* "est sans doute la même espèce". Deshayes, 1863 described his *difficilis* as close to *coralliophaga*. There is little doubt, that Odhner's conclusion is correct and the second SAF *Gregariella* is *G. difficilis* ranging from Port Alfred to the SW. Indian Ocean.

Martens' ***Crenella australis*** from Mozambique, Inhambane seems to belong instead here. Martens compared it with *ehrenbergi*. Far fewer (24) and stronger posterior ribs and the compressed shape remove it from *difficilis*. Certain traits are reminiscent of juvenile *coralliophaga*, but the shape does not fit. The type should be in Berlin.

M. fischeri has recently been found in abundance at bathyal depths (Sorbe et al., 2001). Following Lamy (1937) *Gregariella* is closest, but more likely a new genus is needed for this unique species.

G. vignoni has recently been collected in Ghana by the author. Currently, *vignoni* is only known from very few specimens. The type lot is present in MNHN.

Odhner (1922) reported 6 specimens of ***G. opifex*** found in 30-45 m on coralline bottoms in Juan Fernandez Isl. off Chile. The true identity of these specimens is open; obviously *coarctata* and *denticulata* should be compared.

NV8: ***Arcuatula***: The placement of Arcuatula varies. Older authors placed such specimens in *Modiolus* or in *Brachidontes*. Coan et al. (2000) placed them near *Musculus*, as previously Newell in Moore (1969). Scarlato & Starobogatov, 1979 created a separate subfamily. The latter view is shared. *Arcuatula* is neither in habitat, nor in morphology particularly close to *Musculus*.

Barnard (1964) gave an excellent comparison between *Brachidontes*, *Lamya* (= *Arcuatula*) and *Musculus*.

Arcuatula has been created for ***Modiola arcuatula***, ***Musculista*** for ***Volsella senhousia***, and ***Lamya*** for ***Modiola capensis***, ***V. glaberrima*** is often included in *Amygdalum*, and ***M. papyria** in Mytella* or in *Amygdalum*. However, all these species have a similar fragile, papery, trigonal-elongate, often ventrally curbed texture, are medium sized and prefer shallow habitats in bays or in estuaries. The main difference is the extent of the dysodont denticles posterior and anterior to the long ligament line. These are strongest in *Musculista*, medium in *Lamya*, weak in *Arcuatula*, whereas in *M. glaberrima* these are vanishing and in *papyria* almost completely lost. Newell in Moore (1969) did not treat *Musculista* Yamamoto & Habe, 1958, but *Lamya* has been synonymized with *Arcuatula*. However, the similarities of *Lamya* with *Musculista* are even stronger than to *Arcuatula*. It is impossible to draw a reasonable line between these presumed genera. As indicated by Coan et al. (2000) *Musculista* is here declared synonymous to the older *Arcuatula*. Thus, Habe's (1951 p. 52) view is perceived more fitting than his 1958 differentiation.

The type species ***arcuatula*** is well depicted in Reeve (1857 pl. 6 fig. 27). Characteristic is a comparatively strong and broad umbonal-ventral ridge which is weaker colored. The sculpture is commarginal except radials at the extended anterior portion.

Papyria from Florida belongs in this group, as concluded by Evseev et al. (2005). Furthermore, it appears that the light-brown southern species (from E. Panama to Brazil, ES) with an oblique ridge dividing the surface sharply is distinct from the Floridan species. However, further material from S. America is needed to fully understand this species and to resolve this issue. For the time being the southern species is treated separately.

Modiola liturata Menke, 1830 was described from the Pacific and depicted by Clessin (KUST90 sp.14). There is little doubt that it belongs here, as also concluded by Lamy (1936). *M. senhousia* is locally very common and highly variable in color, moderately also in shape. In Japan greenish-yellowish specimens with brown streaks have been found which fit *liturata* well in color and shape. Likely, ***liturata*** was the earlier name for the well known Japanese *senhousia*. However, the type seems lost (not MfN). Anton (1838) listed as No. 600 two specimens, possibly even received from Menke. However, a search in Dresden did not reveal any results (pers. com. Schniebs 1/09). Until this riddle can be resolved, Menke's species is best considered a nom. dub. Nowadays, ***Arcuatula senhousia*** is widely introduced in various regions and has to be regarded as virtually cosmopolitan (e.g. JAP, IND, Med, Oreg, NZ, and SAU). However, Oliver (1992 pl. 5 fig. 9) and (1995 sp. 954) depicted a smaller species from the Red Sea and Arabia, first as *arcuatula* and in 1995 as *senhousia*. A couple of dozen specimens from SW Yemen could be studied. These are in colors close to true *senhousia* from China and Japan. However, the portion anterior to the beaks is smaller; respectively the beaks are situated more anterior. The shape is generally less high and the size only about half of *senhousia*. As such they conform well to Benson, 1856's distinct ***Modiola variegata*** from India, similar, but smaller than his earlier *senhousia*.

Martens, 1897 described ***Modiola leucosticta*** from Maros River, Sulawesi, Indonesia. He compared to ***A. glaberrima***. The MfN type lot 108841 contains more than a dozen syntypes from 4 to 10 mm. *Leucostica* is perceived as valid species, much smaller than *glaberrima*, somewhat similar in colors, but higher and shorter in shape. *A. leucosticta* is a fragile species, quite uniform in cream-greenish, dorsally lightly brown colors, obviously abundantly found in the Maros River in fresh water. *A. senhousia* with a rather marine habitat is also similar, but has stronger coloring, is more solid and grows much larger.

Volsella subpurpurea Dunker, 1857 was described from Senegal River, but is not reflected in modern WAF literature. Dunker, 1857 further described ***Volsella tristis*** from China, Chusan. Also this species remained enigmatic. Both type series with specimens measuring more than 30 mm have been analysed in BMNH and proved conspecific. The locality of *tristis* Chusan (= EChi, Zhousan, Capt. Benson) is more likely, as related forms are known from Asian waters, but not from WAF. Against page priority, *V. subpurpurea* is here synonymized with *Arcuatula tristis*. This is an elongated species, approximately 35 mm, with a dark brown shiny periostracum, internally purplish-white iridescent; in dentition, *tristis* is similar to the type species, but with a curiously pointed portion at the tip of the valves. However, no specimens except the type series were as yet seen and the exact habitat and distribution of *tristis* needs confirmation.

Modiola varicosa Gould, 1844 from Myanmar has, as far as is known, never been resolved. The type seems lost (JOH64). Reeve (1858) considered it the same as *arcuatula*, which is not impossible, but Lamy (1936) opposed and placed it close to *Dreissena*. However, as the type is lost, it is best considered a nom. dub. Gould's ***Modiolaria varicosa*** from Sydney is a valid *Musculus*.

NV9: ***Limnoperna***: Beu (2006) cut the Gordian knot, synonymized ***L. siamensis*** with ***L. fortunei*** and ***Xenostrobus*** with *Limnoperna*. From the many OD's involved and from the material studied, this view is shared. Kimura et al. (1999) depicted most types.

Limnoperna is close to *Arcuatula* regarding biogeography, habitat, texture, morphology and anatomy. The latter has generally somewhat larger, more elongated valves and more or less numerous dysodont denticles. The two type species *A. arcuatula* and *L. fortunei* are easily confounded in shape, color and commarginal sculpture. The hinge only shows the true identity, denticles in the former, none in the latter.

The type species ***Volsella fortunei*** has usually a greenish-brown-yellowish, glossy periostracum, but is highly variable in shape and internal color, ventrally straight to concave, trigonal to strongly elongate, usually internally deep red-purple and white, but occasionally silvery, or silvery blue.

The synonymous ***Dreissena siamensis*** has been depicted and discussed as *Modiola* by Morelet (1875 pl. 17 fig.

3). As noted by Beu the interpretation of *siamensis* by Swennen et al. (2004 sp. 8) does not fit the OD. It might instead be referable to *Brachidontes striatulus*.

The true identity of ***Limnoperna supoti*** Brandt, 1974 (Thailand) and ***Limnoperna depressa*** Brandt & Temcharoen, 1971 (Laos) is open. They appear close to *fortunei*, but share a special habitat or a special morphology. Brandt identified and found *siamensis* (= *fortunei*).

A specimen of ***M. taprobanensis*** Preston, 1915 from Sri Lanka, sent from the author, was analysed by Lamy (1936) and considered a variety of *lacustris*. However, the locality Sri Lanka leaves doubts. Annandale & Kemp (1916) considered *taprobanensis* the same as *cochinensis* and *jenkinsi*. This latter view appears more likely.

NV10: ***Mytella***: Soot-Ryen selected Lamarck's ***guyanensis*** as type species. However, as originally referenced by Lamarck (1819), Bruguière's ***Mytilus bicolor***, described earlier from the same locality, is conspecific. This has been confirmed by Lamy (1936 p. 314). According to Sherborn ***Mytilus bicolor*** has been validly proposed by Bruguière, 1792 (Catalogue des coquilles, p.126). The OD is clear, the type locality matches. *Bicolor* is also listed in animalbase, Göttingen as available. Unless a formal ICZN request to suppress this name would be successful, I see no arguments against the use of Bruguière's well fitting name. Following Soot-Ryen (1955) the Caribbean, N. Brazilian and Panamic specimens are perceived too close to be separated.

In addition however, in Brazil a further species occurs. Such specimens are comparatively shorter, higher and more truncate posteriorly. The colors are darker, blackish-green-brown, internally iridescent bluish, purplish only at the posterior margin. The posterior scars are narrower and smaller. These specimens match the OD of Chemnitz' ***brasiliensis*** precisely, as recognized by Gray (1825) and Reeve (1857 sp. 31). Thus, I do not share the view that Lamarck's *guyanensis* = Bruguière's *bicolor* from Guyana and N. Brazil is the same species as Chemnitz' *brasiliensis*. From the material studied, *brasiliensis* seems to grow larger than the Caribbean *bicolor*. *Brasiliensis* is mainly known from the Sao Paulo State, Santos area. Orbigny's BMNH lot of *Mytilus guyanensis* from Rio is instead referable to *brasiliensis*.

The narrower *Mytella* is also distributed on the East and West side. The valid, earliest name is ***M. charruana*** as applied by REG71 and Rios (1994).

Whereas Soot-Ryen (1955) accepted 3 *Mytella*, here 6 species are recognized. However, the papery *papyria* is not a *Mytella*. Instead, it is placed in *Arcuatula*.

NV12: **CRENELLINAE**: For this difficult subfamily no review is available. Following Scarlato & Starobogatov (1979) CRENELLINAE is here restricted to small, ovate to rhomboidal genera close to *Crenella* and *Solamen*. This is not the case for the much larger, shallower *Musculus* with a marked distinct sculpture and periostracum, or for the fragile, mytiliform and estuarine *Arcuatula* with another sculpture. Here, the following genera are included:

Crenella: Minute, generally less than 5 mm, exceptionally up to 10 mm; rounded ovate, strong vertical denticles beneath and above the umbones, fine radial sculpture.

Solamen: Rounded ovate, hinge weak, edentate or microscopic denticles only, broad ligament, decussate sculpture, larger than *Crenella*, generally more than 10 mm

Rhomboidella: Rhomboidal shape, narrowed anterior, small denticles beneath the umbones, coarse radial sculpture with commarginal ridges

Exosiperna: close *Rhomboidella* in sculpture, ovate-elongate, narrower anterior in shape, denticles above the umbones

Arvella: Rhomboidal-ovate, solid, rougher radial sculpture and larger than *Crenella*, brownish and varnished periostracum.

Vilasina: Ovate, thin, almost smooth, very weak radials, microscopic denticles umbonally, brown to olive and varnished to silky periostracum.

A. Adams, 1862 described from the Japan Sea *Crenella casta*, *cornea*, *crocea* and *sculptilis*. These were listed by Lamy and Higo et al. (1999) as valid names, but not recognized by Japanese authors as yet. Although they appear to represent later named species (e.g. *yokoyamai*, *columbianum*, *leanum* or *kuroharai*) Adams' species were never depicted and the types could not be located in BMNH, 11/08. Currently these names are treated as nom. dub.

Crenella: Coan et al. (2000) synonymized Orbigny's Caribbean **C. *divaricata*** with the E. Pacific and Northern Atlantic ***C. decussata***. Redfern (2000), as before Lamy (1937), did not accept this synonymy and considered *divaricata* distinct. Their view is shared. None of the E. Pacific and European specimens studied has been found as solid and inflated as the Caribbean ones. *C. divaricata* also remains much smaller and has a stronger hinge plate. According to Lamy (1937), Abbott (1974) and Lubinsky (1980) *C. decussata* does not occur south of Cape Hatteras. In addition to *divaricata*, another species is widely distributed in the Caribbean. Altena, 1968 described from Suriname **C. *abbotti***. He compared to the SAF *minuta*, however not, with the more obvious ***C. gemma*** from nearby E. Panama. Comparing the OD's of *gemma* and *abbotti* I fail to perceive marked differences. Not only size, shape, but also dentition appears too close. Compared to *divaricata*, *C. gemma* is less inflated, broader and thinner, and also less solid. It also seems much less common. There is little doubt, that Redfern (2000)'s *Crenella* sp. A is referable to *gemma*. C. *gemma* also seems to occur in Florida. Altena (1968) analyzed the syntypes of ***C. minuta*** and identified them as true *Crenella*, close to *abbotti*. Barnard (1964) synonymized *minuta* as juvenile of the much larger, edentate ***striatissima*** with a broad ligament. However, these two are markedly distinct. *Minuta* is a *Crenella*, whereas *striatissima* is close to *glandula* and placed in *Solamen*. Consequently, Altena's view is shared and *minuta* is placed as valid SAF *Crenella*, as originally described by Thiele & Jaeckel, 1931.

Solamen: Melvill & Standen, 1907 renamed Adams' ***L. decussata*** from the Red Sea ***Crenella adamsiana***. This species was placed in *Solamen* by Oliver (1995) (= Oliver, 1992 p. 46 fig. 19 "*vaillanti*"). However, one year earlier Smith, 1906 described ***Crenella persica*** from the same locality, mentioned but not compared by Melvill & Standen (1907). Lamy (1937) and Oliver (1995) treated only *adamsiana*, but neglected *persica*. From the OD *persica* is the same and the earlier name for *adamsiana*.

At the end of the broad ligament there is a thickening, which may be interpreted as a single tooth. This tooth-like thickening is found in other *Solamen* species as well. The range of *persica* is here extended to the Andaman Sea, W. Thailand, off Phuket, from where specimens have been collected. Closely related is the WAF ***S. dollfusi***.

Higo et al. (2001 B145s) depicted the type of Habe's large, 41 mm ***S. saccosericata*** and demonstrated it the same as Adams' earlier ***Crenella spectabilis***. They also included in their synonymy Prashad's unique ***sibogae*** and Iredale's ***rex***, the type species OD. Prashad earlier noted a close affinity of *sibogae* to *rex*. I see no arguments against Higo et al.'s action. Furthermore, Dunker described earlier than Adams in 1857 his ***Crenella bulla***, 9 mm, from the Philippines, Luzon. The holotype is present in BMNH 1967568. This is the first description of an IND *Solamen* and very likely the same as *spectabilis*. However, a growth series is necessary to confirm this synonymy.

C. glandula and ***C. fragilis***, often placed in *Crenella* share instead a *Solamen* hinge. *Glandula* is usually seen as ovate, with a maximum size of 11 mm, depth 8-31 m, and a range from Labrador to N.C. (e.g. MALAC). However, a lot of 3 large *glandula* with almost 13 mm from Nova Scotia, 80 m raised questions. First, they are too large, second, too deep and third, too elongate for usual *glandula*, but they approached in all these aspects *fragilis*. The obvious conclusion is that the "rare" *fragilis* is only a huge *glandula* from deeper water, becoming more elongate with age. Thus, *glandula* is understood as ranging much deeper and growing much larger than usually indicated, *fragilis* becomes a junior synonym. As such *glandula* approaches the E. Pacific species, e.g. *megas*, *columbianum*.

Rhomboidella: ***D. radians*** Suter, 1908 from NZ belongs here, as noted by Thiele & Jaeckel (1931) and Ockelmann (1983). Although *rhyllensis* from Australia is considered synonymous by most Australian and NZ authors (e.g. 49, BEU04), Ockelmann (1983) defined for ***rhyllensis*** compared to ***radians*** a distinct prodissoconch size, a distinct nepioconch morphology and also slightly distinct shell features and considered both valid. In addition, the NZ species appears to attain twice the size of the S. Australian. I see no arguments to doubt Ockelmann's sharp analysis.

Comparing the 2.3 mm holotype of *Modiolaria rhyllensis* from Victoria (MV F728) with Cotton's 3.2 mm ***Exosiperna concava*** from SA, then these two are, in all probability, conspecific, as concluded by Lamprell & Healy (1998).

C. vaillanti (= Oliver, 1992 p.46 fig. 20a, b "*adamsiana*") belongs in *Rhomboidella*, as noted by Ockelmann (1983) and Dekker & Orlin (2000). Ockelmann (1983) recognized it widely distributed in the Indian Ocean and reported it also from W. Thailand. There is very little doubt that *praecellens* from N. Gulf of Oman is conspecific (Oliver, 1995 sp. 952).

Lamprell & Healy (1998 sp. 213) reported a large ***R. malaccana*** from Australia. If sexual maturity is reached with less than 2 mm, then a maximum size of 5 mm is possible. Certainly, additional intermediary specimens are necessary to establish identity and range of *malaccana*. Furthermore, Thiele & Jaeckel, 1931 described from SAF ***R. capensis***. Barnard (1964) did not exclude a further northward extension. The inflated, short shape is virtually identical to *malaccana*, and the very large prodissoconch is shared. Not aware of Thiele & Jaeckel's work, Ockelmann (1983) did not compare these two. However, lacking intermediary finds and the reported differences in depths recommend caution at this point of knowledge.

Modiolaria perstriata may also belong here. However, neither from the OD, nor from subsequent works was the exact dentition available. *Musculus* does not fit in shape and sculpture.

NV13: **Septifer**: More than 25 names are available for the likely only 6 true *Septifer*.

Following SAF authors (e.g. Barnard, 1964; Steyn & Lussy, 1998 sp. 826), I could not detect any characteristics in the Natal specimens justifying a separation of ***S. kraussii*** from ***S. bilocularis***, as proposed by older authors (e.g. Küster; Dunker, 1855; Clessin or Lamy). Green as well as brown colored specimens occur there, larger than 30 mm. Whether *S. bilocularis* is indeed established in Hawaii, as noted by Paulay (1996) from single old finds from 1950, should be confirmed.

Septifer forskalii Dunker, 1855, described from the Red Sea is significantly distinct from *bilocularis*, as well elaborated by Çeviker (2002) and listed before by Dekker & Orlin (2000). It is a small, shallow water species, usually found at approximately 10 mm, but reported up to 15.5 mm (Hawaii). *Forskalii* is a very widespread, solid little *Septifer* with a strong cancellate sculpture and a variety of colors, often greenish and reddish, but also bluish to brownish. Compared to equal sized *S. bilocularis*, *S. forskalii* is narrower, the umbones higher and much broader, turned outwards, the septum smaller, and the ribs are stronger nodulose. *S. forskalii* is well known from the Med, Turkey, Red Sea, Arabia and East Africa. However, specimens studied from the Philippines, South China Sea or Polynesia are indistinguishable. ***S. bryanae*** Dall, Bartsch & Rehder, 1938 was described from Hawaii without comparison to existing forms, but later recorded from Easter Island, Micronesia, Philippines, and Indonesia (REH, KAY). ***S. australis*** was described from NSW, Australia by Laseron, 1953 without comparison to existing forms. Beu (2004) noted identity of *australis* and *bryanae*, but did not consider *forskalii* and *cumingii*. ***S. pulcher*** was described as 4.8 mm specimen from Xisha Island and later depicted as 12 mm specimen from Arafura Sea (EVS041). Furthermore, Gould, 1861 described ***S. furcillata*** from the China Sea, 8 mm, coarser sculptured than *bilocularis*. The type is lost, but from the OD, there is little doubt that *furcillata* is also the same species. Finally, there is an even older species, namely ***Septifer cumingii*** Récluz, 1849. Récluz received a few specimens from Cuming from Anaa, French Polynesia. This is not the species depicted as *Mytilus cumingianus* Reeve, 1858 sp. 52 from Panama (= ***zeteki***). From Récluz' OD there is no doubt that this is the same and the earlier name for *forskalii*. It fits in shape, sculpture, habitat and size. Indeed small "*M. cumingianus Récl.*" have also been reported from the Red Sea by Sturany (1899). Dunker, 1855 did not compare his new *forskalii* with true *cumingii*, instead he compared to *zeteki* from "fretum Panamense". I see no arguments to keep *bryanae*, *pulcher*, *australis* or *forskalii* distinct from the earliest ***cumingii***.

A similar, but smaller, deeper living species, paler in colors, with fewer and rougher ribs and dorsally stronger expanded is ***S. rudis*** described from Hawaii and also found around

Japan (Okutani, 2000, pl. 430 fig.11). ***S. xishaensis*** Wang, 1983 was described from S. China, Xisha Isl. as minute, 4.8 mm species without any comparisons. Additionally, Evseev et al. (2004) reported it from "Molucca Strait, South China Sea, 5.7 mm". I fail to perceive *xishaensis* other than a juvenile *rudis*. Furthermore, the minute, 9.5 mm ***ramulosus*** has been described by Viader, 1951 dredged off Mauritius. Bernard, 1964 described from nearby Natal, also from deeper water, the 9 mm ***S. natalensis*** with the same trigonal shape and few ribs. It is highly unlikely that *ramulosus* and *natalensis* are distinct. *Ramulosus* itself appears very close to *rudis*. However, the lack of intermediary records prevents further conclusions.

Smith's BMNH holotype of ***Brachydontes rufolineatus*** proved to be a small, elongated *Septifer* with a rounded septum and a strong, dense sculpture. The name giving reddish streaks on the yellowish-brown valve are special. It has been described from 55 m, Christmas Isl., but not recorded from there by Wells et al. (1990). It must be rare and restricted and nothing close has been seen as yet.

Mytilus pilosus Reeve, 1858 was described without locality and subsequently placed globally as *Mytilus*, *Modiolus* or *Septifer*, even in Chile, Juan Fernandez Isl. It appears close to Wiegmann's earlier ***excisus***. However, the BMNH-type was not located 11/08. Thus, a confirmation was not possible and *pilosus* is treated as nom. dub. *Septifer pilosus* of Clessin appears to be *excisus*; *Mytilus pilosus* of Stempell might represent *Modiolus aurum*.

Hidalgo (1905) recorded *S. virgata* from Philippines, Luzon but not *excisus*. The reverse is more likely. At least no *virgata* was as yet seen from Philippine waters, whereas ***S. excisus*** is well known from there. Finally, Paulay (1996) synonymized the fossil Hawaiian ***S. vaughani*** with *excisus* and noted further fossil *excisus* records from Cook and Pitcairn Isl.

NV14: ***Mytilisepta***: As originally Habe, 1951 and most subsequent Japanese authors, also Evseev et al. (2004) recognized *Mytilisepta* distinct from *Septifer*. These two groups have first been recognized by Dunker (1855 p. 3) in his dissertatio, however, he did not name them. Matsumoto, 2003's genetic results clearly recommend separation of *Septifer* (*excisus*) from *Mytilisepta* (*virgata*). The dentition together with the silky, strongly adherent periostracum with lacking hairs, a generally rougher sculpture and much lower variability in color justifies separation of this NW. Pacific lineage from the tropical Pacific *Septifer*. Evseev et al. (2004) attributed generic rank and placed *Mytilisepta* together with *Ciboticola* in SEPTIFERIDAE. On the other hand, *Ciboticola* is very close to *Sinomytilus* as recognized by Scarlato & Starobogatov (1979).

However, familial status for SEPTIFERINAE is perceived exaggerated and does not have the necessary genetic support (MATSU), but subfamilial status is well recognized.

Dunker (1855) accepted 5 *Mytilisepta*, of which 3 most likely with erroneous type localities. Here, only 3 species are globally recognized.

From the OD's Dunker, 1853 redescribed ***S. virgatus*** twice, first as ***Septifer herrmannseni*** from China and, additionally, as ***Septifer crassa*** from Peru. The latter synonymy has been admitted by Dunker himself (DKR82 p. 227), whereas he then still considered *herrmannseni* as distinct, having the dentition in the right valve, whereas in *virgata* he saw it positioned in the left valve. However, in large specimens collected in Sado Isl. and Sagami Bay, both conditions have been encountered; habitat, size, or morphology did not differ. In addition, this alternate position is found in *keenae* as well. There is no doubt that *herrmannseni* is a further synonym of *virgatus*. *S. virgatus* is a large species; specimens found in Japan are up to 50 mm, Dunker gives 55 mm and in Hong Kong specimens even attain 60 mm.

The second, smaller, trigonal Japanese species, general whitish inside is ***keenae***. *Keenae* remains much smaller and attains only about half size of the larger *virgata*.

A quite similar dentition is also found in the Californian ***M. bifurcata***.

The true identity of the not depicted ***Septifer furcatus*** Dunker, 1855 from "China", 30 mm, purplish, trigonal has never been satisfyingly resolved. From the OD it is a *Mytilisepta*. Lamy (1936) placed it close to *virgata*. However, a misplaced Californian *bifurcatus* is much more likely. The type was not located in BMNH 11/08. Thus, a confirmation was not possible and *furcatus* is best treated as nom. dub.

Septifer grayanus Dunker, 1855 was described as *Mytilisepta* from 3 syntypes from the BMNH Cumingian collection from Maluku, measuring approximately 23 mm, solid, ovate triangular, with a thick brownish-black periostracum. The types could not be located in BMNH 3/09. However, Habe, 1951's synonymy of *grayanus* with *Mytilisepta virgata* was not shared by Lamy, and is also not accepted here. Instead *grayanus* is most likely the earlier name for the Japanese *keenae* with an erroneous type locality. However, a firm confirmation is without type material not possible and *grayanus* is at present treated as nom. dub.

As both species were explicitly described from BMNH specimens, it is still likely that the types of *Septifer furcatus* and *grayanus* are **hidden** in the BMNH general collection.

NV15: ***Ciboticola*** and ***Sinomytilus*** are easily recognized by the small septum and the smooth valves. The latter is freshwater, the former marine.

Brandt, 1974 described a second species ***Sinomytilus morrisoni*** from Thailand. Furthermore, the two BMNH-syntypes of ***Dreissena swinhoei*** H. Adams from China on rocks "Yangtsze River, at Kweifoo" have been analysed. They proved to have a similar curbed shape as *harmandi*, but broader and shorter and somewhat rougher sculptured dorsally. The septum is very small. Shape and biogeography also remove *swinhoei* from Brandt's *morrisoni*, and place it as third valid *Sinomytilus*.

Ciboticola was only known from the uncommon NE. Australian type ***lunata*** and was long considered monospecific. However, Martens, 1887's marine *Mytilus* (*?Septifer*) *andersoni* appeared from the OD close to *lunata*. The 2 MfN 38964 syntypes are present and confirmed that indeed a second marine *Ciboticola* is to be found in the Andaman Sea. ***C. andersoni*** is comparatively broader, higher and less inflated than *lunata*; the ventral side is straighter and much less curbed. The coloring is similar but less intense in pastel colors. Both species are similar in size, at or less than 30 mm. As far as is known, the Berlin types are the only specimens ever found; *C. lunata* is not common either.

NV17: ***Brachidontes***: Keen (1971) and Coan et al. (2000) are followed, they did not accept subgenera. Obviously, also anatomy would not support a division of *Hormomya*. *B. purpuratus* appears most distant from the type species, but it shares, nonetheless, the typical traits of *Brachidontes*.

M. solisianus is better placed in *Mytilaster* as proposed by Ihering (1900) and accepted by Scarabino (2003).

The CAR species are difficult. ***B. exustus*** from Jamaica is well depicted by Humphrey (1975), also by Reeve (1857 sp. 10). This is typically a yellowish-brown, trigonal species, comparatively fragile, with fine divaricating ribs, somewhat metallic, often purplish white internally. This species is well known from the US and typical forms occur from N.C. through Florida, WInd to Venezuela. In the same area, Lamarck's closely related ***domingensis*** is found. This is typically ovate-elongate, purplish, more solid and more inflated, with fewer ribs. Beauperthuy (1967) elaborated further differences and considered these two distinct. However, Lamy recognized them as varieties and Redfern (2001 sp. 814) depicted both forms from distinct habitats in the Bahamas. In the many specimens studied from more than 10 localities between S.C. and Venezuela, both extremes occur, but also many intermediary forms. As early proposed by Mörch (1853) it appears best to consider *exustus* a highly variable species and *domingensis* as synonymous form.

Due to its supposed type locality, ***Modiola magellanica*** Reeve, 1857 from the Magellan Strait is often placed as synonym of *Modiolus patagonicus* (e.g. Bernard, 1983). However, the OD and the BMNH-holotype do not match this synonymy. Ihering (1900) placed *magellanica* synonymous to *domingensis*. The BMNH-specimen is comparatively fragile and very weakly denticulate; it shares most traits with typical American *exustus* and is placed in synonymy. Definitely, the type locality is erroneous.

In Brazil southwards to Argentina ***B. darwinianus*** occurs, often erroneously synonymized with *exustus*. *B. darwinianus* is consistently distinct, more solid, generally more inflated and usually dark brownish-black, reddish around the umbones, with a very glossy periostracum. *B. darwinianus* generally also grows larger. True *exustus* does not appear to occur in S. Brazil. There is very little doubt that Clessin's ***mülleri*** from Rio represents *darwinianus*.

B. rodriguezii, also from Brazil and southwards, is considered distinct by most authors and recognized here as well.

The holotype MfN 112625 of the preoccupied ***Mytilus arcuatus*** Clessin, 1887 proved to represent a *Brachidontes* from unknown locality, as noted by Lamy. Most likely it is the same species as earlier described by Hanley as *granulatus* from Chile and Peru.

From the material at hand in WAF three species occur. 2 are based on Adanson's Aber and Dotel, identified as ***puniceus*** and ***niger*** Gmelin, 1791 by FIP42. There is no doubt that Dunker's ***atropurpurea*** is the same as *niger*. At the same locality in Senegal color forms, all blackish-brown, or whitish underneath a brownish periostracum have been found. However, against Ardovini et al. (2004)'s opinion, Dunker's ***tenuistriatus*** is perceived as third valid, smaller species, as described by Dunker and also recognized by Lamy (1936). In the specimens analyzed, no intermediate forms to *niger* were found.

In IND/JAP the ***ustulatus***-complex is crucial. The preoccupied ***M. variabilis*** was described from SAF. Virtually all modern authors followed Lamy (1936) and considered ***M. pharaonis*** from the Red Sea, Suez and *arabicus* the same. Furthermore, Lamy analyzed Lamarck's MNHN type series of ***M. ustulatus***, described from Brazil and noted it identical to *variabilis* = *arabicus* = *pharaonis*. Lamy also clarified that Lamarck's type locality was impossible, as Baudin's expedition did not visit this region. Indeed, Reeve (1858 sp. 59) depicted *M. ustulatus* from Borneo. Lamarck's 5 syntypic specimens have been studied in MNHN, together with the type lot of *pharaonis*. I see no reason to doubt Lamy's view. *Ustulatus* is usually a comparatively small species, often rather thin, often approximately 20 mm; in shades of brown, internally purplish with numerous fine radial bifurcating ribs; however, it is highly variable in shape, as noted by Oliver (1992), and specimens larger than 30 mm, quite solid and strongly curbed occur. Nowadays, *ustulatus* is also found in the Med, Turkey and Sicily. The eastward extension is open. Lamy (1936) reported it also from Australia and New Caledonia; Thailand authors found it in the Andaman Sea (AUNG); Lee & Morton (1983) identified it from Hong Kong; Bernard, Lee and Morton (1993) also from the South China Sea and Hylleberg & Kilburn (2003) even from Vietnam. On the other hand, ***M. mutabilis*** has been described from Kyushu and is found in Japan and "southward to tropical Indo-West Pacific" (Okutani et al., 2000) or "widely ranging into the western Pacific" (Koyama et al., 1981). Dunker's preoccupied ***M. curvatus*** from the Philippines is generally accepted as synonym. Martens (1887) and Preston (1916) found *curvatus* (= *mutabilis*) in the Andaman Sea and Hedley (1906 and 1909) in Australia. *Mutabilis* is also a comparatively small species, usually found at approximately 20 mm; in shades of brown, internally purplish with numerous fine radial bifurcating ribs, highly variable in shape.

Finally, Iredale, 1939 did not accept Hedley's identification of *curvatus* from Qld. Instead he renamed this species as ***Dentimodiolus sculptus***. Based on the erroneous opinion of Laseron (1956 p. 266) modern authors followed Newell in Moore (1969) and considered *Dentimodiolus* synonymous to *Trichomya*. However, Iredale's OD and picture clearly describe a *Brachidontes*, as well recognized by Habe (1951 p. 51). Neither the arcuate, elongated shape, nor the rounded umbones, or the dentition, the divaricate sculpture, and especially not the missing bristle hairs are close to *Trichomya*. Iredale also mentioned specimens with a smooth medial area, as found in SAF (*semistriata*) or Arabia (Oliver, 1995 sp. 843 form 2). Iredale certainly created an unnecessary gen. nov. It may even be that Hedley was correct and ***Dentimodiolus sculptus*** is indeed the same as *B. incurvatus* (= *mutabilis*). Furthermore, from the Red Sea specimens are at hand, quite similar in shape to Iredale's type, with more than 32.6 mm and more than 100 ribs. Smaller specimens found in Darwin fit Lamprell & Healy (1998 sp. 156 "*maritimus*").

Without locality data, specimens from Turkey, Red Sea, Indian Ocean, Australia or Japan are not unambiguously attributable; but genetic analyses are not available for firm conclusions. Based on prevailing opinions and biogeographic reasons the ***ustulatus***-complex is at present divided as follows: Indian Ocean specimens are listed as *ustulatus*, Philippine, Thailand to Japan specimens as *mutabilis*, Australian specimens are *sculptus*. Future workers will finalize, whether various species are involved, or Lamarck's *ustulatus* is widely distributed from the Red Sea to Australia and to Japan.

Wang's ***Hormomya sinensis*** is from scars, shape and dentition hard to perceive as being anything other than a juvenile *mutabilis*. Zhongyan (2004) only depicted *mutabilis* from S. China, and this view is shared.

B. subramosus is, with its elongated shape and rougher, fewer ribs, markedly distinct from the *ustulatus*-complex. It is well known from Indonesia, the Philippines and SChi. Whether the specimens mentioned by Thiele (1930, SWA) and Lamprell & Healy (1998, S. Qld sp. 155) are indeed conspecific needs confirmation.

The type of ***B. striatulus*** is depicted in Higo et al. (2001). Annadale & Kemp (1916) depicted Preston's types of *jenkinsi*, *cochinensis*, *annandalei* and *celator* from East India and considered them all the same. Lamy (1936) noted their synonymy with *Modiola striatula* erroneous and concluded the Chilka Lake/E. India species instead referable to ***emarginata***. However, the BMNH type lot of *striatulus* demonstrates a high variability. In addition, specimens from India, Cuddalore proved too close to *striatulus* to be separated. Thus, Annandale & Kemp's view of a synonymy of *emarginatus* and *striatulus* is here confirmed. Considering the variability seen in *striatulus*, I fail to recognize Lamy's MNHN-type lot of ***eudeli*** from India reaching more than 30 mm worth distinguishing.

On the other hand, Chinese specimens (e.g. ZHO pl. 123 fig. A, LEE83 pl. 1c "*emarginata*") identified as *emarginata* appear instead to represent *setiger* (type HIG01 B96).

B. subsulcatus has remained largely enigmatic, confounded by authors. Originally, Dunker, 1857 defined it in between *setiger* and *modiolus*, thus, elongate-ovate in shape, with a weak carina. He further noted a white base color, dorsally purplish and red-brown. Hidalgo (1905) found it in the Philippines noted Reeve's picture erroneous and only accepted Clessin's pl. 28 fig. 7-8 as fitting. This view is shared. The BMNH type lot is still present. *B. subsulcatus* appears quite uncommon, only a single specimen fitting the OD well could be studied.

B. evansi is a valid, small estuarine species, unique in color, dark green with black lines, found in Malaysia and SE. Thailand.

The high variability of ***B. undulatus*** Dunker has been discussed in-depth by Annandale & Kemp (1916). It appears to be a widely distributed Indian Ocean species and has been studied from Kenya, Tanzania and Mauritius. The sculpture and the dentition leave no doubt that this is a *Brachidontes* as noted by Viader (1951). However, many species are almost completely smooth and in some the dentition is very weak. Spry (1964)'s *pulex* from Tanzania with a "crenulate margin" appears the same.

NV18: ***Lithophaga***: In this subfamily largely the views of Kleemann and his many excellent papers are followed.

It is currently open, whether a firm generic separation of ***Leiosolenus*** is justified. Nonetheless, in this very difficult group the absence of calcareous deposits in *Lithophaga*, together with a generally larger size, radial sculpture and uncalcified boreholes offers easy recognition. Here, *Leiosolenus* is generically separated.

In some well known Caribbean *Lithophaga*, Philippi's 1846-7 names, validly proposed according to Sherborn, antedate Orbigny in Sagra, 1853's names. Philippi's names have been used by many authors after 1899, though often erroneously as synonyms of the misdated Orbigny names. Thus, a reversal procedure is not possible. Philippi's names do, by no means, qualify as nomina oblita (e.g. Lamy, 1937, Kleemann, 1983). In addition, each of Orbigny's often misdated names is antedated by a couple of further species. This affects:

- *Modiola* (*Lithophagus*) *caribaea* Philippi, 1847 antedates the blackish *Lithodomus niger* Orbigny in Sagra, 1853 as ***Lithophaga caribaea*** (**R. A. Philippi 1847**). According to Lamy (1937) and Turner & Boss (1962) Philippi, 1847's *antillarum* is the same, somewhat higher in shape. Against page priority *caribaea* is here selected as valid name and Philippi's *antillarum* as synonym. Both have been described from the WInd. According to Beauperthuy (1967), Dunker, 1849's *crenulata* from Venezuela is the same and also earlier than Orbigny's *niger*.

Furthermore, Kleemann consistently considered the CAR *caribaea* and the earlier IND ***teres*** identical. Philippi described both and mentioned 3 distinctive marks. However, in the specimens studied none of these marks hold firm. Additionally, in both species narrower and higher shapes occur, as the synonymies witness. At present, the distinct and disjunct biogeography and the larger size of *teres* remain. However, a genetic analysis could easily settle this issue and prove that the black Caribbean *caribaea* is indeed a synonym of the earlier *Lithophaga teres*.

- *Modiola corrugata* Philippi, 1846 antedates the yellow-brownish *Lithodomus antillarum* Orbigny in Sagra 1853 as ***Lithophaga corrugata*** (**R. A. Philippi 1846**). According to Kleemann (1983) also Philippi's *ferruginea*, 1847 is this species. Philippi, 1846 described *corrugata* from unknown locality; but in 1847 p. 21 he added "Westindien".

A similar disjunct distribution is found in the pair ***corrugata*** and ***straminea*** (type HIG01 B172). However, as experience shows many earlier cosmopolitan views have nowadays proven erroneous. Consequently, without genetic evidence to the contrary, these are here separated. In addition, ***Lithophagus caperatus***, Philippi, 1849 (KLE83), described from Okinawa, qualifies as earlier name for the IND *straminea*. Unless genetic analysis shows them the same, Japanese authors are followed and *straminea* (= *caperata*) is recognized as valid species.

L. zitteliana is accepted by Japanese authors as valid species, distinct from ***straminea***. Taki (1951 pl. 19) well illustrated both species from Wakayama.

NV19: ***Leiosolenus***: *Leiosolenus* with calcareous incrustations in various arrangements, a commarginal sculpture underneath, generally encompassing smaller species than *Lithophaga* and often calcareous inner walls in boreholes is perceived recognizable.

Subgenera are difficult. Apparently, a large *attenuatus* (= *Labis*) is significantly distinct from a full grown *divaricalx* (= *Diberus*). However, in many species the differences are much smaller and in some species (e.g. *malaccanus*, *mucronatus*) even intermediate. Also the presence of a sulcus proves questionable. On the other hand, the two *Stumpiella* known, the type *calyculatus* and the Japanese *lithurus*, share both an internal channel underneath the calcareous extension, producing ventral and dorsal openings. Their role is unknown, but may even indicate distinct anatomical functions.

Phylogenetic data to base relations more solidly is largely lacking. Therefore, weak subgenera are for the time being applied, following here convention:

Leiosolenus (syn. ***Myapalmula***): incrustations posteriorly rounded, not or only slightly beyond posterior margin.

Diberus (syn. ***Exodiberus***, ***Salebrolabis***): incrustations projecting beyond end; incrustations rougher, plumlike

Labis (syn. ***Doliolabis***, ***Rupiphaga***): incrustations projecting beyond end, incrustations finer, rather smooth

Myoforceps: incrustations projecting beyond end, strongly divided

Stumpiella: incrustation with internal channel producing a ventral and dorsal opening of unknown function.

The anterior incrustation in ***plumula*** is quite variable, often visible as small dots, in specimens from Panama occasionally also vertically striated (= ***pessulatus***).

L. divaricalx is a distinct and valid IND species, more solid, shorter and medially higher, also in juveniles. It is occasionally found from Australia to Philippines; 5 specimens have been personally collected off N. Borneo, 25 m from corals. Recently, it has also been depicted from Honshu, Minabe (MAA04). Iredale's type is figured in KLE84 fig. 1.

Lithodomus canalifera was originally described by Hanley, 1843 p. 239 from S. America. Later, in 1844 he gave for the same species Philippines, Cebu. Soot Ryen (1955) found it in Manta, Ecuador. Kleemann, 1983 selected the larger of the two syntypes as lectotype. The respective Philippine, Chinese and Japanese records are therefore referable to other *Diberus* species.

L. hanleyanus is crucial. Obviously, Reeve confounded various species in his type material. Kleemann (1984 fig. 4) selected a lectotype stating "although the type locality is Suez, Red Sea, it represents fairly well a valid biological species from GBR". Kleemann also depicted Iredale's holotype of ***instigans*** and synonymized these two, as did Wilson (1979) before. *Hanleyanus* as selected by Kleemann (= *hanleyanus* Lamprell & Healy, 1998 sp. 220) does not resemble REV58 fig. 18 from the Red Sea (= *malaccanus*), nor does *hanleyanus* occur in the NW. Indian Ocean. Kleemann's selection makes Reeve's original type locality erroneous. Wilson, 1979 came to the same conclusion and doubted identity of Red Sea material with *hanleyanus*.

In the Red Sea extending to Japan instead the more pointed, generally rougher sculptured ***D. malaccanus*** occurs (= "*L. hanleyanus*" Oliver, 1992 pl. 7 fig. 9a-b; Oliver, 1995 sp. 963). Kleemann (1984) depicted the types of Reeve's *Lithodomus malaccana* and Jousseaume's ***fauroti*** and synonymized the latter. Nielsen (1976) well illustrated the variability in *malaccanus* from Phuket in shapes from narrower to broader. *Malaccanus* occurs occasionally with almost smooth incrustations; however, typically these are strongly wrinkled. It is not excluded that Philippi's 19 mm ***crispata*** from Reunion Isl. is the earlier name for *malaccanus*. However, without type material *crispata* is best considered a nom. dub.

Another *Leiosolenus* from the NW. Indian Ocean is ***tripartitus***. Oliver (1995 sp. 965) demonstrated the differences to *malaccanus* (= sp. 963 "*hanleyana*"). *Tripartitus* is also found in the Persian Gulf. From there Melvill & Standen, 1907 described ***townsendi***, 18 mm, very acutely pointed, rather smooth. Oliver (1995) did not treat it. Shape and long, smooth incrustation approach the *Labis* condition. Indeed Melvill & Standen compared their *townsendi* with *attenuatus*. It appears that *townsendi* falls into the variability displayed by *tripartitus*. Nonetheless, the two syntypes should be compared.

Obviously, Reeve's ***Lithodomus cumingianus*** is composite. The two depicted species were variously attributed. Fig. 8b is a large *L. peruvianus* with an erroneous locality as noted by Kleemann (1983); fig. 8a appears indeed to be Australian. Here, fig. 8b is selected to represent Reeve's *cumingianus* (BMNH 197597/2: 3 syntypes). The type locality is corrected to Callao, Peru. Thus, *L. cumingianus* becomes a synonym of *peruvianus*.

Leiosolenus (***L***) ***lischkei*** is proposed as nom. nov. *Lithophagus curtus* Lischke, 1874 non *Lithodomus curta* Stoliczka, 1870, as recognized by Kleemann (1983). Type locality is Japan, Tokyo "prope Jedo in madreporis"; *lischkei* is named after the original author. Stoliczka's *L. curta* is an Indian fossil. Both, *Lithophagus* and *Lithodomus* are synonyms of *Lithophaga*, and both species are closer to *Leiosolenus*, than to *Lithophaga*. Although Lischke's type has not been located (COS981), *lischkei* is consistently recognized in Japan literature and is a quite common Japanese species. It is generally placed in *Leiosolenus* s.s. the calcareous incrustation strongest posteriorly, rounded, not pointed, just surpassing the edges by one or two mm; it is usually light-yellowish brown outside, iridescent inside. It may exceptionally reach 65 mm, but is usually found at approximately 40 mm. *L. lima* has a shorter ligament, generally a darker color and a stronger, wrinkled incrustation.

Modiola appendiculata Philippi, 1846 (Cuba) predates *Lithodomus bisulcatus* Orbigny in Sagra, 1853 as ***Leiosolenus*** (***Diberus***) ***appendiculatus*** (R. A. Philippi 1846).

Most authors consider ***Myoforceps*** monospecific. Virtually all authors followed Turner & Boss (1962) and included ***Lithophagus caudatus*** Gray in King, 1827 (from Australia) in synonymy. Kleemann (1983) added ***Lithophaga jeffreysii*** Dunker, 1880 from Samoa. However, as far as is known, *aristatus* has not been reliably recorded from Australia or Samoa. These two synonyms need confirmation. *Aristatus* is a predominantly Atlantic species, occasionally known from Hawaiian and Panamic waters.

Kleemann (1983) kept ***lessepsianus*** and ***simplex*** distinct and gave 2002 the key. Barnard (1964 p. 405) reported small specimens from Mozambique with a thin chalky incrustation not extending beyond the valves and no vertical striations, thus, a *Leiosolenus* s.s. He further noted the shape as very little oblique and a long hinge line. Finally, he considered them "perhaps as juvenile *obesa*". A few specimens have been available from Natal. However, juvenile *obesa* have a distinct shape. Kleemann (pers. com. 11/08) considered these Natal specimens as very possibly *simplex*. This gives Iredale's species an extended IND range.

NV20: ***Adula***: The nestling habitat of ***diegensis*** is atypical. However, following Coan et al. (2000) it is close in anatomy and morphology to the other mechanically boring *Adula*.

The preoccupied ***Modiola parasitica*** Deshayes in Maillard 1863 non Eudes-Deslongchamps, 1838 (SHE) from Reunion is still enigmatic and was, as far as is known, not refound. It was secured from *Teredo* holes in an anchor in approximately 45 m. Whether it is indeed a true nestler is unknown. Definitely, this name was used earlier and it is here renamed as ***Adula kleemanni***. Karl Kleemann contributed markedly to our understanding of lithophagines for many years, noted the presence of an earlier name, considered Deshayes species distinct from *Adipicola* and placed it in *Adula*. The type series is present in the MNHN type collection and some specimens have been depicted by KLE901 pl. 2.

Obviously, ***A***. ***falcatoides*** grows much larger outside Japan. Scarlato (1981) reported a specimen of 61 mm, and a further specimen from the East China Sea, off China studied measured even 71.3 mm.

Kleemann (1990) included ***truncata*** in ***Adula*** and synonymized ***Zelithophaga***. However, the chemically boring habitat, together with biogeography, the probable NZ fossil records (BEU04) and the slightly distinct morphology recommend keeping this NZ genus distinct from the mechanically boring, typically NE. Pacific group of true *Adula*. Definitely, *Zelithophaga* is closer to *Adula* than to *Lithophaga*. The S. Australian *Botula tatei* is markedly distinct.

NV21: ***Botula***: Many authors list globally 2 species, a cosmopolitan large and the small preoccupied SA *cuneiformis*. However, from the material at hand, many more *Botula* exist. At least 6 species are here recognized.

Despite Iredale's (1939) remarks, the prevailing usage is followed. Thus, ***B***. ***fusca*** is applied for the large CAR species. This is the type species, SD. Dall, Bartsch & Rehder (1938) gave the reasons to correct the erroneous earlier designation of Dall, 1898 and placed *fusca* in the West Indies. Nielsen (1976 p. 7) designated a lectotype from ZMUC for ***B***. ***cinnamomea*** (Gmelin 1791) and selected Nicobar as type locality for the large, widely distributed IND species. The huge 40 mm ***Modiola favannii*** Potiez & Michaud, 1844 from "exotique" locality appears to fit large *cinnamomea* better than large *fusca*. I do not perceive the large Caribbean and the common IND species as conspecific, but genetic data is lacking.

B. ***silicula*** (MNHN, type coll.) 25 mm, from Australia, with a dark periostracum, has also a terminal umbonal position. Very similar specimens have also been found in Arabia, there identified as *cinnamomea* (Oliver, 1995). Thus, Lamarck's *silicula* seems to fall in *cinnamomea*. Whether the blackish ***B***. ***projectans*** from Darwin with marked umbones is indeed conspecific needs verification.

Keen (1971), as well as Paredes & Cardoso (2003), did not accept synonymy of the uncommon, comparatively small Panamic ***B***. ***cyclista*** with a blackish periostracum with *fusca* or *cinnamomea*. This view is shared.

I further doubt that the uncommon, small, short, deep water Hawaiian ***B***. ***hawaiensis*** is conspecific with the much larger, shallow water IND *cinnamomea*. *B*. *hawaiensis* is perceived as valid species.

In addition, a well known distinct species with a preoccupied name occurs in S. Australia. ***Botula tatei*** is here proposed as nom. nov. *Lithodomus cuneiformis* Tate, 1892 non Gourret, 1887 (= French foss., GOURR p. 260, pl. 9 fig. 8-9, KLE83); type locality is S. Australia, Spencer Gulf; the species is named after the original author. The holotype is depicted in KLE901 pl.1. This is a small *Botula* with a dark brown periostracum, well known from SA, but extending West at least to SWA, Busselton. *B*. *tatei* has been accepted as distinct by virtually all authors.

Furthermore, Ockelmann in Hylleberg & Kilburn (2003) recognized two species in Vietnam, one obviously *cinnamomea*. Indeed, in the Western part of the S. China Sea, N. Borneo, Kota Kinabalu, a couple of small ***Botula*** have been found, boring into shallow water corals. The marked distinct subterminal position of the umbones, demonstrate, together with the smaller size and dark brown periostracum, a significant difference to the larger *cinnamomea* with terminal umbones. It is not excluded that this species is found elsewhere in the South China Sea, e.g. Vietnam. It appears **undescribed**.

Overall, at least half a dozen *Botula* is more likely than only 2 species.

NV22: ***Modiolus***: For this large and diverse genus no recent review is available. In habitats, anatomy and morphology very distinct groups were placed in *Modiolus*. Fortunately, modern authors, most notably Oliver and Wilson, started to recognize distinct genera, e.g. *Fulgida* (OLI01), *Arenifodiens* (WIS06), *Jolya* (syn. *Modiolusia*; WIS06, unfortunately as "*Modiolatus*"). Furthermore, the groups of *Gibbomodiola* and *Modiolatus* are not close to the Northern type species, as recognized by earlier authors. These are here separated and *Modiolus* is restricted to modioliform species close to the rather solid type species with a strong hirsute periostracum and simple branchial structure. However, whether the 35 species recognized as *Modiolus* indeed all belong here, needs to be resolved by future workers.

Following Coan et al. (2000), ***Modiola papuana*** Lamarck, 1801 is considered a synonym of *M*. *modiolus*. However, a huge species, similar in shape to *modiolus* occurs from Australia to the Gulf of Thailand. Rumphius tab. 46 fig. B from Amboina obviously represents this species. Chemnitz considered the Rumphius species synonymous to the Northern type species, despite a distinct biogeography and brownish instead of the blackish-blue periostracum, followed here by early European authors. However, Philippi, 1847 recognized it as distinct. Based on Rumphius' figure, he erected ***Modiola rumphii***, which appears the earliest available name for this huge species. Swennen et al. (2002) depicted such specimens as *proclivis* from the Gulf of Thailand and Lamprell & Healy (1998 sp. 170) from Northern Australia. There is little doubt that Iredale's *proclivis* is indeed conspecific. *M*. *rumphii* is also often confounded with *biradiata* or *philippinarum*. However, Lamprell & Healy (1998 sp. 171, = HIG01 B111) depicted a syntype of ***M***. ***philippinarum*** which shows the differences higher, shorter, stronger colored and with a smoother, less ridged sculpture. The largest *rumphii* studied measured more than 120 mm.

Compared to the large, fragile and rather uncommon *philippinarum* the smaller and usually more solid ***M***. ***auriculatus*** is very common and also highly variable in color. It is typically brownish, lighter umbo-ventrally, inside purple dorsally and whitish ventrally; but dark purplish and lighter yellowish, orange and red colors occur. I fail to recognize the Red Sea *aurantius* as distinct, following here Lamy. The same golden yellow, internally white colored specimens have been found side by side at other localities (e.g. Egypt, Soma Bay, Hurgada or Saipan), but these share otherwise solidity, periostracum, size and shape with typical *auriculatus*. From the OD, I also fail to recognize Preston's ***Modiola cymbula*** from Andaman Isl. other than this species. *Auriculatus* is found in these colors and *auriculatus* is also well known from the Andaman Sea. Based on the depicted type species Kimura et al. (1999) correctly removed ***Mytilus*** (***Modiola***) ***hepaticus*** from Ockelmann's *Xenostrobus*. *Hepaticus* appears indeed as true *Modiolus*, most likely representing the common *auriculatus*. Finally, it is not excluded that Lamarck's ***Modiola semifusca***, possibly from Mauritius, was indeed this species. However, C. Pannell (mail 23.10.08) stated the type in the Edinburgh Dufresne collection not found, *semifusca* must consequently be treated as nom. dub.

From the material at hand, at least two closely related "*australis*" occur. One is the well known ***M. areolatus*** from S. Australia/NZ, the other is the species depicted from N. Australia as "***australis***" by Reeve (1857 sp. 21). The flatter NW. Australian form (Wells & Bryce, 1988 sp. 562 "*philippinarum*") was considered to represent either the Northern (Wells & Bryce) or the Southern species (ALLAN). Instead, it may even represent a third "*australis*", but no material was available for study. Either way, Gray's single water worn valve from "Australia" was not the species depicted by Reeve. From Gray's original comparison with *tulipa*, a species with a *philippinarum* shape is more likely than *areolatus*. However, Hedley (1923) and Laseron (1956) noted Gray's valve unlocalized and declared *australis* as nom. dub. This course is followed. Thus, Reeve's tropical *australis* is currently without name. Whereas the SA *areolatus* is generally purplish colored on the upper half inside and outside, Reeve's species is white underneath a yellow chestnut, glossy periostracum. The periostracum is sparser haired with fewer and larger bristles. Such shells are also known from the tropical Pacific Island, e.g. Poly, Cook Isl. The solid ***Mytilus cochlear*** Menke, 1848 from Fiji shares some traits as well. The sparse material hinders progress and a conclusion whether 1 or 2 tropical species are involved.

Bernard's ***M. kurilensis*** has been analyzed by Coan et al. (2000) and synonymized with *modiolus*. Recently, this view has also been accepted by Russian authors (e.g. EVS06).

Dunker, 1857 described an enigmatic mytiliform ***Volsella gubernaculum*** from unknown locality, depicted by Reeve (1857 sp. 32). Lamy (1936) recognized it as valid, but accepted a Caribbean record. However, this species occurs instead in the Central Indo-Pacific and has been found off N. Borneo. In addition, it is known from a few samples from the Philippines, Masbate. There is very little doubt that Preston, 1908' ***Modiolus zebra*** from Andaman Isl. is the same, as is Wells et al. (1990 *Modiolus* sp. 343) from Christmas Island. The coloring in *gubernaculum* is variable, orange or red with darker radial streaks or purplish with lighter radial streaks. Large specimens are ventrally curbed, precisely reverse as found in *Stavelia*. However, *gubernaculums* remains much smaller, more fragile and the periostracum contains rather sparse, comparatively long bristles. The habitat is in coral reefs.

M. nipponicus seems much wider distributed. Although *auriculatus* occurs occasionally in reddish colors, specimens found off N. Borneo, in the Philippines, Samar and Panglao and in Samoa are referable to *nipponicus*. These two appear to occur partly within the same areas. Okutani (2000) has depicted both from Japan and gave differences.

Verco's ***Modiola penetecta*** was placed in *Austromytilus* (COTT), *Brachidontes* (ALLAN), or in *Trichomya* (Lamprell & Healy). However, the original genus matches best. Another small, ovate, hairy modiolid, sharing some traits is the Chinese/Japanese ***comptus***. Indeed, Zhongyan (2004) gave a range for *comptus* from Japan to Australia, but this needs confirmation. From the sparse Japanese and Australian material at hand, these two appear distinct.

Deshayes ***Modiola microptera*** is based on Chemnitz 8 85 760, a thin, elongated species from India, Coromandel. As concluded by many authors (recently also HYL03), Hanley's ***metcalfei***, described 1843 from the Philippines and Iredale's ***penelegans*** from Qld are this species, giving *microptera* a range from India to W. Japan. However, as early recognized by Mörch (1853 p. 54) Röding, 1798 based his ***Musculus modulaides*** on the same figure of Chemnitz as later Deshayes. According to Sherborn, *M. modulaides* has been validly proposed and was used by Maes (1967) in her report on the Cocos-Keeling *Modiolus*. Consequently *M. microptera* becomes a junior synonym. *M. modulaides* from India, Myanmar and Kyushu have been studied and proved to represent the same species. The largest specimen measured 57 mm; Hanley's type from unknown locality is still largest with 68.5 mm (HIG01 B110). From the OD it is likely that ***Modiola triangulum*** Koch in Philippi, 1847 from China was this species.

In older Japanese books (e.g. Habe, 1971 pl. 50 fig. 26) a distinct species is depicted as *M. metcalfei*. This has recently been identified by Okutani (2000 pl. 431 sp. 23) as *philippinarum*. Neither view is shared. The Japanese species is neatly in between the expanded *metcalfei* and the ovate-elongate *philippinarum*. However, Philippi, 1847 described from Chinese waters ***Modiola cecillii***, similar to *metcalfei*, but more inflated and with more prominent umbones. This species fits exactly. Japanese specimens reach the size indicated by Philippi, or slightly more than 60 mm. Bernard, Cai & Morton (1993) recognized it, though unnecessarily emendated as *M. cecillei* from Chinese waters. However, their distributional range "Philippines, South China Sea, Guangsi, Beibu Gulf" needs confirmation. The species depicted by Zhongyan (2004 pl. 122 fig. G) from China are true *modulaides* and 122 fig. I seems *philippinarum*. What can be confirmed from material collected is Japan, W. Kyushu and Honshu, Sagami Bay, confirmed by Habe (1971 i.e. W. Kyushu, Ariake Bay to Honshu, Boso). This old name should be added to the Japanese faunal lists. The western extension of *M. cecillii* has to be further elaborated. *M. traillii* (Reeve 1857) from Malaysia (type HIG01 B112) is close and may be responsible for some Western records. It appears that Lamy (1936) confounded *traillii* and *cecillii* while reporting the former from Japan and the latter from the Philippines. What Hylleberg & Kilburn, 2003 reported with an erroneous date and spelling as "M. *trailli* (Reeve, 1843)" from "Vietnam, Hai Phong" "known from Japan" is open. The exact distribution of *traillii* has also to be worked out.

Lamprell & Healy (1998) even noted it living in Australia, but instead of an Australian specimen, unfortunately, they only depicted the same syntype as Higo et al. (2001).

The Caribbean ***Modiolus americanus*** (Leach 1815) is a well known old species unmistakably depicted and localized by Chemnitz 8 85 758 from the West Indies. Favart d'Herbigny, 1775 ***Mytulus americanus*** is this species, but was described in a non-binominal work (SHE). Previous to Leach, Röding, 1798 named this species ***Musculus papuanus***. According to Sherborn the name is valid and not preoccupied. However, as far as could be ascertained Röding's name has never been used, even not before 1899, and was also not mentioned by Lamy; whereas *americanus* has been consistently applied in American literature for this species (e.g. Lamy, 1936 p. 277-8 and many older records, SOO55, BEAU and many older records, REG71, 7, 51, 30, 27, DIA94, AND94, ALA97, 71, LEAL, MIK04). Based on ICZN Art. 23.9.2. ***Modiola americana* Leach**, **1815** is here declared valid and considered **nomen protectum** and the older *Musculus papuanus* Röding, 1798 is a nomen oblitum.

Comparing specimens from Ghana, Ampenyi, nestling 5-8 m among rocks and from S. Brazil, Bombinhas, 1-3 m, on *P. perna*, then ***M. pseudobarbatus*** Ockelmann, 1983 and ***M. carvalhoi*** Klappenbach, 1966 are the same. Indeed, Kensley & Penrith (1970) found and depicted *carvalhoi* from S. Angola, identical to specimens from SW. Africa. It is highly unlikely that two small, very inflated, shallow water modiolids with the same characteristic sculpture of periostracal hairs occur that close. Furthermore, *Perna perna* occurs in Brazil and WAF. Ockelmann only compared to the Med *barbatus*, but not with Klappenbach's earlier species. Thus Ockelmann's *pseudobarbatus* is considered a junior synonym of *carvalhoi*.

As concluded by later European authors (e.g. RUE98, ARC04) Ockelmann (1983)'s view that ***lulat*** is the same as ***martorelli*** was erroneous. Here, these two are even placed in distinct genera. Both are well depicted in Ardovini et al. (2004 p. 263). Adanson's Le Lulat has been precisely described, even with anatomical details. It is a large 80 mm species, inflated, quite solid, subequal in height and breadth with a thick, persistent brownish periostracum. Ockelmann's *thorsoni* is perceived to represent a juvenile *lulat*. No substantial differences were found to Adanson's OD, or seen in smaller *lulat* studied from Senegal. Indeed, Ardovini et al. (2004) did not list *thorsoni* as valid. Unless further distinguishing marks can be presented, Ockelmann's species is considered a junior synonym.

The Uppsala specimen of ***Mytilus ruber*** Linnaeus, 1758 (UL504) has been studied. It measures 44 mm, is reddish, umbonally white and silvery-purplish inside. This beached specimen conforms well to the OD and is understood as **holotype**. Despite the abraded periostracum *M. ruber* belongs in *Modiolus*. The shape, the special color, the still visible strong and characteristic commarginal sculpture leave no doubt that *Mytilus ruber* is the well known red color form of the Mediterranean *Modiolus barbatus* (Linnaeus, 1758). ***M. barbatus*** has page priority.

The E. Pacific group of ***M. rectus***, ***eiseni*** and probably also ***neglectus*** seem correctly placed in *Modiolus*, as concluded by Soot-Ryen (1955) and Keen (1971). At least the huge *rectus* is quite solid with a strong periostracum and fits well. *M. neglectus* and *eiseni* are more fragile with a weaker periostracum; they share some traits with *modulaides* and *cecillii*. Despite the untypical habitat, the placement of Coan et al. (2000) in *Modiolusia* is not shared.

NV23: ***Gibbomodiola*** specimens are modioliform, gibbous, smooth without periostracal hairs; the European ***adriatica*** fits, the S. Australian ***albicosta*** and the Philippine *biradiata* are included here as well. All three colored species are rather uncommon and their precise mode of life is not well known.

Hanley, 1843 described, tentatively from S. America, the comparatively large, 62 mm, ventricose ***M. biradiata***, just after *philippinarum*, thus, similar in shape, but smooth and glossy without periostracal hairs. Soot-Ryen approached it to *eiseni*, but this Panamic species is quite distinct in shape and remains much smaller. Lamy (1936) approached *biradiata* to the also large *albicosta* which is also smooth, but internally white. Hidalgo (1905) reported the S. Australian endemic "*Modiola albicosta"* from Phil, Luzon. Indeed, specimens from the Philippines, Luzon, Bauang, Visayan Sea, Bantayan and Camotes Isl. resemble *albicosta* and fit Hanley's OD well. Consequently, the erroneous *biradiata* type locality is here corrected to the Philippines. Philippine specimens are in purplish-white colors close to *albicosta*, in shape closer to *philippinarum*, and have a smooth glossy, ridged periostracum without hairs. Hanley's type was not located in BMNH 11/08. However, the type lot of *philippinarum* includes 2 distinct species. First, the depicted and well known syntype of *philippinarum* (BMNH 19829/1) inside white, still with periostracal hairs; second, a lot BMNH-198210/1-3 originally labelled *M. philippinarum* **var**., Philippine Isl. from M.C. These are larger than Hanley's type, but fit *biradiata* well and may serve for a neotype selection, in case Hanley's type stays lost. ***Gibbomodiola biradiata*** grows at least to 107.3 mm and is found subtidally, 2–30 m, in the Central Philippines. Furthermore, conspecific specimens have been studied from East Africa, Tanzania. It may well be that many "*philippinarum"* records from the Indian Ocean are instead referable to *biradiata*; *biradiata* and abraded *philippinarum* are superficially close.

NV24: ***Modiolatus***: This group of uncommon species is characterized by strong commarginal ridges, a fragile texture, an elongate-ovate, rather inflated shape, and a non hirsute periostracum. Often, *Modiolatus* build a byssal nest.

The type OD ***M. plicatus*** appears rare. The only recent picture found is Zhongyan (2004 p. 231) from S. China.

Related are Dunker's uncommon Japanese ***M. hanleyi***, as concluded by Koyama et al. (1981) and Higo et al. (1999). The large species interpreted as *hanleyi* by Lamprell & Healy (1998 sp. 177) from Australia is distinct. Instead, it represents the more elongated ***M. nitidus***, originally described from Darwin, but also known from WA, Broome and reported from Qld. It is tentatively included here as well.

Dunker's ***V. flavidus*** seems close to Gmelin's type species. *Flavidus*, originally described from the Philippines, and accepted from there by Hidalgo, is reported as widely distributed (i.e. Andaman Sea, Australia, Japan). However, too little material hinders a confirmation of these records. Oliver et al. (2004 "*M. hanleyi"*) from Rodrigues Isl. is distinct from true Japanese *hanleyi*, and also from true

Australian *nitidus*. Instead, it may represent *flavidus*. Nielsen (1976 fig. 18 *flavidus*) from a reef flat habitat off Phuket seems to be Oliver's species and is perceived as true *flavidus*.

Habe in Koyama et al., 1981 described *Modiolus* (*Fulgida*) ***oyamai*** as very closely related to "*Modiolus* (*Fulgida*) *flavidus*. This view is shared. However, both Japanese "*Fulgida*" appear closer related to *Modiolatus* than to the ovate, glossy *Fulgida* (= *Lioberus*), which do not occur in Japanese waters.

Iredale' ***M. pulvillus*** seems very close to *flavidus* and is here included.

The SA ***M. victoriae***, earlier confounded with *flavidus*, is also closer to this group than to true *Modiolus*.

Nicklès, 1955 described the rare WAF ***M. nigeriensis*** which shows close affinities to this group.

Finally, Hanley's enigmatic ***M. sordida*** described from unknown locality may belong here. However, the type was not found at BMNH 11/08 and at present, Hanley's species remains dubious.

All these species are uncommon to rare and not well known. This group certainly needs much more material and work for a satisfying picture.

Modiola siliqua Philippi, 1849 ("PHIL49") from Okinawa close in shape to *vagina*, but internally red-purplish and with rougher ridges has been validly proposed. However, it is preoccupied by the European fossil of Matheron, 1843 (SHE). It was neither mentioned by Küster & Clessin (1840-90), nor Lamy (1936-37), nor was it found in Japanese literature. Possibly, Philippi's preoccupied *siliqua* might have been the same as Dunker's *M. flavidus*.

Modiola legumen Philippi, 1851 ("PHIL51") from unknown locality, was obviously a similar species. It was validly proposed and is not preoccupied (SHE). However, it was neither mentioned by Küster & Clessin (1840-90), or by Lamy, (1936-37), nor was it found in any other mytilid literature after 1899. The types are not at MfN. It is a truly forgotten species.

NV25: ***Lioberus*** does not belong near *Musculus* and *Gregariella*, but is close to some *Modiolatus* and especially to ***Fulgida***. Without locality data, the two similar sized type species ***Fulgida ligneus*** and ***Lioberus castaneus*** are virtually indistinguishable. Indeed, Dall (1886 and 1889) considered specimens from S. Carolina and Florida as *Modiola lignea*, before, in 1898, he created *Lioberus* for *castanea*. The two type species also share the hinge configuration, muscle scars and according to Wilson (2006, *Lioberus*) the same nest building habitat. Long siphons are well known for *Lioberus*. For *agglutinans* and for *lignea*, precise anatomical data is currently unknown. However, from Philippi, 1844's OD and picture of *Modiola vestita* (= *agglutinans*) siphons may be expected.

Soot-Ryen in Moore placed *Lioberus* (CRENELLINAE) remote from *Fulgida* (MODIOLINAE), exclusively based on siphons. However, Wilson (2006) noted for *vagina*, long hidden in *Modiolus*, long siphons as well and created *Arenifodiens*. It is open, whether for siphoned modiolids indeed a new subfamily is necessary, or the existing subfamilial definition should be widened. Until phylogenetic data indicate otherwise, the latter option is here chosen.

Thus, I see currently no arguments to keep *Fulgida* distinct from Dall's earlier *Lioberus* or to remove *Lioberus* from MODIOLINAE.

Without doubt, Dunker's OD of ***Volsella splendida*** from "California" is marked distinct from Reeve's interpretation from Sydney (= *Gregariella*). Dunker's syntypes are depicted in Keen (1971 sp 136). From size and shape *ligneus* and *castaneus* are possible. Coan et al. (2000) opted for *castaneus* with an erroneous type locality. Their view is shared, as *ligneus* has been described by Reeve himself and *castaneus* was not treated.

NV26: ***Jolya***: The well known ***Modiola stultorum*** was established by Jousseaume, 1893, recognizing that Reeve's sp. 25 *plicata* from WAF was not Gmelin, 1791's IND species. In 1911, Haas depicted the Geneva types of ***Jolya letourneauxi*** Bourguignat, 1877. In 1912 p. 85, Haas noted identity of *letourneauxi* and *stultorum* and requested use thereof henceforth "*Modiola letourneauxi* (*Bgt.*)", based on E. A. Smith's comment on the true identity of Reeve's *plicata*, There is no doubt that these two are conspecific. Although Bourguignat's name is rarely used, I see no reason not to follow Haas' statement and consider the well known *stultorum* as junior synonym. Gofas et al. (1986) reported *Modiolus* aff. *stultorum* from Angola, Pta. Lagostas, 50 m. Further specimens have been studied from nearby Moita Seca, 73 m and from N. Namibia, 17.3°S, 11.6°E, 102 m. These fit *letourneauxi* well. Thus, the range of *letourneauxi* is here extended to N. Namibia.

J. letourneauxi is in elongate, glossy shape, fragile translucent texture and missing periostracal hairs significantly distinct from the type species of *Modiolus*. ***Jolya*** is here accepted as valid genus.

Swainson's ***Modiola elongata*** from the Indo-Pacific (type HIG01 B115) is globally the most similar species. Fresh *elongata* are very close in compressed, fragile texture and color of periostracum. However, the IND species grows twice the size and has the umbones very low and very terminal. Yamamoto and Habe obviously considered *elongata* as unique and created ***Modiolusia***. However, *Modiolusia* is here synonymized with the earlier *Jolya*, as also the hinge configuration is the same, an elongated ligamental ridge posterior and a thickening anterior. *M. elongata* has been described from NT, Darwin. It is known from tropical Australia, from Indonesia and also from the Philippines.

Habe well recognized the Chinese/Japanese species as distinct from his *Modiolusia* type species and considered it (1971 pl. 50 fig. 25) to represent Reeve's *nitidus*. However, as recognized by later Japanese authors this was erroneous, *nitidus* is a generically distinct Australian species. Subsequently, Habe's *nitidus* was interpreted as *elongatus* (e.g. Koyama et al., 1981, Okutani, 2000 pl. 432 fig. 30). Unfortunately, this view can not be shared either. True *elongata* is not known from China or Japan. Instead, Grabau & King, 1928 described this species well as ***Modiola subrugosa*** from the Yellow Sea. It has much stronger umbones, remains shorter and broader and is more rounded posteriorly, not as obliquely truncate as true *elongata*. It remains also smaller, and only reaches about 2/3 of the length of *elongata*. However, as Dunker (1882) and Clessin (1887) before them, Grabau & King recognized a close resemblance of *subrugosa* to Reeve's ***M. rhomboidea***. Reeve, 1857 sp. 28 described this species from "The Gambia, West Africa". However, from WAF nothing identical is known. From there, only 2 species bear a certain resemblance. The smaller *letourneauxi* (syn. *stultorum*) is depicted on Reeve's same page fig. 25 "*plicata*" and is easily excluded. The only other known WAF species, Hidalgo's larger, rare ***martorelli*** is distinct in color, rounder posteriorly and with broader umbones. No modern European author accepted identity of *martorelli* and *rhomboidea*, or listed *rhomboidea* from Europe or from West Africa. I am convinced, that Lamy's identity of *rhomboidea* Reeve = *stultorum* is erroneous and that Dunker (1882) and Clessin (1887) are correct in that Reeve's *rhomboidea* bears an erroneous type locality and is, instead, the Pacific species. Indeed, Reeve's depicted specimen 78.8 mm (BMNH 165120), selected lectotype by Wilson, 1965, has been studied in London. This is the Pacific species, not the WAF, as erroneously labelled. *M. subrugosa* is the same. An earlier *M. rhomboidea* Hanley does not exist.

In addition, Japanese authors consistently consider Jousseaume's ***sirahensis*** from Aden identical to their Japanese species (= *rhomboidea*). Indeed, Red Sea specimens are very close in size and shape. Tomlin (1923) and Barnard (1964) considered *sirahensis* identical to *rhomboidea*, based on Natal material. Unless genetic data can identify the Indian Ocean species as distinct, *sirahensis* is considered a further synonym of *rhomboidea*. Finally, Iredale, 1939 described ***Modiolus ostentus*** (= Lamprell & Healy, 1998 sp. 176) from Qld, Keppel Bay and declared it distinct from *elongata*. This view is shared. However, size, shape and morphology of *ostentus* are perceived as identical to *rhomboidea*. The type locality of Reeve's ***rhomboidea*** is here corrected to **East China**. *Jolya rhomboidea* is widely distributed from the Red Sea and Natal, Australia to Japan but it occurs generally deeper than *elongata* and is found living in its characteristic byssal nest.

Related to this group of true *Jolya*, namely *letourneauxi*, *elongata* and *rhomboidea* is the MED/WAF ***martorelli***. It is similar in shape, though more inflated and with a somewhat rougher periostracum, but also without any hairs and shares the same hinge configuration. Rueda and Salas (1998) well elaborated the differences to *M. lulat*, which is a typical *Modiolus*. *Jolya martorelli* is found in the Med, Malaga in 1-2 m, or in SE. Spain 25 m and in the Atlantic, e.g. Senegal, Cayar or Morocco, Agadir, in 100-114 m. Rueda and Salas, as well as Ardovini et al. (2004) considered all records representing the same species. Their view is followed.

Less close is Dunker's uncommon ***arata***, but still better fitting here than in *Modiolus*.

NV27: ***Idas*** and ***Adipicola*** are close. However, Dell (1987) and Coan et al. (2000) gave distinguishing marks, especially missing periostracal hairs in *Adipicola*. Gustafson et al. (1998) added anatomical differences. *Idas* and *Adipicola* represent barely known genera of uncommon, deeper water species.

Recent trawling operations off EAfr, Mozambique procured 2 distinct *Idas* species. Although the depths have been indicated, the exact habitat remains unknown.

The type of ***I. japonicus*** is depicted in HIG01 B126. Specimens trawled off Mozambique, Xai Xai, 380-420 m, 17-18.5 mm share the sparse periostracal hairs, the glossy yellowish periostracum, the expanding and posteriorly broader shape, with a weak central sinuation and the milky-pearly interior. Dell (1987) reported *japonicus* from NZ waters. All evidence indicates that *japonicus* is a widely distributed species.

The other species has been trawled off Mozambique (off Bazaruto Isl. and off Zavora) 420-480 m, 16-20.3 mm; very elongate and the umbones very anterior, with sparse but long periostracal hairs posteriorly. The inside is whitish iridescent. ***I. indicus*** was described by Smith, 1904 from Andaman Isl., 338 m, 11.5 mm. The ZSI-holotype is depicted in ANA09 pl. 18 fig. 2 and shares some traits. Both, the Mozambique and the Andaman species have growth lines more marked than *simpsoni* and weak radials anterior also not found in *simpsoni*. They also share the same diameter, marked inflated centrally, with two quite strong postero-dorsal ridges. However, Dell (1987) analysed the BMNH-specimens and noted short, stout bristles, which together with differences in shape would not fit. The presence of a related, **undescribed** species in Mozambique waters is more likely.

From the East China Sea, trawled in about 300 m another species is recognized. It is comparatively large, 26.5 mm. The shape is similar to *I. indicus*, but broader and the umbones are very terminal. This species appears **undescribed**.

Another, smaller specimen also from the East China Sea has the umbones terminal as well, but is much more slender in shape. Unless *Idas* would display an unexpected extreme variability in shape, this species appears also **undescribed**.

Prashad's ***Modiolus dubius*** shares some traits, however, the obviously absent periostracal hairs, and the white, non glossy interior would, when confirmed, rule out *Idas*. *Dubius* is tentatively placed in *Adipicola*, but the type and fresh material needs to be studied to achieve a firm conclusion.

A huge 52.9 mm ***A. crypta*** from Japan is depicted in Koyama et al. (1981 pl. 1 fig. 1) or in Okutani (2000 pl. 432 fig. 32). However, whether these double sized Japanese *crypta* are indeed conspecific with the Hawaiian original should be confirmed by genetic data.

A. iwaotakii grows much larger than originally described; the largest studied from East China is 21.7 mm, but remains narrower and more fragile than *crypta*, also translucent, and paler whitish-cream in color.

Some species are unresolved:

- ***macdonaldi*** shares some traits, but is not a typical *Idas* (GUS98)

- ***dalli*** does obviously not belong here (DELL87), however, no solution was as yet presented; *Urumella* shares some features, but a new genus is possible

- whether ***projecta*** indeed belongs in *Adipicola* is open (DELL87). *Idas*, as proposed by Lamprell & Healy (1998) fits even less. Here, a new group is also possible

The preoccupied ***Modiola parasitica*** Deshayes in Maillard 1863 (= *kleemanni*), superficially close to *iwaotakii* has been resolved by Kleemann (1990) and is now placed in *Adula*.

Overall, *Idas* and *Adipicola* need much more work and material for a satisfying picture. It may well be that much more closely related species are present than conventionally accepted. It can also not be excluded that some further genera are necessary to properly accommodate these uncommon deeper water forms.

NV28: ***Benthomodiolus***: A third species may live off Mozambique. Shape, hinge, ligament and muscle scars of the E. African species are closer to *abyssicola* than to *lignocola*. However, the lack of exact habitat and live taken specimens to compare anatomy restrict progress.

NV29: ***Amydalum***: Oliver (2001) differentiated 3 groups within *Amygdalum*, a view shared.

The first group encompasses the dentritic patterned forms, e.g. *dendriticum*, *americanum*, *beddomei* (= *striatum*) and *peasei*.

Lamy (1936) considered the Caribbean type species as cosmopolitan. Indeed, Oliver (1992) identified Red Sea specimens as cf. *dendriticum*. However, Oliver (1995) identified Arabian specimens with virtually the same wording as *peasei*. Subsequently, Oliver (2001) identified Borneo specimens again as *dendriticum* (without cf.) and NSW-specimens as *peasei*. However, from NSW *beddomei* has been described, whereas *peasei* is originally a Hawaian species. Mienis (2001) rejected the use of the Caribbean *dendriticum* for Red Sea specimens, but still accepted *peasei*, although mentioning that *peasei* is distinct in shape.

Large dendritic Caribbean and IND species are significantly distinct. Originally, Megerle did not give a locality, but from his wording and reference it is apparent that he saw ***dendriticum*** in the West Indies. W. Florida to Brazil are the locations currently known for this species.

Beu (2004) demonstrated that the NZ fossil *Lithodomus striatus* Hutton, 1873 is the earlier name for Iredale's ***beddomei***.

From the OD's and the material at hand *A*. ***striatum*** (BEU04; IRE24 and Lamprell & Healy, 1998 sp. 182 as *beddomei*) is markedly underestimated and is instead perceived as the large, widely distributed dentritic IND species (= OLI01 fig. 1 "*dendriticum*", fig. 2 "*peasei*" and fig. 5 *beddomei*). Oliver's Indian Ocean "*dentriticum*" and "*peasei*" are perceived as this species. Lamprell & Healy (1998) included also the WA forms, and specimen collected in the Marquesas are perceived the same, as earlier reported by Dautzenberg & Bouge (1933). *A. striatum* remains slightly smaller than *dendriticum*, and is more elongate, less trigonal in shape, the colors of the dentritic pattern and of the yellowish periostracum are stronger in adults.

A. ***peasei*** (DBR, 1938 pl. 8 figs. 11-14) is smaller and shorter and comparatively broader. Following Japanese authors *A. plumeum* is perceived the same (type: HIG01 B125s; = OLI01 fig. 3). A specimen studied from the Philippines, Camotes, 28 m, 15.8 mm is referable to *peasei* as well. In the Marquesas, both *striatum* and *peasei* have been found in approximately 20 m. *A. peasei* appears restricted to Philippines, Japan and China, Marquesas, Easter Isl. and Hawaii.

Soot-Ryen, 1955 compared his ***americanum*** with Iredale's *beddomei*. However, the Caribbean *dendricticum* is closer to the Panamic species, as noted by Lamy (1936). Small specimen off Florida, are hard to distinguish from similar sized specimens off W. Panama. *A. americanum* grows with at least 29 mm (W. Panama) larger than indicated by Soot-Ryen and Keen. Adult *dendriticum* still reach twice this size, and are broader. It also lives deeper, whereas *americanus* is found beached and while snorkeling. The Panamic species seems to occur much more commonly than the Caribbean species.

The second group encompasses smaller species with an opaque, dorsal pattern (*A. pallidulum*, *sagittatum*, *soyoae*, *anoxicolum*) . Following Soot-Ryen (1955), Keen (1971) and Oliver (2001), I see no arguments to synonymize the E. Pacific ***pallidulum*** with the Atlantic *politum*. *Pallidulum* is broader and shorter in shape, has a distinct coloring and dorsal pattern and only grows half the size of the Atlantic species. It also lives somewhat shallower. Instead *pallidulum* is close to the smaller Caribbean ***sagittatum*** and to the similar shaped and sculptered ***soyoae*** and ***anoxicolum***, as depicted by Oliver (2001) and noted by above authors. Similar *Amygdalum* are also known from the Philippines, off Mactan Isl., 170 m, 22.4 mm. These are usually identified as ***soyoae*** and are indeed in shape and sculpture closer to the Japanese specimens than to the even larger and broader Arabian *anoxicolum*.

The third, the *Modiella*-group, encompasses the largest, almond shaped, whitish, unsculptured forms. All may change inflation (stronger in large specimens) and colors (yellowish, rusty red periostracum in larger specimens). The Atlantic *A*. ***politum***, the Philippine *A*. ***watsoni***, and the Hawaiian *A*. ***newcombi*** belong here. Whether these represent a single or 3 distinct species is currently open, genetic data is lacking. However, it can be noted that smaller specimens from Florida are very close to Med specimens, but also to specimens from Mozambique, or larger specimens from the Med are virtually indistinguishable from Chinese or Okinawan specimens. Just *newcombi* is in small size and comparatively shallow depths at least superficially distinguishable. As cosmopolitanism is exceedingly rare in bivalves, and genetic results are not available, biogeography is stronger weighted and *watsoni* and *newcombi* are for the time being separated.

Thus, at present 11 *Amygdalum* in 3 groups are recognized. The affinities of *Amygdalum* are open. A position near *Arcuatula*, as proposed by Scarlato & Starobogatov (1979) neglects habitats, mode of life and many morphological features. *Modiolus* is not close either. It is not excluded, that a new subfamily is necessary to properly accommodate this group.

The S. Australian ***Modiolus lineus*** does not belong here and seems to represent an **undescribed** genus. *Amygdalum*, where placed by Laseron (1956) does not fit. Iredale & McMichael (1962) questioned *Modiolus*, where Cotton (1961) placed it. However, failing material and the lack of anatomical and phylogenetic comparisons hinders progress.

The fragile, papery Caribbean ***papyrium*** is not an *Amygdalum* either. It is closest to the IND *perfragilis* and *glaberrima* and placed in Arcuatula.

The European ***agglutinans***, sometimes placed here, is understood as *Fulgida* (= *Lioberus*). It does not share the characteristics of the *Amygdalum*-group.

6.11 ARCIDAE

NL1: Arcids have been treated in many papers; notably Reeve(1843-44),Nyst(1848),Dunker(1858-78,Novitates), Kobelt (1841-91), Lamy (1904-7), Reinhart (1935). Important is also Chemnitz vol. 7. In modern literature, Oliver and Russian authors contributed significantly. One of the best, but also most neglected papers on arcids has been written by Iredale (1939 pp. 245-296). His generic views are sharp and here largely applied.

Though rather reluctantly, following convention 5 subfamilies are used. Despite a large pile of books and papers, many questions are open in this large family. The sparse phylogenetic data (e.g. OLI06) show surprising results, e.g. a close relation of *Cucullaearca* to *Anadara*, but no relation at all to *Barbatia* s.s. Whether the conventional subfamilies hold firm is therefore doubted. At least some typical anadarids are byssally attached (*Diluvarca*) or have a byssal gap (*Mosambicarca*), thus, strongly questioning the conventional definitions of ANADARINAE.

Litharca and *Scaphula* have marked distinct habitats, apart from a unique morphology. This makes distinction of LITHARCINAE and SCAPHULINAE more substantial. However, whether *Litharca* is correct placed here instead of noetiids is open. The group around *Bathyarca*, *Bentharca*, *Asperarca* and *Samacar* contains small, deeper water species with special hinge configurations. Oliver et al. (2006) pointed to their close affinities to PARALLELODONTIDAE. BATHYARCINAE may indeed be better placed there.

Some paleontological views proved here as quite difficult. Many characteristics found in living specimens are missing in fossil material. Consequently, many fossil workers tended to oversimplification.

Also in arcids, it appears that not even the surface has been scratched. I am convinced that this family will look marked distinct after 3 generations of future workers.

Nyst, 1848 considered approximately 450 arcids as valid, of which 162 recent. However, in the meantime many additional species have been described and virtually all of Nyst's enigmatic species were resolved by Lamy. Whereas Boss, 20 years ago, estimated less than 150 extant arcids, here, more than 250 extant species are recognized globally.

NL2: ***Arca***: Within *Arca* three groups can be differentiated, according to Oliver & Chesney (1994, see also OLI92 table 1, OLI06): The *noae*-group (= ***Arca*** **s.s**.), the "*avellana"*-group and the *tetragona*-group (= ***Tetrarca***).

Although the latter two groups share few features, the smaller size, the ligament and the posterior dentition in *Tetrarca* are distinct. Members of the "*avellana"*-group (*avellana* (*= patriarchalis*), *imbricata*, *mutabilis*, *turbatrix*, *ventricosa*, *volucris*) are therefore placed as unnamed (**I**). In addition to these 3 groups, the Japanese *boucardi* with a quite regular radial sculpture, a rather velvety, dense periostracum, an irregular dentition, and a very densely chevroned ligament seems to represent a **fourth lineage**, quite remote from *Arca* s.s and is here placed as unnamed (**II**). Globally, approximately 20 *Arca* are recognized, as usual almost half in the Indo-Pacific.

I do not consider ***Arca despecta*** from Senegal synonymous to *Arca* ***noae***. As originally defined by Fischer, 1876 the umbones are consistently more central. Furthermore, the umbonal portion is very flat, whereas in *noae* it is centrally elevated; this is well visible in full adult specimens from posterior view. The outside coloring in *despecta* is generally weaker; the ligamental part typically broader, and also darker. However, the shape, especially in juveniles, may be very close. Ardovini & Cossignani (2004 p. 256) from CapV, and Oliver & Cosel (1993 fig. 1A-D) from W. Sahara depict true *noae*. Kobelt (1889) illustrated *despecta* well. Nicklès (1950 "noae") is instead *despecta*. Following older authors, *despecta* occurs along the WAF coast to Angola, growing up to 110 mm. The larger specimens analysed have been dived, off N'Gor, Senegal 20-21 m, among stones. Smaller specimens came from approximately 10 m.

Specimens studied from the Galapagos are not perceived specifically distinct from ***pacifica***; therefore ***truncata*** is considered synonymous.

Arca navicularis is perceived as exceedingly variable species. Bruguière's *navicularis* is based on Chemnitz 7 54 533 from the Indo-Pacific. Chemnitz's species corresponds to specimens commonly found in the Indian Ocean to the Philippines. This form is moderate in compression and elongation, has a large, dark, regular diamond between the umbones and up to 27 rather fine ribs, rougher at both extremes. It includes forms as described as *A. linter* (very elongate) and *symphenacis* (22-26 fine ribs). A special form, broader, with fewer and rougher ribs was described by Iredale, 1939 as *subnavicularis*. It appears that Oliver & Chesney (1994) redescribed Chemnitz' 533 (= *navicularis*) as *symphenacis* and considered Iredale's *subnavicularis* as distinct. However, these rougher ribbed forms are also found with 25 ribs, and also occur in the Red Sea. On the other hand, the diamonds change from regular to elongate, sometimes two diamonds are found, unequal in *linter*, equal in others. *A. subquadrangula* from Amboina is a very broad, rather short form, closely resembling Australian specimens; but it has more than 30 ribs, whereas Iredale's *subnavicularis* has only about 20 and Lamprell & Whitehead's sp. 50 is in between with about 26 ribs. In the many dozen *navicularis* studied, no consistent pattern in shape, ribs, diamonds or biogeography was found. Thus, Lamy (1907) is followed and all these forms are considered extremes of a widely distributed, highly variable, elongate, shallow water arcid. As noted by Lamy, it is also likely that Dunker's ***A. fuscomarginata*** from Madagascar is only a worn, broad *navicularis*.

Dall, Bartsch & Rehder's ***mauia*** was synonymized by Kay (1979) with ***kauaia***. Due to the small size and the narrow anterior border she kept it distinct from the widespread *navicularis*. Severns (2000) depicted this small, uncommon orange-white species well.

Arca ventricosa with a much finer sculpture and usually higher, more inflated valves than *navicularis* is widely distributed and also quite variable. Dunker's ***A. insignis*** described without locality is sometimes synonymized with the Med *noae*. However, it most closely resembles narrow *ventricosa* specimens in sculpture and diamonds.

On the other hand, whether Iredale's ***Arca parventricosa*** is indeed conspecific, as noted by Lamprell & Healy (1998), should be confirmed. No *ventricosa* as yet seen from NT or Qld came close to Iredale's OD.

Arca **(*Tetrarca*)** ***dayi*** was described as *acuminata* ssp. from

Masirah. Dekker & Orlin (2000) reported only *acuminata acuminata* from the Red Sea, but not *dayi*. However, it could not be confirmed that true *acuminata* occurs outside an enlarged Natal range. *Dayi*, as well depicted by Oliver (1995 sp. 907) is not particularly close to the comparatively broader and usually smaller SAF *acuminata*. Definitely, ***acuminata*** is significantly distinct from *avellana* (= *patriarchalis*), where Kilburn (1983) placed it. In addition, Reeve, 1844 described the 29.9 mm ***Arca ocellata*** from Singapore. *A. ocellata* was synonymized with *patriarchalis* by some authors, others synonymized it with *boucardi*, but Stevenson (1972) considered it valid. The BMNH holotype has been studied and fits in shape, ligament and dentition in *Tetrarca*. I could not detect any important differences to Oliver's *dayi*, which also attains the same size and is here synonymized. Oliver & Chesney (1994) just compared *dayi* to *acuminata*.

Chemnitz 7 53 532 described an *Arca noae* variety from the Red Sea, Suez. Such a specimen is well depicted in Oliver (1992 pl. 1 fig. 1c) as ***Arca avellana*** Lamarck, 1819. However, earlier Röding, 1798 erected ***Arca patriarchalis*** based on this Chemnitz figure 532. *A. patriarchalis* has been considered validly proposed by Sherborn (though erroneously as *patriarch**i**alis*) und mentioned after 1899 by Lamy (1907 p. 30) as valid name. Thus, a reversal procedure is not possible. Unless an ICZN-petition is filed to invalidate Röding's name, Lamarck's well known *avellana* has to be regarded a junior synonym. Philippi's ***Arca arabica***, Krauss' ***kraussii*** und Reeve's ***cunealis*** are this species, as many others throughout the IND. Lamarck's type of ***retusa*** was depicted by Lamy (1904). Similar to *Arca navicularis* also in larger *patriarchalis* two consequent diamonds between the umbones may occasionally occur; but usually there is only one, multiplying the lines posteriorly by growth. *Patriarchalis* is a smaller arcid, generally found at approximately 30 mm, occasionally extending to 54 mm (Australia). As concluded by Lamprell & Healy (1998) there are few arguments not to consider both of Iredale's *Navicula*, ***aladdin*** and ***terebra***, synonymous. *N. terebra* is the typical whitish form with a pale brown periostracum on the ligamental area. *A. aladdin* with its reddish-brown color and dark blackish ligament is depicted in Lamprell & Healy (1998 sp. 52). ***A. martensii*** is in many respects intermediate between *aladdin* and *terebra* and as concluded by Lamy (1907) considered synonymous as well.

Reeve's ***Arca volucris*** from the Philippines is usually synonymized with *patriarchalis* (e.g. Stevenson, 1972). However, many specimens studied from N. Borneo, Philippines, Guam, Saipan and Vietnam show quite consistently distinct features to *patriarchalis*. The color is always whitish with marked yellow brown on the flanges. The persistent yellow or dark brown periostracum on the ligamental area in *patriarchalis* is lacking. Instead Reeve's dark blotch, a brownish lined diamond structure, variously composed, is present between the umbones. The texture is somewhat lighter and more fragile than typically found in *patriarchalis*. In shape *volucris* is usually squarish. The maximum size studied is 50.5 mm (Vietnam), but usually specimens are less than 40 mm. *Volucris* is perceived as recognizable and belongs in Oliver's unnamed *avellana*-group.

Dunker's elongate, finely sculptured ***Arca angusta*** from Fiji seems to surpass the variability of *patriarchalis* and might be a valid *Arca*. However, it is multiple preoccupied (Lamarck, 1805; Risso, 1826; Sowerby, 1840) and needs to be redescribed with fresh material.

As discussed by Kobelt, Dunker's ***Arca constricta*** from unknown locality belongs in the unnamed *avellana*-group. Lamy (1907) had specimens from Panama exactly fitting DKR pl. 37 figs. 17-18; Kobelt (1891 pl. 21) illustrated the other syntype. Lamy's course is followed and *constricta* is considered a further synonym of the Panamic *mutabilis*.

NL3: ***Acar***: Iredale (1937 and 1939) concluded that the type species of *Acar* SD Woodring, 1925 is *A. gradata*, but that Stoliczka, 1871 p. xxi had earlier designated *A.* ***divaricata*** Sow. as type SD.

Arca reticulata Gmelin, 1791 was used during 2 centuries globally for at least 10 distinct species in at least 5 biogeographic regions (e.g. Turton, 1819; Risso, 1826; Bean, 1829; M'Coy, 1844; Dall, 1898; Lamy, 1904; Suter, 1913; Caribbean authors; S. Australian authors). The original locality was unclear. Additionally, all possible "*reticulata*"-candidates were allocated local names. Unless, Chemnitz type can be found in St. Petersburg *reticulata* is considered a **nom. dub**.

Comparing larger series of ***domingensis*** and ***plicata***, then the WAF species is perceived as distinct from both. Oliver and Cosel (1993) well elaborated the differences to *domingensis* (more inflated nodes in the WAF species and more vivid, pale orange-pink coloring; also smaller size) and to *plicata* (more regular, less lamellar posterior sculpture in the WAF species; apart from smaller size and generally narrower, more elongated shape). However, they hesitated to name it. Here, *Acar cf. plicata* Oliver & Cosel, 1993 non Dillwyn, 1817 is renamed ***Acar olivercoseli***. As illustrated, the type locality is from CapV south to Angola, Praia Amelia. This WAF species is well depicted, Oliver & Cosel (1993 p. 311 fig. 10 (internal), pl. 2 fig. 7A-B (external)). The maximum size known is 26 mm, whereas *plicata* reaches almost 40 mm. In addition to the localities mentioned, Ghana, Tema, intertidal, can be added. At present, between S. Angola and Transkei no related *Acar* is known.

Arca carditaeformis was described (DAU97) and depicted (DAU971 pl. 6 fig. 3-4, as *Arca* (*Barbatia*?) from a single worn, 8.7 mm left valve from 318 m, off the Azores. This is an *Acar*. As far as is known, it has not been reported since. Lamy (1907) compared it with *pulchella* (= *clathrata*), whereas CLEMAM considered it valid. The name is valid; *A. carditaeformis* Koch, PHIL2 p. 31 is a nom. nud., not recognized by Sherborn. Biogeography, depth as well as strong posterior lamellation exclude *olivercoseli*. On the other hand, *clathrata* is known from the Azores, extends down to 500 m and has indeed a posterior lamellation. Dautzenberg & Fischer (1897) did not find any *clathrata*, nor did they compare their new species with it. I fail to perceive *carditaeformis* as other than a worn *clathrata*.

A. plicata has been described from the Red Sea. It is typically a large, comparatively high, moderately to strongly inflated, roughly cancellate species, with a densely, irregularly crenulated margin, rounded posteriorly, dirty white, but often orange-pink inside, occasionally also outside. The hinge plate is typically broad, compressed centrally. It is widely distributed and grows large, up to 37 mm (Tanzania) or 38.9 mm (Philippines). Hawaiian specimens studied are too close to be separated. ***Laysana***, as concluded by Kay, 1979, seems to be a humped form, as similarly also known from Philippine waters.

A. ***abdita*** from Arabia is very close, but only dirty white with a denser radial sculpture, weaker nodules and remains much smaller. ***A***. ***petasion*** from SAF is also small, but has a regular sculpture and a unique hinge line, with the teeth line interrupted by a smooth gap. ***A***. ***botanica*** from NSW is another very close species, also whitish, comparatively high, but it remains also very small, with a smooth internal margin. ***A***. ***marsupialis***, from Rodrigues Isl. is small, but has a pouch ventrally.

As nowadays accepted by virtually all authors, Iredale (1939) correctly considered Lamy's global synonymy of *plicata* erroneous. However, he did not accept *plicata* as widely distributed IND species, but saw it exclusively in the Red Sea. He named the only comparable species in Qld waters ***dubia***. However, Lynge (1909) recognized *plicata* also from the Gulf of Thailand and *dubia* as identical. Iredale's pl. 2 fig. 10 *dubia* is a typical *plicata*. It appears that Lamprell & Healy (1998) inflated the *Acar* species living in Qld. Their sp. 71 is perceived as identical to sp. 69. Their sp. 68 *"riculata"* (= *reticulata*) is instead true ***squamosa***, which occurs in S. Australia only. ***A***. ***laminata*** from SA is a synonym of *squamosa*, following here Cotton (1961). Tenison-Woods' ***Arca m'coyi*** from Victoria is also this species. *Squamosa* is distinct from *plicata* in commarginal sculpture and elongated shape.

A. ***iota*** was described from a juvenile Qld specimen. A white and a yellow-orange specimen are well depicted in Lamprell & Healy (1998 sp. 70). They gave a depth of 20 m and a size of 10 mm. *Iota* has a broad, truncate, not rounded posterior end, is coarser cancellate, and squarish in shape. As *plicata* also *iota* is found in similar colors, but it remains markedly smaller and more compressed. It also has a weaker dentition, with fewer teeth. In the Philippines it is occasionally found in 70-150 m. However, from the Philippines, Mindanao, 150 m Smith's ***congenita*** has been described, also from a juvenile specimen (type HIG01 B204). It shares exactly the same distinguishing marks towards *plicata* as does *iota*. From the specimens studied there is little doubt that *iota* is a junior synonym. Okutani (2000 pl. 422 fig. 19) depicted a white species, gave a maximum size of 20 mm and a range to Honshu, Boso. The largest *congenita* seen from the Philippines is 20.6 mm, 100 m, yellowish-orange. The view of Stevenson (1972) who synonymized *congenita* with *plicata* is not shared.

The small ***A***. ***requiescens*** is difficult. It was originally placed as true *Arca*, where it does not fit. Oliver (1995) placed it in *Bentharca*; however, *requiescens* is not close to *asperula*. It is trapezoidal, equivalve, with a deep median sulcus and 24-27 strong nodulose riblets. The ligament is posterior, the periostracum unknown. It appears closest to the NZ *sociella*. Thiele & Jaeckel (1931) placed it in *Acar* as well. Definitely, fresh material is necessary to better understand its affinities.

A. ***agulhasensis*** from SAF has a collared prodissoconch, obviously a highly unusual feature in *Acar*. A similar feature, together with a related shape and an equally weak dentition is found in the minute, solid ***Bentharca decorata***. Both species are tentatively placed in ***Acar*** but may constitute a distinct, undescribed lineage.

Following Iredale (1936), there are few arguments to include ***Destacar*** in *Barbatia*. It appears as rare deep water species restricted to SE. Australia, somewhat related to *Acar*. The relations to *Calloarca* are not perceived close.

NL4: Following Iredale (1939), I see few merits in mixing the vitreous ***Vitracar*** into the rather uniform group of solid ***Acar***. Obviously, Japanese authors, notably Koyama et al. (1981) and Matsukuma (1984) came to the same conclusion.

Usually, 2 species are differentiated, ***V***. ***albida*** from Japan and the type species *laterosa* from Qld. However, Matsukuma (1984) analyzed specimens from Micronesia and synonymized *albida*. ***Vitracar laterosa*** is quite widely distributed and also occurs in the S. Red Sea, Yemen, SChi, N. Borneo, and Philippines. The many specimens studied confirm Matsukuma's view.

Going through the anadarids, Deshayes rare ***dichtoma*** was encountered, often placed in *Mabellarca*, sometimes in *Acar* or in *Barbatia*. Iredale (1939) compared *dichotoma* with *laterosa*, but considered them distinct. Oliver (1992) compared *dichotoma* with *sulcata* from Aden, depicted a specimen from MNHN pl. 1 fig. 4c and 2 juveniles (4a, b) and considered them the same, a view shared. Lamarck's *sulcata* originally described from Australia, was depicted by Lamy (1904). Finally, it transpired that Lamarck's ***sulcata*** is the same and the earlier name for *laterosa* and that *Vitracar* is monospecific. *Sulcata* is a highly variable species in shape, but not in color and sculpture.

Furthermore, Thiele & Jaeckel, 1931 p. 172 described ***Arca mauritiana*** from Mauritius, close to Deshayes *dichotoma* locality. Their excellent picture of the ligament leaves little doubt, that this is a further synonym of *sulcata*.

Oliver (1992) depicted a 30.5 mm *sulcata* and gave 40 mm as maximum size; the largest specimen dived off N. Borneo, 13 m, is 26.2 mm.

As originally described, the monospecific ***Mabellarca*** appears better placed in the *Vitracar* vicinity than within *Anadara*.

NL5: Kilburn (1983) drew attention to the bipartite ligament in ***Calloarca***. This condition is not found in *Arca*, *Trisidos* or *Barbatia*, but similarly, also in *Acar*, *Vitracar*, and *Fugleria*. Obviously, Scarlato & Starobogatov (1979) considered this feature important and created CALLOARCINAE. However, the sparse genetic data (e.g. OLI06) does not indicate a close relation among these groups and CALLOARCINAE is best considered synonymous to ARCINAE.

Nonetheless, all above 4 genera encompass distinct lineages. Unless phylogenetic data shows otherwise, these are kept separate.

Dall, Bartsch & Rehder, 1938 differentiated ***Barbarca***, type OD ***hua***, subgenerically from *Calloarca*. They mainly based this on the absence of a posterior keel. Iredale, 1939 created ***Opularca*** for *tenella egenora* type OD, having a similar ligament condition as *Acar*, but a more fragile, ovate, inflated shell and a distinct dentition, with a few separated anterior teeth. Dall, Bartsch & Rehder included *hua* and *nuttingi* in *Barbarca*. Subsequently Habe & Okutani (1968) differentiated *nuttingi* from *Barbarca*. They based on the much smaller, more solid shell, a broader hinge and the marked reticulate sculpture and created ***Coraliarca*** as new genus. Kilburn (1983) treated *tenella* as *Calloarca* and *Barbarca* and *Opularca* as probable synonyms and placed *tetraquetra* and *cibotina* in *Calloarca*.

As concluded by Kay (1979) and accepted by Japanese authors (e.g. Higo et al., 1999), all evidence indicates that *hua* is the same as *egenora* and, thus, *Opularca* indeed a junior synonym of *Barbarca*. However, *Barbarca* and *Coraliarca* are perceived as sufficiently distinct. Both are placed subgenerically within *Calloarca*, following here DBR's view. However, it is not excluded that phylogenetic data demonstrate that instead three distinct genera may be present.

B. benthicola (type Lamprell & Healy, 1998 sp. 62) seems better placed in *Barbarca*. The dentition is close, the shape broader posteriorly, the habitat deeper. Originally, described from Qld, in addition, specimens found off N. Borneo, 70 m are perceived conspecific.

B. tetraquetra is very close to *tamikoae* and also placed in *Coraliarca*. Oliver et al. (2004 fig. 36) is instead *Barbatia sculpturata*.

A. cibotina fits *Coraliarca* in ligament, dentition, size and sculpture better then *Calloarca*, where placed by Kilburn (1983). The placements in *Barbatia* (Oliver, 1995) or in *Samacar* (Stevenson, 1972) are perceived as remote.

Striarca* (*Spinearca*) *soyoae was variously placed, in *Verilarca*, in *Didimicar* (HIG99), or in *Acar* (Okutani, 2000). Oliver (1990) analyzed the type and noted it arcid, not noetiid. Kilburn (1983) considered it synonymous to *cibotina*. However, I hesitate to synonymize, as intermediate records (e.g. Indonesia, Philippines) are lacking, and as the Japanese species reaches twice the size of the W. Indian Ocean species. Definitely, both are close and have to be placed side by side. In both *soyoae* and *cibotina* the sculpture is somewhat less reticulate.

Kilburn's ***Destacar colpodes*** appears closer to *Coraliarca* than to the monospecific SAU *Destacar* with a marked distinct shape, hinge and size.

NL6: ***Hawaiarca*** is considered well recognizable, following the OD and Japanese authors. Noda (1986) even created a new subfamily HAWAIARCINAE, based on intermediate arcid and anadarid characteristics.

As noted by Kilburn (1983) *Hawaiarca* shares some traits e.g. ligament position with *Calloarca*. The relations to *Barbatia* appear less close. The species conventionally included are all rather small and live rather deep.

Specimens well fitting Prashad's ***weberi*** are known from N. Borneo, Sarawak, 67-70 m and the Philippines, Bohol, Cebu, sublittoral 10-120 m. Regular sculpture, position of the ligament and shape fit *Hawaiarca* better than *Barbatirus*. All specimens seen are smaller than 20 mm.

Many valves collected sublittoral off N. Borneo seem to fit Smith's OD of the not depicted ***innocens***, described from India. These are tentatively placed here as well. A comparison with Smith' type in ZSI, India is pending.

NL7: ***Mesocibota***: The type, OD ***M. luana*** from Qld has been synonymized by Lamprell & Healy (1998) with ***bistrigata***. *M. bistrigata* is the type *Nipponarca*, OD. Even when *luana* should prove specifically distinct from *bistrigata*, there is no doubt that *Nipponarca* has the same concept as *Mesocibota* and is a junior synonym. Iredale, 1939 characterized *Mesocibota* well. Full grown specimens do not fit *Arca*; the relations to the European type of *Barbatia* are even more remote. As concluded by Iredale, 1939 and modern Japanese authors. *Mesocibota* is best placed in between. A full generic rank is supported by molecular results (MATSU as *Nipponarca*).

M. bistrigata has been described from China and is known from the Yellow Sea. As noted by Koyama et al. (1981), there is little doubt that this is Grabau & King's uncommon *Arca* (*Barbatia*) *obtusa var. duplicostata*.

I currently fail to consider Lamy's ***fischeri*** from Vietnam as distinct. Hylleberg & Kilburn (2003) only reported *bistrigata* from Vietnam, and Oliver et al. (1993) gave a range for *bistrigata* from Pakistan to Japan. Kilburn (1983) and Barnard (1964) earlier reported *bistrigata* from S. Mozambique.

Closely related to *bistrigata* are ***adamsiana*** Dunker, even synonymized by Stevenson (1972), and ***paulucciana*** Tapparone-Canefri.

Nonetheless, this complex needs much more material to verify, whether indeed only one variable species or a couple of closely related species are present in the central IND.

M. signata appears best placed here. Dunker placed both, his *bistrigata* and *signata* in Arca, presumably based on a similar dentition.

NL8: ***Miratacar*** fits neither in size, shape, sculpture, nor in ligament in *Barbatia*. Lamy (1907) placed it as *Arca* s.s., but it fits even less there. Following Iredale, 1939 *Miratacar* is separated, and placed near *Mesocibota*. ***Miratacar wendti*** is an uncommon species mainly known from tropical Australian waters. Though quite large specimens have been found in Darwin (29.6 mm), all have been single fresh beached valves, without periostracum. *Miratacar* seems monospecific.

NL9: ***Mimarcaria*** does not fit in size, shape, or ligament in *Barbatia*. Following Iredale, 1939 and Japanese authors *Mimarcaria* is generically separated. It contains a small group of colored, rather small, fragile, equivalve deeper water species with a decussate sculpture and a very small byssal opening. The gender is feminine, but *saviolum* is a noun.

Both ***aizoi*** and ***matsumotoi*** have been described as small species from Japan, but both are much wider distributed and grow approximately 30 mm. In deeper water, these occur quite commonly.

Just tentatively included here is Oliver's ***diphaeonotus*** (syn. *elegans* Viader). Smith earlier described similar, but white, larger and deeper living species as *Arca* (*Barbatia*) ***incerta*** (type: ANA09 pl. 13 fig. 3) from India. The hinge configuration in these two with a marked division and a large edentulous gap does not fit *Mimarcaria* well and is reminiscent of the condition found in *Samacar*. It may well be that a new group is necessary to properly accommodate these two uncommon equivalve species.

NL10: ***Barbatia***: This is a large genus, with marked distinct species. The extreme lumping of Newell in Moore (1969) is inappropriate. Following Japanese authors, most of Iredale (1939)'s groups are perceived useful. However, Iredale's *Arca* non Linnaeus is an obj. synonym of *Barbatia* and some Australian species placed here by Iredale appear closer to *Cucullaearca*.

Generally in *Barbatia* the periostracum and the ligament offer good distinguishing features.

- *Barbatia s.s.* is restricted to species closely resembling the type species in strong chevroned ligament covering the whole interumbonal space, with a radially lined periostracum, ovate, usually somewhat distorted, brown-white. Globally, only *barbata*, *novaezealandiae*, *perinesa*, *pistachia*, and a large undescribed species from Polynesia are considered true *Barbatia*.

- ***Ustularca***: As recognized by Iredale (1939) and by Japanese authors the ligament structure in the type, OD *cruciata renuta* (= *amygdalumtostum*) is marked distinct from that found in *barbata* or *pistachia*. *Ustularca* species are generally more regularly ovate, equally inflated and less distorted. Sculpture and periostracum are similar to *Barbatia*. The Caribbean *cancellaria* fits here well. Also *B. setigera* and *B. lacerata* are perceived to share many traits with *amygdalumtostum* and to belong in *Ustularca*. However, genetic data (MATSU) show a distinction between the type *Ustularca* and *lacerata*. Unfortunately, neither *setigera* nor *cancellaria* were included, thus, further analysis is necessary to elaborate the relations within this group.

- *Cucullaearca*: dense, often lamellate periostracum, usually fringing; usually irregular in shape and generally distorted, whitish, generally large and heavy, and often widely gaping.

- *Abarbatia*: sparse, spiked periostracum, generally ovate, whitish, gap usually moderate,

- ***Savignyarca***: solid, oblique, attenuated anterior, broad posterior, strong lamellate periostracum, strong ligament, dentition very feeble medially,

- *Barbatirus*: very thin, generally abraded, pale to light brown periostracum without spikes; ovate elongate, very inequilateral, whitish to whitish brown, marked nodules on posterior radial ribs. This small group may even merit generic distinction.

Arca magellanica Bruguière is based on Chemnitz 7 54 539, originally from the Magellan Strait. However, from there nothing similar is known, but in the Mediterranean Sea very elongate, brown ***barbata*** are found which otherwise fit Chemnitz' description well. *A. magellanica* is considered synonymous, the type locality erroneous. Philippi (1849) and Lamy (1907) came to the same conclusion. From an analysis of the BMNH-types Stevenson (1972) added *cylindrica* and *eximia* to the type species.

A large brown, true *Barbatia* with a fine ribbing, measuring more than 50 mm is known from Cook Isl., Polynesia. Lamy (1907 p. 50) mentioned "*barbata*" from New Caledonia, and Oceania which may have meant this species. Polynesian specimens show affinities to *novaezealandiae* but are more elongate and internally brownish. These seem **undescribed**, but too little material prevents progress.

Lamarck's ***pistachia***, which is a true *Barbatia* and also related, is confined to S. Australia. Iredale's ***Arca prolatens*** from S. Qld, Caloundra was not treated by Lamprell & Healy (1998). However, it fits *pistachia* in sculpture and color well and is considered a further synonym of the single S. Australian true *Barbatia*.

B. complanata also identified as *helblingi* by WAF authors fits well in *Cucullaearca* regarding habitat and morphology, but it does not attain the large size of the Caribbean *candida*.

A special group of small *Barbatia* is found in the IND. With the exception of Kilburn (1983), who placed ***sculpturata*** in *Calloarca*, Japanese authors place these as *Ustularca*, where they indeed have most affinities in ligament, periostracum and sculpture. *Parva* has originally been described from Polynesia, but identified by Oliver (1992, 1995 and 2004) also in the Indian Ocean. His view is followed, but as noted by Iredale (1939), these records should be confirmed with Polynesian material. A quite similar species is ***stearnsi***, described from Japan, but also found in China and the Philippines. Zhongyan (2004 pl. 113) depicted both species from China. In general *parva* is more rounded and has a rougher, denser periostracum; *stearnsi* is typically trapezoidal with a very fine, spicate periostracum. *Parva* is often found more than, *stearnsi* usually less than 15 mm. The minute ***pyrrhotus*** from Rodrigues Isl. appears closely related to *stearnsi*.

B. solidula Dunker, 1868 was originally described from the Gulf of California, but never found there. As assumed by Keen (1979) this is indeed an IND species. Sculpture and ligament are comparable to *sculpturata*, but outside it is whitish, brown, posteriorly, inside dark brown umbonally including the hinge, the periostracum is stronger portioned, as well captured by Dunker (1968 pl. 38 fig. 10). *Solidula* appears to be small. Dunker gave 20 mm; all specimens seen are 22 mm or smaller. It is known from Java, Pangandaran area and Melanesia, Niue Isl., but probably wider distributed. The type locality is here corrected to **Java**, **Pangandaran**.

Another similar species and consequently placed in *Ustularca* is the SAF ***sculpturata***.

Difficult are the larger white *Barbatia* from the Red Sea to Japan, Polynesia. Oliver (1992) defined two species from the Red Sea and Arabia: the huge ***foliata*** with a dense, lamellar periostracum often abraded umbonally, which fits the *Cucullaearca* condition; second, the smaller ***decussata*** with a sparser, spicate periostracum, which fits the *Abarbatia* condition. Oliver (1992) considered ***trapezina*** Lamarck and ***lima*** Reeve, 1844 synonymous to *foliata*. Dekker & Orlin, (2000) accepted also 2 species, but removed *trapezina* from Oliver's *foliata* synonymy and considered it the same and the earlier name for *decussata*. Lamarck's *trapezina* types have been depicted by Lamy (1904). Iredale (1939 p. 253) came earlier to the same conclusion and accepted Timor as type locality, but excluded Tasmania, King Isl. In general, modern Japanese authors recognize only one smaller, spicate species in Japan, variously named, but well depicted as *B. lima* (Okutani, 2000 pl. 421 fig.5), generally placed in *Abarbatia*. Lamprell & Healy (1998) depicted 3 related species, namely *foliata* (*syn. velata*, *lima*), *grayana* (syn. *decussata*, *multivillosa*), and *trapezina*, and placed all three in *Barbatia* s.s. Dall, Bartsch & Rehder, 1938 earlier created *Abarbatia* for their new *oahua*, a medium sized, sparsely spicate species.

Based on Lamarck's types, Dekker & Orlin (2000) is followed and only ***foliata*** and ***trapezina*** are perceived as valid species. *B. grayana* Dunker (syn. *multivillosa* Iredale) is also valid, but markedly distinct in shape and in characteristic periostracum from the complex under consideration.

Chemnitz 7 54 538 depicted *nivea*, from the Red Sea. This was likely from the material brought back by Niebuhr, which served them earlier as base for their ***foliata***. Röding's *nivea* and Gmelin's *ovata*, both based on Chemn. 538 are this species. At least, Chemnitz had 2 syntypes, well depicted by Martynov (2002 fig. 2 J, K and fig. 2L). The larger fig. 2L, sales lot 300, 68.9 mm is the species depicted on pl. 54 as 538 and is here selected as lectotype. It is probable that the smaller species is instead *trapezina*. Lamprell & Healy (1998) depicted the syntypes of *lima* (fig. 54b, non a) and *velata* (fig. 54a, non b) and synonymized these correctly with *foliata*, as before Oliver (1992). They also synonymized Iredale's huge *corallicola*. As such *foliata* is the larger species, often distorted, generally with a rougher sculpture, and usually with a larger ventral gap.

However, regularly ovate *foliata* occur, whereas, on the other hand, distorted ***trapezina*** are known. In both species the ribs may be granular. In such cases, the periostracal condition is perceived as the only reliable distinction.

Only *trapezina* has been found in Japan, though often distorted in shape. Kay (1979) synonymized *oahua* from Hawaii with *decussata*. However, Paulay (1996) identified this action as erroneous. He synonymized the extinct ***hendersoni*** with *foliata* and made the type *Abarbatia*, OD ***oahua*** an endemic Hawaiian species, a view here shared. Kay's smaller "*lima"* is instead the distinct *B. hawaia*. An Australian *trapezina* sp. 57 and the syntype of *decussata* (fig. 55, not *grayana*) are depicted in Lamprell & Healy (1998). *B. foliata* shares most features, also anatomy and size, with ***Cucullaearca***, as concluded earlier by Rost (1955). Regarding *trapezina* Japanese authors, notably Matsukuma (1984) is followed and ***Abarbatia*** is perceived well fitting.

B. petersii from Madagascar fits the condition found in *trapezina*, but not in *foliata* and is here synonymized with the former. Kobelt (1891) reported it also from Tanzania, from where specimens have been studied.

A further *Abarbatia* with much sparser spikes appears widely distributed. It is markedly smaller than *trapezina* and *oahua*; the periostracum is thin spotted and flecked with dark brown. The anterior lateral part bears up to 8 strong nodulose ribs approaching the condition in *cometa*. Originally, this species was described as ***B. molokaia*** from Hawaii. Specimens closely resembling have been found in Poly, Marquesas, but also in Japan, Sagami Bay, and SChi, off N. Borneo. It is possible that Japanese *cometa* records from Honshu represent instead this species. True *cometa* does not seem to occur there.

B. grayana is an uncommon, but quite characteristic species. Although the type seems lost, Dunker, 1867 pl. 31 fig. 8-10 gave excellent pictures. Rows of a very strong, extended periostracum are present on the expanded posterior side only, somewhat similar to the condition found in *lacerata*. Internally *grayana* is white, the umbonal region slightly yellowish. It is not excluded that Prashad (1932)'s nearby Indonesian records were indeed this species, but the missing periostracum makes the identification somewhat shaky. The only other record found fitting Dunker's species is Iredale's OD of *Arca multivillosa*, described from Qld, Keppel Bay. It has also been collected in NWA, Regnard Bay, low tide level, in coral slabs, also slightly larger than 60 mm and in Port Hedland, 6-7 m. Due to large size, strong periostracum, color and habitat it is also placed in *Cucullaearca*. *Grayana* appears restricted to tropical Australia and possibly to adjacent Indonesia. Beesley et al. (1998 fig. 6.2 C "*Barbatia cf. helblingi*") is instead a typical *grayana*. The true identity of Iredale's 1939 ***A. multivillosa antilima*** is unknown and should be established on the type material. Lamprell & Healy (1998) did not treat it.

B. bullata was described without locality and was subsequently placed in Panamic and Caribbean waters. Alternatively, specimens studied from the South China Sea, E. Malaysia and NE. Borneo agree very closely with Reeve's OD. The periostracum is arranged in regular, lamellar rows and approaches the condition found in *foliata*. However, the sculpture in *bullata* is very regular and the valves smaller, square, not distorted. Thus, *B. bullata* is understood as valid IND species.

Savignyarca obliquata (type Lamprell & Healy, 1998 fig. 61b) is only found in the W. Indian Ocean, SAF to Sri Lanka. From the Philippines to Japan ***virescens*** is commonly found. All specimens seen so far from Australia are distinct and ***S. scazon*** is considered the third valid IND *Savignyarca*. Iredale, 1939 compared his *scazon* with Sri Lankan material and gave the distinctive features, which are found in periostracum, shape and maximum size. Lamprell & Healy (1998) confused three species; they depicted *scazon* (61a), living in Australia, the type species *obliquata* (61b), not found in Australia, and included erroneously in synonymy *virescens*, not known from Australia either. ***Legumen*** is a rather uncommon WAF congener.

B. (***Barbatirus***) ***cometa*** has been described from the Philippines, the type depicted in Lamprell & Healy (1998 sp. 58); the type specimen is comparatively small and narrow, broader shapes are more common and much larger sizes occur. *Barbatirus* has no periostracal spikes. *Cometa* is widely distributed, from the Andaman Sea through Australia to Okinawa. It is variable in shape, but mostly rather compressed and elongate. The largest specimen and the westernmost locality seen is Andaman Sea, Similan Isl. 55.5 mm, dived 22 m, coral reef area.

Referable to *Barbatirus* is also Deshayes in Maillard, 1863' equally large ***B. revelata*** from the Indian Ocean and the Red Sea. Due to the coarse ribbing and the lack of a bristly periostracum, Oliver et al. (2004) included it in *Acar*. However, the large size, the sculpture and the periostracum fit *Barbatirus*. Reeve, 1844 sp. 110 described ***Arca caelata*** from unknown locality (as *A. coelata* Reeve, 1844, emendated Reeve, 1845 in the index). Martens (1880) reported *caelata* from Mauritius and Lamy (1907) synonymized therein *revelata*. Whereas Kilburn (1998) considered *caelata* synonymous to the Caribbean *candida*, based on Jacobson & Usticke (1966), Oliver et al. (2004) considered *caelata* the same as *revelata*, but Reeve's name as preoccupied. However, as Sherborn, also Stevenson (1972) correctly considered *caelata* not preoccupied (Conrad's *coelata* is given as of Jan., 1845). The BMNH-holotype of *Arca caelata* has been reanalyzed. Typically fresh *B. candida* and *B. revelata* are markedly distinct. However, extreme specimens without periostracum are very close. From the material analyzed Jacobson & Usticke's and Kilburn's view is shared and *caelata* is considered an extreme form of the Caribbean *candida*. This leaves *B. revelata* as valid Indian Ocean species placed in *Barbatirus*. *Revelata* is generally more inflated, stronger noduled and slightly more robust than *cometa*.

The Juan Fernandez ***platei*** has been described as *Barbatia* from the tidal zone. The comparatively large size and the intertidal habitat rather recommend placement in *Barbatia* s.l., than in *Bentharca* as proposed by authors. The type material should be in Germany, but nothing is indicated in systax. The species depicted by Forcelli (2000) from the Magellan Strait as *Barbatia magellanica* appears to be *platei* as well.

Based on Enc. Meth. pl. 308 fig. 2a-b, Bory, 1827 founded his ***Arca modiolina***. Although validly proposed according to Sherborn, this name was nowhere found after 1899 and was not treated by Lamy (1917). It is a truly forgotten name; the identity of this species without locality is unknown.

NL11: ***Trisidos***: Linnaeus gave neither in 1758, nor in 1767 any locality for his *tortuosa*. However, India is likely and *tortuosa* from there have indeed a comparatively smooth posterior portion and an oblique, not very acute carina. Older authors usually differentiate ***tortuosa*** and ***semitorta***. In modern literature generally 3 species are differentiated; Zhongyan (2004 pl. 114) well depicted above two and the third species ***kiyonoi***.

3 species are easily recognized: an elongate narrow, marked carinate and twisted, rather fragile *tortuosa* from Aden, through India, Australia to China, Hainan; a broad, heavy *semitorta* from S. India through Australia to Taiwan and a somewhat intermediate *kiyonoi* from China and Japan and likely also Vietnam. China and Taiwan are the only places, where all these species occur.

However, Iredale (1939) was able to distinguish 11 species/ subspecies.

After careful study of the material available and the depicted specimens it appears indeed, that in addition, at least in the Indian Ocean a further species is present. This species is closest to *kiyonoi*, i.e. rounded, weak carinate, shorter, broader, heavier than *tortuosa*, but more elongate and stronger carinate than *semitorta*. Oliver (1995 fig. 919), the huge specimen from Arabia represents this species well. Other specimens have been studied from Zanzibar and Mozambique and Iredale (1939) identified these also from NW. Australia. For this species Mörch's ***Arca torta***, as characterized by Mörch and interpreted by Iredale (1939), fits precisely. However, in the many dozen Philippine specimens studied none was found fitting *torta*. Instead, there very commonly *semitorta* and less commonly *tortuosa* occur. All evidence points to the fact that Kierulf's indicated locality Philippines was erroneous and that *torta* is, instead, Indian Ocean only, i.e. Mozambique to NWA and into the Persian Gulf.

On the other hand, "*tortuosa*" from the Red Sea (= ***fauroti***, 120 mm, Oliver, 1992 pl. 72 fig. 7), from India (= ***tortuosa*** s.s., coll. auth.), from N. Australia (= ***yongei***, Lamprell & Healy, 1998 sp. 74, coll. auth.) or from the Philippines (= ***reevei***, coll. auth.) are perceived as intergrading and too close to be separated. All these have rather fragile, elongated valves, are more or less strongly carinate and the posterior area is very weakly to strongly radially ridged.

Also ***semitorta*** is quite variable and occurs all white, yellowish, or brownish, rather compressed or strongly inflated. As furthermore, extremes of *semitorta* are quite close to extremes of *torta* and *kiyonoi*, a separate subgenus for *semitorta* is without substantial genetic support not justified; Iredale's ***Epitrisis*** is synonymized.

Thus, 4 *Trisidos* are recognized.

NL13: ***Anadara***: This is one of the most crucial genera in bivalves. Including *Tegillarca* and *Mosambicarca* approximately 100 species are globally known. Newell in Moore (1969) came in part to strange conclusions, based on erroneous type species. Unfortunately, Reinhart (1935) analyzed too little IND material. Generically, Iredale (1939) is largely followed; his views are also widely shared by Japanese authors.

However, due to often small or even intergrading differences, a full generic separation of many groups, especially *Scapharca* and *Tosarca*, appears premature. Phylogenetic data is here necessary for further steps.

Nonetheless, ***Mosambicarca***, byssally attached with a marked byssal gap, ***Tegillarca*** with solid, inflated valves, a few nodulose ribs and a marked distinct periostracum is perceived distinct enough to be generically separated. Matsumoto, (2003)'s molecular results also support a clear separation of *Tegillarca*, whereas other groups (e.g. *Scapharca*, *Diluvarca*) seem less supported.

- *Anadara* s.s. no byssal gap, ovate-elongate, solid, and generally heavy, usually inflated, equivalve to moderately inequivalve, approximately 35 rather flat, often divided ribs, ligament with or without chevrons. ***Sectiarca***, type OD *floridana* (= *secticostata*) is perceived as too close to be separated, except shape, all other features are close to *Anadara*. ***Rasia***, type OD *formosa* is very close. Keen (1971) recognized it as weak subgenus, Coan et al. (2000) not. As the posterior sinuation is found in many anadarids, this trait is not perceived as significant and Coan et al. is followed. There is no doubt that the type species of ***Cara***, Reeve, 1844's preoccupied *aviculoides* (= *aviculaeformis* Nyst) is a juvenile specimen of *formosa*. Lamarck's *auriculata* is a similar species from the Red Sea and the Indian Ocean. ***Caloosarca*** may be justified for Floridan fossils with unknown periostracum. However, the differences between the extant *notabilis* and true *antiquata*, also in base structure of the periostracum, dentition and inflated shape are comparatively small. Unfortunately, Vokes (1969) compared *notabilis* with a *hankeyana* without periostracum, increasing the supposed differences unnecessarily.

- *Scapharca* encompasses less solid, typically thinner, ovate, marked inequivalve species. However, as discrepancies among authors demonstrate, some species are difficult to place. *Scapharca* is morphologically a rather weak subgenus. However, molecular results show some distance of 4 typical species to "*antiquata*" (MATSU), but some crucial species were not included. It also appears that the inequivalvity has been overstressed; most moderately inequivalve, but elongate, solid anadarids are closer to *antiquata* than to *inaequivalvis*; others, e.g. *gubernaculum* may be placed with good arguments in *Anadara* or *Scapharca*. Basically Lamy (1907) and Iredale (1939) are followed in a wide understanding of *Anadara* and a restricted view on *Scapharca*. The latter is Pacific only. Newell in Moore (1969) did not depict the correct type species *inaequivalvis*.

- *Tosarca*, with a fossil type, usually applied for the extant *vellicata*, encompasses an elongate, compressed as juvenile and strongly, box like inflated species as adult, comparatively light and with a high number of approximately 45-48 ribs. However, the ribs are also divided, base structure of the periostracum and ligament are close to the *Anadara* type species. A full genus as applied by Japanese authors is without solid genetic data exaggerated. Iredale (1939) even placed the synonymous *exulta* in *Anadara* s.s.

Oliver (1995) considered *birleyana* as distinct. However, Stevenson (1972) had earlier synonymized *birleyana* with *vellicata*. This view has been confirmed by Dekker & Orlin (2000) and a presence in the Red Sea has been added. *A. siamensis* appears at least very close.

The following groups may constitute full genera, but need phylogenetic confirmation:

- Imparilarca, type OD *hubbardi* (= *rotundicostata*) encompasses elongate, solid anadarids with a strong, discrepant sculpture and raised ribs. As concluded by Lamprell & Healy (1998) ***Kikaiarca***, type OD *kikaizimana* seems too close to be separated, but, definitely, the two type species are specifically distinct. The identity with *Cunearca* as proposed by Reinhart (1935) and accepted by Newell in Moore (1969) is highly superficial and confuses significantly distinct lineages. *Imparilarca* is IND, whereas *Cunearca* is only found in the Americas.

- Potiarca is applied for very inflated, rounded, smaller species, with a discrepant valve sculpture. However, the typical species are IND. The WAF, CAR and PAN species tentatively placed here, have weak chevrons on the ligament and are more elongate; these may represent a further undescribed group.

- Cunearca encompasses a compact American group of inflated, strongly inequivalve, and comparatively thin species. *Cunearca* is PAN and CAR only. This is another candidate for generic separation. The similarity to *Scapharca* is perceived as superficial and relations to *Imparilarca* are virtually absent. Newell in Moore (1969) did not depict the correct type species *incongrua*, but instead an *Anadara*, probably *hankeyana*.

- Diluvarca encompasses a group of elongate, rather acutely pointed species, broader anterior than posterior. The sculpture is strong, radial, and slightly discrepant. Species are equivalve to moderately inequivalve. At least some species are known to live byssally attached, thus, marked distinct from the condition found in *Anadara*. The synonymization with *Anadara* proposed by older authors (e.g. Grant & Gale, 1931; Reinhart, 1935; Newell in Moore, 1969) neglects mode of life and is not justified.

The conventional definitions of ARCINAE and ANADARINAE are partly obsolete and have to be reworked as mentioned by Kilburn (1983).

Anadara: As noted by Kilburn (1983) the ***Anadara antiquata***-complex cries for a review with modern methods. However, this is still lacking. From the material at hand, Iredale (1939)'s harsh criticism on "Lamy's *antiquata* chaos" seems well justified.

In many cases the periostracum reveals that quite distinct patterns are involved, which highly unlikely belong to the same oblique, 35+/- flat rib-species. True *antiquata* appears as predominantly Indian Ocean species.

According to Hanley (1855) and Dodge (1952) Reeve's ***A. maculosa*** from N. Australia should represent Linnaeus' type species ***antiquata***. Consequently, Lamprell & Healy accepted *antiquata* = *maculosa*. However, Iredale (1939) did not. He noted that only *maculosa* is found in Australia, but not Linnaeus' type, the latter probably representing a species from Sri Lanka.

Linnaeus' type is depicted in Hanley (1855 pl. 4 fig. 3). This shows an oblique-ovate *Anadara* with 35 ribs, anterior flat and angular, weakly, irregularly incised, these ribs become more rounded posteriorly and are no longer divided. The umbones are comparatively small, pointed; no periostracum is visible any longer. The shell is obviously moderately inflated, and internally strongly crenulated. These features are indeed close to NW. Indian Ocean specimens. Thus, Oliver (1992, Red Sea) and (1995, Arabia)'s interpretation is followed. He added "ligament lacking all but the outer chevron" and "periostracum persistent at margins of fine lamellae and fine erect bristles, dark brown in color". Such forms occur in the Red Sea, Indian Ocean at least to the Philippines and in the westernmost part of the Gulf of Thailand. Oliver (1992) synonymized Adams' *transversalis*.

Older authors usually distinguish ***scapha*** with the same biogeography, as having a strong rib incision (deep narrow ditch) and being more squarish in shape. However, from the material studied these two differences are very gradual. More important, the structure of the periostracum is identical. *Scapha* is here understood as synonymous. Iredale's ***suggesta*** appears to be close, however, the low number of 30 ribs leaves doubts and the type material should be reanalyzed.

Often included in *antiquata* is Reeve's ***hankeyana***. It shares shape and number of ribs with *antiquata*. However, the periostracum is markedly distinct. The long bristles are missing; instead a very dense regular periostracum with very short spines is visible. Boshoff (1965) described it well as "four lines of little fimbriate scales on each rib". Every rib is finely, generally 3-5 times incised. *Hankeyana* occurs in the same biogeographical area; it is often found whitish, but is also known with yellowish red umbones from New Caledonia. Kobelt's ***amaliae*** is perceived as large *hankeyana*. Vokes (1969)'s *"antiquata"* from the Comores is instead *hankeyana*. *Hankeyana* is without doubt a valid, characteristic species, as early recognized by Nyst (1848).

"Antiquata" of Chinese and Japanese authors (e.g. Kira pl. 44 fig. 12 "*maculosa*") is more elongate, and has generally more, between 35 and 40 ribs, but, most importantly, the periostracum is distinct. It gives a velvety impression, is finely lamellate, the strong erect bristles are missing. This is perceived as a distinct species. Dunker's ***subrubra*** fits precisely. It is not excluded that Philippi, 1845's 68 mm ***Arca lamarckii*** with 40 ribs described from Chinese Seas is the earlier name. However, the OD does not fit in all respects and a type is currently missing. Unless a type can be located in Chile, *lamarckii* is treated as nom. dub. The identity of *subrubra* with *antiquata* proposed by Evseev et al. (1998) is not shared. These two species are distinct.

Maculosa from Australia with 36-37 ribs was not available in sufficient quantities to fully understand its variability. Lamprell & Healy (1998 sp. 76) obviously represents this species. In the few museum-specimens studied, comparatively broad umbones, a slightly lower rib number and very inflated shapes could be observed. Iredale noted 35 ribs and a markedly lower number of hinge teeth compared to the Indian Ocean species; this could be confirmed, especially on the anterior hinge portion. Both, Lamprell and Iredale accepted ***novaecaledoniae*** with 32 ribs as synonym. Furthermore, Lesson's common, oblique ***oceanica*** with 32 ribs and broad umbones seems to be the same. For the time being *oceanica* (syn. *maculosa* and *novaecaledoniae*) is separated from *antiquata*. It is likely that *A. antiquata* records from New Caledonia are instead referable to *oceanica*.

Iredale, 1939 further described a small stout, solid anadarid from N. Qld. ***nugax*** close to ***compacta***, but with more ribs. This is a valid species, indeed close to *compacta*, but with 33-36 ribs and not a synonym of *oceanica* as noted by Lamprell & Healy (1998). ***A. compacta*** and also ***A. pumila*** are both small, inflated, slightly inequivalve species, both described without locality. *A. compacta* has been reported by Lamy (1907) from Indonesia, Java, Lombok Isl., 28-29 ribs, strongly nodulose on the left valve. Hylleberg & Kilburn (2002) reported it from S. India, Gulf of Mannar. Specimens well fitting the OD have been dived in the Maldives, 31 m and in Kenya, 26 m, on sand. *Compacta* seems to be and Indian Ocean species. The maximum size seen is 28 mm. This is a solid, inflated, slightly inequivalve species, the largest specimens with 30 ribs, slightly smaller specimens with 28-29 ribs and the smallest with 26 ribs. The ribs on the larger left valve are generally stronger noduled than the smoother ribs on the right valve. The ligament is comparatively broad with regular chevrons. The hinge line is broad and fresh specimens yellowish internally. *A. pumila* appears related, but smaller and shorter with a narrower ligament. The holotype is in MfN. A single valve found beached in Trivandrum, S. India appears to conform to the OD. However, this species is poorly understood.

Furthermore, Dunker, 1866 described ***A. rugifera*** from the Indian Ocean. This is a heavy, massive, strongly inflated species, higher in shape, the ribs often undivided, with a strong commarginal sculpture. It is often sunk in *antiquata* as well. However, shape, sculpture and lamellate periostracum, strong in the interribs, without bristles are distinct and *rugifera* is perceived as valid, but uncommon species, often found with yellowish umbones. Specimens have been studied from EAfr, Tanzania, Kenya and NW. Australia. It is likely that Kilburn (1983 fig. 39 "*antiquata*") from Mozambique is instead *rugifera*. Furthermore, it is not excluded that Reeve's preoccupied ***crenata*** is the juvenile hereof, but the type is not isolated. Dunker gives 78 mm; the largest *rugifera* studied is 81.1 mm (Kenya).

An unresolved WAF species was Reeve's preoccupied ***obliqua*** with 35-36 ribs, renamed ***A. setigericosta*** by Nyst. Kobelt gives on plate 38 fig. 4 a good picture. Neither Nyst (1848), nor Lamy (1907), or Oliver et al. (1993) identified it from WAF. Stevenson (1972) noted the type not isolated. However, a specimen from the Philippines, Bohol conforms well to Reeve's OD. It is very oblique, rather compressed, has 35 ribs, the anterior most are divided by a groove and the interstices finely striated. The ligament area is narrow, bent inside and the umbones very approximate. The size is 38.3 mm. Overall, it is closest to *A. antiquata*, though shorter, more compressed and more fragile. As many true *Anadara* it is almost equivalve, the left valve slightly larger. A. *setigericosta* is considered a valid species; but its type locality is here corrected to Philippines, Bohol. Exact habitat and distribution are as yet unknown.

2 distinct species are usually identified as ***crebricostata***, an Australian and a Philippine/Chinese species. Both species reach approximately 80 mm; the periostracum is similar in both, densely lamellate. Taking Reeve's OD as base, then Iredale (1939) and Beesley et al. (1998) are followed and *crebricostata* described from unknown locality is considered the NW.-NE. Australian species with approximately 42ribs. Iredale had a series from Seaforth, N. Mackay; well fitting are also specimens studied from NWA, Broome and from Port Hedland. Beesley et al. (1998) considered *crebricostata* as Australian endemic. **Qld**, **Mackay** is here selected as type locality.

The Philippine-Chinese species is well depicted in Zhongyan (2004 pl. 115 fig. J). It is more regular in shape, especially posteriorly, stronger inflated and heavier, the valves almost equal ventrally, the ligament area is broader and it has usually some more ribs, up to 47 in large specimens, but these are less pronounced. The largest Chinese specimen studied is 78.8 mm (Taiwan). For the Chinese species Sowerby's ***fultoni***, described from nearby Philippines fits well. The type in BMNH has been studied. I do not share the opinion of Stevenson (1972) that *fultoni* is a synonym of *crebricostata*. Admittedly juveniles as is Sowerby's holotype are close, but large Chinese adults are marked distinct from their Australian congeners.

Following Iredale (1939), I fail to consider the above species other than *Anadara* s.s., a byssal gap as in *Mosambicarca* is not present. They share most features with the type species *antiquata*.

Reeve, 1844's ***A. secticostata*** described without locality was placed globally, as Caribbean (Kobelt, 1890; Dall, 1898), as Panamic (Coan et al., 2000), as NW. Australia (Lamprell & Healy, 1998), Lamy (1907) indicated specimens, but gave no locality. Stevenson (1972) mentioned 3 syntypes in BMNH which could be studied. The type lot 40.6.11.35-37 indeed consists of 3 specimens, but also of two distinct species. Lamprell & Healy (1998 sp. 83) depicts the "syntype" BMNH 40.6.11.35.37. However, this specimen does not fit Reeve's description and has only about 30 rounded instead of 35 bifurcate ribs. This specimen is also the smallest of the lot, with much narrower, centrally pointing umbones. Specimens analyzed from Port Hedland are perceived conspecific. However, the differences to *Anadara auriculata* Lamarck, 1819 from the Red Sea are perceived too small to propose a new name. Thus, ***A. secticostata*** Lamprell & Healy, 1998 non Reeve, 1844 is for the time being considered synonymous to *auriculata* and the range of Lamarck's species is enlarged.

Instead, the smaller of the conspecific two larger syntypes has been depicted by Reeve, 1844 pl. 6 fig. 38. This specimen is here selected **lectotype**. Consequently, Reeve's true *secticostata* consisting of two large syntypes 96.8 and 98.3 mm with 35-36 ribs is valid and must be placed biogeographically. Coan et al. (2000 p. 133) synonymized it with *tuberculosa*. This does not match. On the other hand, Kobelt (1890) as well as Dall (1898, 1901 and 1909) placed ***secticostata*** consistently in Florida and/or in the West Indies. Indeed, large *floridana* match and this characteristic species was not depicted by Reeve. Thus, Kobelt's and Dall's view are shared; the **type locality** of *Arca secticostata* Reeve, 1844 is here designated as USA, Florida.

Macsotay & Campos recently described ***crassissima***, which is an *Anadara*, but not a *Scapharca* very close to *secticostata*. Size, shape, solid texture, number of ribs and habitat do not offer any special features compared to

Floridan specimens, from where even larger specimens with strongly divided ribs are known. The only feature not found is the medial contraction in both valves. However, as "normal" *floridana* have been found in Venezuela, it is doubted that this is sufficient for specific recognition. *Crassissima* is synonymized.

A. hemidesmos was described from unknown locality with 33 ribs and the ligament only extending to midline. It is depicted in PHIL2 pl. 2 fig. 5 and KOBELT91 pl. 45 fig. 9-10. Lamy (1907) recognized it as valid West Indian species. It is, without doubt, similar to ***notabilis*** which is widely distributed and also known from the WInd and Brazil. However, whereas *notabilis* has 25-27 rather coarse ribs, *hemidesmos* has 32-33 rather fine ribs, the ligament area may be identical, the periostracum is similar but in *hemidesmos* numerous fine erect bristles on the posterior slope are present.

Hemidesmos also has a more regular shape, especially so posteriorly, is less inflated than *notabilis* and remains smaller. Philippi gave 25 mm, the largest seen is 44.8 mm, whereas *notabilis* grows larger than 90 mm. Following Lamy (1907) *Arca* (*Scapharca*) *jamaicensis* Kobelt, 1889 non Gmelin, 1791 38 mm, West Indies, is this species. Orbigny (1853) reported it as *Arca hemidermos*, 40 mm, from Cuba and Martinique. At present *hemidesmos* is only known from the West Indies. Here, Martinique St. Anne is clarified as **type locality**. There specimens have been personally snorkeled at 1-2 m, sand among seagrass, adjacent to a mangrove area. In the same area, slightly deeper a couple of true *notabilis* have also been found. *A. adamsi* appears to be the PAN cognate.

A difficult complex consists of *A. indica*, *japonica*, *jousseaumei* and *deyrollei*. All describe elongate, rather compressed anadarids, with a narrow ligament and with 30-38 ribs, approximately 35-40 mm, from India to China. Reeve's ***japonica*** (type HIG01 B236s) obviously does not occur in Japan, but is known from China (ZHO pl. 116 fig. L.). Stevenson (1972) synonymized *japonica* with *indica* and her view is shared. According to Lynge (1909) neither Reeve, nor Lamarck, and consequently not Lamy correctly identified ***indica***, which Lynge depicted figs. 5-12 from the Spengler collection. *Indica* is an elongated species, up to 44 mm, equivalve, 30-36 obtusely nodulose ribs and moderately inequivalve, as also well visible on Chemnitz 543 or in Zhongyan's fig. L. The ventral side is usually slightly curved, the shell not lying flat. On the other hand, Lamy created two related new species *deyrollei* with 36-37 ribs and *jousseaumei* with approximately 30 ribs. I fail to consider ***deyrollei*** other than a synonym of *indica*. *A. indica* appears widely distributed. Apart from the type locality India, Tranquebar, Lynge also mentioned Sumatra, Gulf of Thailand; here Hainan, EChi and the Yellow Sea are added.

On the other hand, ***A. jousseaumei*** is understood as valid uncommon species, more equivalve, umbonal and ventral side almost parallel, more solid, with approximately 30 flat ribs. It has been described from NW. Malaysia, Penang and also found in SW. Thailand, Satun, intertidal burrowing in sandy mud. Lamy gave 35 mm; the maximum size seen is 38.2 mm. The view of Evseev & Lutaenko (1998) that *jousseaumei* is a synonym of *gubernaculum* is not shared. It appears that Swennen et al. (2001 sp. 30 "*jousseaumei*") is instead *gubernaculum*, which is broader posteriorly. *Gubernaculum* has indeed a dense hairy periostracum between the ribs, whereas in *jousseaumei* this is more regularly lamellate.

A related species is Dunker's thin, white ***subgranosa***, but with up to 40 fine ribs.

The syntype of ***gubernaculum*** is depicted in Lamprell & Healy (1998 sp. 87). However, the number of ribs is not, as erroneously noted in the text, 45 but usually 30, in extremis 25-35. Stevenson (1972) synonymized Reeve's *chalcanthum* (type HIG01 B235) and *luzonica*, a view accepted by most authors, recently also by Evseev & Lutaenko (1998). *Gubernaculum* is widely distributed and variable in shape, usually found at approximately 30 mm. However, the posterior portion is generally marked broader than the anterior portion. Grabau & King's *peitaihoensis* fits small *gubernaculum* better, than small *kagoshimensis*. Specimens found in the Phuket area had usually approximately 30 ribs, but a small specimen displayed exceptionally 36 ribs.

A close Australian species, ***A. jurata***, was placed in *Anadara* s.s. by Iredale, 1939. It is open as to whether *jurata* can be kept separate from *gubernaculum* in larger series.

Oliver & Cosel (1993) noted similarities of *deyrollei* and *jousseaumei* to *Stenocista*. These are indeed similar in elongate compressed shape, size and ribbing. However, these two, as well as *subgranosa*, have prosogyrate umbones and are at least moderately inequivalve. Although not very typical, above mentioned species of the *indica*-complex are placed tentatively in *Anadara* as well.

Scapharca: Lutaenko (2006) condensed the definitions of ***A. inaequivalvis*** Bruguière and depicted the Indian species with 33-35 ribs and a maximum size of 67 mm. Bruguière's species is the type OD, Gray, 1847. This equals Reeve (1844)'s perception and is identical to Lamy (1907)'s type selection of Reeve's fig. 54. Chemnitz 552 is distinct, and Bruguière's reference was therefore erroneous. The later type designation of Reinhart (1935) based on Chemnitz' species is invalid. Lutaenko concluded convincingly that the introduced Med species named "*inaequivalvis*" is distinct, a view endorsed here. Both, Lamy (1907) and Lutaenko (2006) accepted Philippine specimens as identical, Lutaenko (2006 pl. 10 fig. C-D) depicted Lamy's large specimen. However, the Philippine forms are perceived indistinguishable from Faustino's ***binakayanensis***, described as common from the Philippines, 55 mm, 34 flat ribs and very close in shape to the type species. Thus, *binakayanensis* is here synonymized with true *inaequivalvis*.

All other species, not fitting Bruguière's Indian-Philippine *Scapharca* type are distinct, notably:

- *A. natalensis* from Transkei, Natal to the Red Sea, the Persian Gulf, and immigrated into the Mediterranean, close to *inaequivalvis* but with fewer, 28-31, ribs, growing slightly larger, being slightly more inflated. In the Mediterranean this was also identified as preoccupied Japanese *inflata* (CEVI021) or as Australian *rufescens*. However, CIESM set the issue right. This is the only European anadarid correctly identified, and the only one which indeed might have migrated through the Suez Channel.

- *A. rhomboidalis*: ***A. hispida*** occurs in the Andaman Sea, Indonesia, Java, Malaysia and Gulf of Thailand. It was described from a very small, 35 mm specimen from the Andaman Sea, Mergui, but it grows larger than 80 mm. As concluded by Lamy (1907) and applied by Lynge (1909) this is the same as Chemnitz' true *rhomboidalis* 7 56 552, thus, identical to Bruguière's erroneous *inaequivalvis* reference. This *Scapharca* has more ribs, 35-38, the ligament area is narrow, the umbones lower, and the periostracum has long thin bristle hairs. Juveniles are more compressed, and more fragile than true *inaequivalvis*. Adults are usually more elongate. Often the oblique truncate posterior border is slightly concave, somewhat acute dorsally. ***A. penangana*** (type LUT061 pl. 16 fig. E-F) described from the same area and also found in the Gulf of Thailand is perceived as adult form. No distinguishing features holding firm were found. As indicated by Swennen et al. (2004), *penangana* is here synonymized.

According to Sherborn, Chemnitz' species has been first validly latinized as ***Arca rhomboidalis*** by Schumacher, 1817 and this name was used by Lynge after 1899. As such it stands for this common *Scapharca* centered on Thailand, Malaysia and Indonesia.

- A. cistula was described from unknown locality. However, Lamy (1907) identified specimens from the Philippines so, and considered it valid. Stevenson (1972) noted Reeve's type as not isolated. *Cistula* is in many features reminiscent of *hispida*. Lamy's material was not analysed, and no *cistula*, but also no *hispida* from the Philippines was as yet seen. This species is tentatively listed, but certainly needs confirmation.

- A. disparilis was synonymized by most authors with *hispida*. However, Scott (1994) analysed the type and designated Hong Kong as type locality. He gave 29-34 ribs; Kobelt (1889) earlier depicted *disparilis* from China with 32-33 ribs, identified so by E. A. Smith, based on the BMNH-type material. Specimens studied from South China, Beibu Gulf, precisely fitting Scott pl. 2 fig. in inflated, rectangular, comparatively light shape and dense ribbing with robust, triangular periostracal hairs. These had up to 37 ribs, as such included Reeve's 36-37 ribs. *Disparilis* appears quite variable in number of ribs. Evseev et al. (1998)'s view of synonymy with *inaequivalvis* is not shared; instead their *Scapharca* sp. 1 appears to be *disparilis*. *Disparilis* is similar to *globosa* but broader and growing larger. *A.* "*inaequivalvis*" of Chinese authors (e.g. Zhongyan, 2004 pl. 115 F) is this species. Whereas *inaequivalvis* generally attains less than 67 mm, *disparilis* grows larger than 90 mm and is also distinctly higher in shape.

- A. aliena Iredale, 1939 from Qld is definitely close to *inaequivalvis* and was even synonymized by Lamprell & Healy (1998). However, Iredale gave more ribs and a larger size; the specimen depicted by Lamprell & Healy has indeed more than the 33 ribs noted in the text. A greenish brown periostracum and a comparatively strong hinge division of Iredale's OD are also not typical for true *inaequivalvis*. Unless larger series or genetic data would prove else, *aliena* is kept separate.

- A. rufescens: Specimens from N. Australia conform in high number of ribs, in elongated shape, low, truncate umbones, strong inequivalvity well with Reeve's OD. A syntype is depicted by Lamprell & Healy (1998 sp. 84b) or by Lutaenko (2006 pl. 12 figs. A-D). On the other hand, reddish tinged umbones are present in many of the large *Scapharca* and not all *rufescens* collected are reddish tinged. *Rufescens* was described without locality. Following Lamprell & Healy (1998) here **NT**, **Darwin** is selected as type locality. There *rufescens* occurs very commonly on the shallow sandy beaches after rough weather. *Rufescens* has more ribs than *inaequivalvis*, and is closer to *hispida*. Lamy (1907) therefore considered *penangana* a variety of *rufescens*, but a specific growth series shows them both valid. Juvenile *hispida* and juvenile *rufescens* are markedly distinct. The former are much more compressed, with a narrower ligament, the periostracum distinct with thinner, longer bristles. *Rufescens* is more solid than *hispida* and seems to remain comparatively small. The largest collected in the Darwin area is 57.3 mm; Lamprell gives 55 mm. *Rufescens* remains also marked smaller than *natalensis* and has more ribs.

- A. globosa from Vietnam, China and Japan shares some traits with *hispida*, but is more inflated, higher, has fewer ribs, 33-36, and is less inequivalve. This is a thin species, slightly broader than high. Although described from the Philippines, none was ever seen from there; Hidalgo (1904) just copied Reeve's localities, but obviously did not have own material. The type locality of *globosa* is therefore considered erroneous. As noted by Sherborn and recently confirmed by the Smithsonian authors of his Internet version, Dubois' earlier *globosa* is a nom. nud.; Reeve's name stands. Following Evseev et al. (1998), I fail to perceive the Japanese ***ursus*** as distinct.

Russian authors use for this species ***A. binakayanensis*** Faustino, 1928 from the Philippines. However, Faustino's OD does not fit *globosa*. *A. binakayanensis* is a thicker species; it only grows up to 55 mm, whereas *globosa* attains 79.6 mm (Vietnam) or 80 mm (Japan); it has been described as very commonly found on Philippine markets, which *globosa* does not, and also the shape is broader and less high. Instead, *binakayanensis* is identical to the Philippine *inaequivalvis* forms.

- A. broughtonii from China, Hainan, Japan and Russia is one of the largest *Scapharca* with up to 150 mm. The highly inflated, but comparatively thin adult valves are obliquely ovate in shape, with a high number of approximately 42 (39-43) flat ribs and a restricted biogeography, which makes identification comparatively easy. However, juveniles are somewhat distinct in shape, less inflated, with a narrower ligament and with fewer ribs than huge adults. Evseev et al. (1998) treating the Vietnamese fauna did not illustrate *broughtonii*, instead they depicted ***kafanovi***. However, *broughtonii* is known from nearby Hainan and most likely *kafanovi* is only the juvenile form. Comparing Lutaenko (1993)'s OD with smaller *broughtonii* collected in Honshu: the number of ribs, the moderately inflated, strong but rather thin shape, the deep marginal crenellations, the pallial line with its characteristic concavity beneath the umbones, the narrow ligament, slightly larger anterior, with a few chevrons, the position of the umbones and the dentition, all fit. Unfortunately, the worn *kafanovi* holotype did not contain a periostracum. Unless other distinguishing features can be found, *kafanovi* is treated as juvenile *broughtonii*.

Reeve's ***inflata*** is twice preoccupied and was renamed ***reeveana*** by Nyst, 1848. Following Stevenson (1972), accepted by all Japanese authors, *reeveana* is considered the same as the Japanese *broughtonii*. Nothing close was as yet seen from the Philippines; Hidalgo (1904) just copied Reeve's locality, but obviously had no material. Thus, Reeve's Philippine locality is also considered erroneous.

- A. satowi from China and Japan is close, but remains smaller, is much heavier and has fewer ribs. It seems much less common than *A. broughtonii*.

- Oliver (1995) depicted a huge 150 mm "***inflata"*** with 37 ribs from Arab, Gulf of Oman, and Persian Gulf. This species does neither fit Reeve's preoccupied *inflata* well, nor the Chinese/Japanese *broughtonii*. Furthermore, no biogeographic connection is currently known. Unless some of Reeve's enigmatic species in BMNH would fit, Oliver's gigantic "*inflata"* is **undescribed**.

- A. ambigua and ***anomala*** Reeve non Eichwald are two similar small and lightweight *Scapharca* from China and Japan. The preoccupied and unlocalized *anomala* has been renamed ***A. guangdongensis*** and placed in S. China, Guangdong. Specimens studied from there have indeed a narrow shape and a marked distinct sculpture on either valve. The number of ribs is 29-32; the maximum size seen is 41.4 mm (Guangdong). Zhongyan (2004 pl. 116 fig. K "*anomala*") depicts it well. This is a shallow water species and also known from Japan, Wakayama Pref., Minabe. It is not likely that Lamy's species pl. 3 fig. 12 from Oceania is conspecific, but instead seems to represent a *Potiarca*. Although mentioned by Bernard et al. (1993), no *guangdongensis* was as yet seen from the Philippines, nor is any known from Australia, as mentioned by Zhongyan. However, it may be that the Japanese *ambigua* records are instead referable to *guangdongensis*.

A. ambigua was also described without locality. It is a squarish elongate, thin species with 33-34 ribs. Although recognized from Japan by authors, all specimens seen so far came from East China Sea, Taiwan, N. of Taiwan and Taiwan Channel, all trawled and taken alive between 36-160 m, the smallest 7.9, the largest 44 mm. *Ambigua* is slightly more elongate, less square, rounded anterior and has about 2 ribs more. The anterior ribs of the left valve are nodulose, well visible in juveniles. The ribs of the right valve, as in *guangdongensis*, are almost flat and smooth. Obviously, *ambigua* is a deeper water *Scapharca*, whereas *guangdongensis* is found very shallow. The **type locality** of ***ambigua*** is here clarified as **Taiwan**. Both species seem to be quite uncommon.

The following species are less typical, share instead the solid, elongated shape with *Anadara* and are only moderately inequivalve, but are usually placed in *Scapharca*:

-A. kagoshimensis from SChi, Beibu Gulf, Yell, Korea and Japan is a comparatively small, usually less than 50 mm, rather solid species, with low umbones, a comparatively narrow ligament area, with approximately 32 ribs. It is highly variable in shape, as early recognized by Dunker (1882). Japanese specimens are usually more elongate, specimens from China often shorter.

Together with Chinese and Japanese authors (e.g. Koyama et al., 1981; Bernard, Cay & Morton, 1993 p. 25) Philippi's preoccupied ***amygdalum*** from China is considered the same. The OD with elongated shape and low umbones fits precisely. However, as recognized by Evseev et al. (1998 p. 27) the "immigrated" European ***demiri*** is marked distinct from Philippi's species. ***A. demiri*** is instead perceived as introduced American *transversa*.

On the other hand, European authors named another introduced species "***inaequivalvis"***. Rinaldi (1994) depicted such specimens from Italy, collected 1972/73, but known from there since the 1960's. Such forms are not found in India and are also absent from the Red Sea. Lutaenko (2006) well demonstrated that the European species is not true *inaequivalvis*. Specimens studied from Italy match instead *kagoshimensis*, collected in Japan. There are no marked differences in shape, ligament, moderate inequivalvity, number of ribs and rib sculpture. Even the often seen whitish-reddish colors are identical. However, European specimens grow slightly larger than the original Asian stock. It is presumed that the European "*inaequivalvis*" has been introduced from ballast water from Japan.

Thus, Philippi's preoccupied *amygdalum* is indeed present in European waters, not as "*demiri*", but as "*inaequivalvis*". The illustrated upper, whitish specimen was collected in Honshu, Shizuoka Pref., 7/95; the lower, orange white in Italy, Venice, 8/98.

- A. sativa: Modern Russian authors (e.g. Evseev et al., 1998; Lutaenko, 2002) synonymized ***sativa*** nom. nov. s***ubcrenata*** Lischke, 1869 non Michelotti, 1861 with *kagoshimensis*. Indeed both species have approximately 32 ribs. However, as well recognized by older German authors and Higo et al. (1999), two distinct species are present; Kobelt (1891) gives good pictures and depicted a syntype of *subcrenata*. *Sativa* is the same as the Japanese "***inaequivalvis***" (e.g. Okutani, 2000 pl. 424 fig. 39). *Sativa* is superficially similar to *kagoshimensis* but grows much larger, has a broader, stronger chevroned ligament and especially, a higher, more pointed umbo; large specimens are often oblique in shape. The largest sativa collected in Mie Pref. is more than 85.5 mm, also reported 81.1 mm (S. China, Beibu) and seen from there at about 70 mm. The largest *kagoshimensis* collected in Honshu, Chiba Pref. is 51.8 mm; Okutani gives 56 mm as maximum size. *Sativa* has fewer ribs, is less inequivalve and in very solid texture markedly distinct from true *inaequivalvis*.

-A. transversa is in dentition, in narrow ligament and weak periostracum not close to the *Anadara* type species; but it also does not match *Scapharca* very well. It shares some traits with *kagoshimensis*. *Transversa* is highly variable in shape moderately to strongly elongate, moderately to strongly inflated, in rib number 25-35, and whitish to yellow-orange.

In the Med, the introduced ***A. demiri*** was first recorded 1977 in Turkey as *Arca* (*Scapharca*) *amygdalum* by M. Demir. Piani (1981) found the name preoccupied and replaced it, without any comparison with Chinese or Japanese material, as *demiri*. *Arca amygdalum* was described by Philippi, 1845 from China, solid, moderately inflated, ovate, 32 ribs and 45 mm. Nothing similar is known from the Red Sea, thus, a Lessepsian migration is not possible. Philippi's *amygdalum* is the same as the common Japanese *kagoshimensis*. However, the European *demiri* is not close to *kagoshimensis*. *Demiri* is perceived indistinguishable from the American *transversa*. Instead of a migration, an introduction by ships from the US is more likely. Consequently, *A. demiri* is an unnecessary nom. nov., originally erroneously interpreted, for the common and well known NE. American species. The illustrated upper specimen was collected in the USA, New York area 3/97; the lower, orange-white in Greece, 11/96.

Imparilarca: At least 5 IND-species occur. Despite its synonymization by Lamprell & Healy (1998) ***kikaizimana***, described as Okinawa fossil, remains markedly smaller, is more angled posteriorly and lives much deeper than *rotundicostata*. It is well known from Okinawa, where it grows up to 40 mm. Philippine, Balicasag specimens (31.7 mm) are conspecific and came also from deeper than 100 m. The Australian ***hubbardi*** reaches more than twice this size, is more robust, more rounded posteriorly, the discrepancy in sculpture on both valves is stronger expressed and it lives much shallower. Although Reeve's type has not been isolated as yet, and despite Iredale (1939)'s arguments, it is most likely that ***rotundicostata*** is identical to Australian specimens, as concluded by Lamprell & Healy (1998). Recently a closely similar specimen was found in Mozambique, Nacala Bay, subtidal, 66 mm, 21 ribs. Despite somewhat more angular ribs, this population is considered identical to the huge W. Australian *rotundicostata*.

Another *Imparilarca* from the Philippines to S. China is Reeve's preoccupied *clathrata*, renamed ***craticulata*** by Nyst, 1848, well depicted by Habe & Kosuge (1966 pl. 46 fig. 10). It has a similar distinct sculpture on either valve as *rotundicostata*. It is in size in between, but has more ribs than the other two. Scott (1994) lists the differences to *ferruginea*. Stevenson (1972) synonymized here also Reeve's ***angicostata*** and ***myristica***. Obviously, both names are older than Nyst's replacement; but the synonymy of *myristica* clearly needs confirmation and much more material than at present available. *Arca angicostata* is removed at once. The shape is distinct and the number of ribs, with approximately 30, much higher. Furthermore, the old BMNH 1969252 label reads "possible holotype, loc. North Western Australia sand banks low water". This is for the time being assumed correct, but needs confirmation.

Lamprell & Healy (1998 sp. 92 "*craticulata*") is instead Iredale's ***disessa***, unrelated to *Imparilarca*.

A. ehrenbergi from the Indian Ocean is perceived as closer in shape and strength of ribbing to the type species *Imparilarca* than *Diluvarca* or *Anadara* and placed here as well.

Oliver & Chesney (1994) described with ***pesmaticis*** another *Imparilarca* from Arabia. However, they overlooked H. Adams' earlier ***crassicostata***, described from the same locality. Lamy (1907) discussed the affinities of *crassicostata* to *craticulata*. *Crassicostata* is here reinstated, *pesmaticis* is a junior synonym.

Potiarca: As concluded by Lamprell & Healy (1998) there are not many arguments to keep Iredale's type, OD ***saccula*** distinct from ***pilula***. Reeve's Philippine type (HIG01 B239) is, also in size, virtually identical to specimens found beached in NE. Qld.

A. sabinae keeps with more than 24 mm its characteristic oblique shape, it also stays markedly less inflated than *pilula* with a narrower ligamental area and has lighter and less robust valves. Other than assumed by Lamy (1907) it is not a juvenile form, but a distinct comparatively small *Potiarca*. The number of ribs in juveniles is 24, in adults 26-27. Morlet described it a juvenile specimen from the SE. Gulf of Thailand. Larger specimens analyzed have been found in NE. Malaysia, Pangahan.

Furthermore, Lamy (1907) described and depicted pl. 3 fig. 4 ***bataviensis***, as "au moins une variété distinct". This is perceived as valid, square, weakly carinate species, also with a broader hinge in adults. Specimens have been identified from N. Qld, Daintree and Sri Lanka, Negombo.

Thus, I do not share Evseev et al. (1998)'s synonymy, but it seems that in Vietnam only *pilula* occurs.

A. senegalensis from WAF belongs also here. Oliver et al. (1993) synonymized ***Arca pertusa*** with ***senegalensis***. However, ***pertusa*** grows almost twice this size and has about 10 additional ribs, with a finely pricked sculpture. On the other hand, nothing known from WAF fits *pertusa*, and Lamy (1907) could not properly identify it either. Stevenson (1972) noted the type not isolated. *A. pertusa* is treated as nom. dub. likely with an erroneous type locality.

A. subglobosa is distinguishable from *senegalensis* by more ribs and quite inflated shape. However, the other 2 species ***eborensis*** and ***camerunensis***, characterized by Oliver et al. (1993), are close. It is not completely excluded that instead only two highly variable species are present. Ardovini et al. (2004) listed even just one, but it is not clear whether this happened intentionally.

A. nux and the cognate ***A. chemnitzii*** are better placed here than in the marked inequivalve *Cunearca*, as concluded by American authors.

The Panamic ***obesa*** closest resembles large WAF *subglobosa* and is tentatively also placed here.

Cunearca: This exclusively American-group is quite well known. Occasionally, *Cunearca* is erroneously applied for IND-species. However, Lamprell & Healy's four "*Cunearca*" are referable to *Potiarca* (sp. 89), *Imparilarca* (sp. 90), *Diluvarca* (sp. 91) and *Tegillarca* (*disessa*, sp. 92).

Most American authors accept a highly variable ***A. brasiliana*** widely distributed from N. Carolina to Venezuela and S. Brazil. Instead, here 3 species are perceived recognizable. Macsotay & Campos, 2002 separated with sufficient arguments the Venezuelanean *axelolssoni*. Furthermore, Lamy considered *brasiliana* and ***incongrua*** conspecific and separated the Brazilian species as *corrugata*, based on Kobelt pl. 27 fig. 3-4 from Bra, Santos. All evidence indicates that Lamarck's *brasiliana* is indeed the same as *incongrua* and that Lamarck's type locality is simply erroneous. His smaller MNHN single valves (LA040 fig. 3-4) and obviously Defrance's larger 35 mm specimen conform to the US species, but not to the Brazilian form. As indicated by Lamy (1904), the **type locality** of *brasiliana* is here corrected to US, S. Carolina and ***Anadara*** (***Cunearca***) ***corrugata*** Lamy, 1907 type locality Santos is hereof separated. Lamy, p. 264-5 gave the differences, Kobelt p. 97 *incongrua* (= *brasiliana*) and p. 100 *brasiliana* (= *corrugata*) discussed and depicted both species well.

Still unresolved is ***Arca occlusa*** Reeve, 1844 described without locality. It is a medium sized highly inflated species with particularly close umbones and strong, long internal ventral ridges. Closest appears the *Cunearca* group.

Diluvarca: According to Oliver & Cosel (1993) Lamarck, 1805's ***Arca diluvii*** is a Miocene fossil with 33 ribs and with the beaks more closely to the midpoint than the extant species. From the Netherlands, Miocene specimens have been studied; it can be added that the valves are somewhat less inflated than *polii* and that the number of ribs may range from 30-33. Lamarck's fossil is the type OD, *Diluvarca*. The extant *A. diluvii* auctt. with a chevroned ligament as well, but with 24-28 ribs and umbones more anterior is instead known as ***A. polii*** Mayer, 1868 (= *Arca antiquata* Poli, 1795 pl. 25 fig. 14-15 non Linnaeus, 1758). Reinhart (1935 p. 40) summarized the history of *Diluvarca*. However, neither is true *diluvii* extant, nor is *Diluvarca* synonymous to *Anadara*; *Diluvarca* is represented by two extant European species.

On the other hand, the unresolved BMNH type of Reeve, 1844's ***Arca gibbosa*** described from unknown locality has been studied. This is a comparatively small, 37 mm species, highly inflated with 27 ribs, a very broad strongly chevroned dorsal area and a narrow straight dentition with the broad anterior umbones specially curbed. *A. gibbosa* was considered a valid species by Lamy (1907), and was tentatively placed in Java. Stevenson (1972) listed it as valid *Anadara?* from unknown locality with its BMNH number. However, a close comparison with ***polii*** from Med, Malaga left no doubt that these two are conspecific and *gibbosa* instead the valid earlier name for this well known European species. The **type locality** for *Arca gibbosa* Reeve, 1844 is here designated as Med, Malaga.

A. corbuloides is congeneric, slightly inequivalve, but larger, broader and has more than 30 ribs, the umbones are more central, and broader than in the type species. Lamarck's type is between these extant species, even slightly closer to *corbuloides* than to *gibbosa*. Poppe & Goto (1993) gave the correct text, but confounded the pictures; their pl. 2 fig. 11a, b is *corbuloides*, their 10a, b is *gibbosa*. Despite the lack of a byssal gap, *gibbosa* as well as *corbuloides* are byssally attached species. Neither *Diluvarca* are morphologically, in periostracum, in deeper water habitat, nor in mode of life, close to *Anadara*. Modern authors consider it generically distinct (e.g. Swennen et al., 2000, Japanese authors). As however, the exact habitats and mode of living in some other presumed *Diluvarca* are as yet unconfirmed, I hesitate to separate. Furthermore, there lacks genetic confirmation.

A species very closely related to *corbuloides* is Reeve's preoccupied ***radiata*** described from unknown locality. It has been renamed ***tricenicostata*** by Nyst, 1848. Dunker, 1882 found *radiata*, also preoccupied, was unaware of Nyst and named specimens from China and Japan *Scapharca* ***philippiana***. However, Dunker had his own material and one of his specimens is well depicted in KOBELT91 (pl. 25 fig. 1-2). *A. tricenicostata* is the *ferruginea* of modern Japanese authors but not of Reeve (e.g. EVS98; Okutani, 2000 pl. 425 fig. 41); Kira (1972 pl. 44 fig. 11) has it right.

The 3 possible syntypes of ***A. ferruginea*** described from unknown locality are depicted in Lutaenko (2006 pl. 14-15). His pl. 14 fig. a-d corresponds to the syntype depicted in HIG01 B327. Identical specimens are currently only known from the Philippines, e.g. Zamboanga. Closely similar species are depicted by Lutaenko from S. India pl. 1 and pl. 2 and by Lamprell & Healy (1998 sp. 91) from Australia. *Ferruginea* is clearly distinct from *tricenicostata* in more prominent, broader, squarish, in adults also less ribs. Anteriorly *ferruginea* is shorter, the size is smaller, and the shell rather more solid.

However, I do not share part of Lutaenko's synonymy. From the material studied Smith's ***consociata*** is a distinct valid species, more ovate, almost equivalve, shorter posteriorly, with broader ribs as analyzed by Evseev et al. (1998) from Vietnam. Scott (1994 pl. 1 fig. D "*ferruginea*") from Hong Kong is, instead, perceived as *consociata*; Swennen et al. (2004 sp. 32 "*rotundicostata*") appears also to represent *consociata*. Smith (1885) gave the differences to *tricenicostata*.

Iredale's ***disessa*** (type Lamprell & Healy, 1998 sp. 92) is a distinct valid Australian species, neither close to *craticulata*, nor to *pygmaea*, or to *dautzenbergi*, but closely related to *Tegillarca*.

More elongate and considerably smaller than *ferruginea* is the SAF ***africana***, recognized as valid by Kilburn (1983), against Stevenson (1972)'s unwarranted synonymy. Despite lacking EAfr records, I fail to consider the earlier Red Sea ***pygmaea*** distinct.

Related to this group is Reeve's unresolved ***cymbaeformis*** from unknown locality. The type is a comparatively large species, 46.8 mm; it is similar in shape to *ferruginea*, though somewhat rounder and higher, with a higher number of 32 ribs.

Above species were either placed in *Mabellarca* or in *Diluvarca* (Japanese authors for *tricenicostata*; Swennen et al., 2002 for *ferruginea*, stating byssal attachment to solid objects). Despite the lack of data on the precise mode of life in some, *Diluvarca* seems to fit better. *Mabellarca* is considered monospecific, non anadarid, but close to *Vitracar*.

In the Americas ***A. baughmani*** is a similar species. The much larger *secticostata* (syn. *floridana*) with more, usually 35-36 medially grooved ribs, especially so anterior as well as the cognate *formosa* are perceived as *Anadara* s.s. Very large US-*baughmani*, more than 46 mm, may become very broad; the number of undivided, moderately beaded ribs is generally 27-30. *A. baughmani* has been described just quite recently by American authors. However, it was known long before. Kobelt (1888 pl. 11 fig. 1-4) depicted two "*floridana*"; his fig. 3-4 represents indeed the well known species. The other, fig. 1-2 is distinct, broader, with only 29 undivided, moderately beaded ribs, a much weaker periostracum and fits large US-*baughmani* well. Also the typical growth phases often seen in *baughmani* are precisely expressed. Kobelt's species was recognized as distinct by Lamy (1907) and named *Anadara floridana var. secernenda*. There is no doubt that this is the valid earlier name for *baughmani*. Nowadays, ***A. secernenda*** (syn. *baughmani*) is recognized as valid species, well known from Florida, Texas to Colombia, measuring 48 mm (Texas) to 52 mm (Suriname, OKU831). *Secernenda* appears cognate to the equivalve PAN *mazatlanica*.

In Brazil much larger specimens occur, growing to at least 80 mm (E.S., Vitória, BRASIL). These are usually also named *baughmani*. They share the same rib number. However, the shape is generally higher, the umbones broader, the ribs more rounded, the muscle scars broader as well and they are marked inequilateral, with a larger left valve. This Brazilian species, comparable to the PAN *biangulata*, is **unnamed**. On the other hand, Rios (1994) depicted a small specimen from N. Brazil. Further material is necessary to clarify the identity of these small Northern forms.

The equivalve species (*mazatlanica*, *secernenda*) are usually placed in *Anadara*, the inequivalve species (*biangulata*, the unnamed Brazilian species) in *Scapharca*, but neither group fit. In ligament, shape and ribbing these are closer to *Diluvarca*. These four species are only tentatively placed here, as their exact mode of living is not known.

Another huge, but still enigmatic species Philippi's ***Arca speciosa*** is also placed in *Diluvarca*. Closest appears the Japanese *tricenicostata*.

NL14: ***Mosambicarca*** has been created by Lutaenko, 1994 for ***erythraeoenis*** and ***mosambicana***. Kilburn (1983) earlier placed these large, elongated species in *Scapharca*, which does not match. Significant is the large byssal gap, otherwise not found in anadarids. A quite similar condition is found in large WAF ***geissei***, where at least juveniles are byssally attached. *A. floridana* (= *secticostata*) on the other hand, compared by Oliver et al. (1993) with *geissei* is perceived as distinct in habitat, byssal gap and morphology and placed in *Anadara* s.s.

However, Reeve, 1844 described ***Arca hians***, a species without locality, anterior ribs divided as well and gaping anterior. *Hians* was variously treated by Lamy and Stevenson (1972). However, the BMNH holotype 1969179 revealed that *hians* is instead a large *geissei* from WAF with the typical ventral hiatus. The **type locality** is herein corrected to Senegal. In addition, Dunker, 1866 described ***Anomalocardia carpenteri*** from S. Australia. Despite Iredale's (1939) approach to *pistachia*, this species is not a *Barbatia*, and nothing close is known from S. Australia. Also Stevenson's (1972) approach to *indica* does not match. Instead, the BMNH type 1969176 proved to be the same and the second earlier name for *geissei*. The **type locality** of *A. carpenteri* is erroneous and herein also corrected to Senegal.

NL15: ***Tegillarca***: Usually ***Anomalocardia*** "Klein" Mörch, 1853 non Schumacher, 1817 is here synonymized (e.g. Newell in Moore, 1969). Sherborn in his Epilogue also considered ***Anomalocardia*** "Klein" Bruguière, 1792 as properly proposed. However, R. Petit (pers. com. 5/09) clarified that this was in error and that Bruguière himself did not accept this genus.

The common ovate ***granosa*** (LUT061 pl. 18) with 17-21 nodulose ribs, a comparatively narrow, flat, chevroned ligament and a break in the hinge line under the beaks is widely distributed, also found in India, W.-E. Australia, Yellow Sea and Japan. Iredale's type, OD ***bessalis*** is not separable, as concluded by virtually all modern authors. *Granosa* is perceived as highly variable, widely distributed species.

However, there is indeed another quite distinct species, well recognized by Kobelt (1891) and older German authors.

This species seems restricted to the southern part of the Indian Ocean. It has usually less expressed ribs, which are not or only very weakly noduled posteriorly, a much narrower, more pointed umbo and a broad ligament, deeply bent inwards. The teeth line is more regular and the deep break is not expressed. This species fits the preoccupied ***cuneata*** of Reeve, renamed ***zanzibarensis*** by Nyst, 1848. Specimens have been studied from NWA, Broome and Port Hedland. It has originally been described from Zanzibar and also reported from Mauritius. Boshoff (1965)'s N. Mozambique specimen with the unnoduled posterior portion appear to belong here as well. Whereas *granosa* is locally exceedingly common, *cuneata* seems to be rather rare. The largest specimen analyzed is 48.2 mm, Broome, intertidal, sandbars. Other than assumed by Lamy (1907) *zanzibarensis* is not a juvenile form of *granosa*.

Lutaenko (2006) placed Dunker's ***A. pulchella***, described from unknown locality, but subsequently located by Dunker in China (1878) and in Japan (1882) as synonym of ***granosa***. At present, I see no better solution. However, it should be noted that Dunker counted 22-23 acute ribs, a number not seen in any *granosa*.

Following Lynge (1907), I fail to consider *oblonga* and *paucigranosa* as distinct from ***nodifera***, which is generally more elongate, with slightly more ribs and often smaller than *granosa*. *A. paucigranosa* was synonymized by Kobelt (1889) with *nodifera* and the preoccupied *oblonga* considered very close at the least. The largest seen is 42.1 mm (Phil), but *nodifera* is reported up to 60 mm.

Two further rare *Tegillarca* species are known from Australia.

Born's type ***A. rhombea*** (NHMW 14.093) has been described from a single right valve from unknown locality. The Vienna holotype is small, not carinate, with a very broad trigonal ligament area, marked with irregular, almost concentric lines, 26 deeply incised ribs. The anterior half is noduled; the hinge plate is very narrow. Specimens very closely fitting Born's holotype are currently only known from Indonesia, N. Java. Nothing similar occurs in China, as noted in older literature. The Java species is moderately inequivalve, the ribs of the left valve are densely regularly noduled, except the 8 anterior ones, no specimen was as yet seen larger than 40 mm. Kobelt (1888 pl. 16 fig. 5-6) seems to be a true *rhombea*. It is not excluded, that Philippi's ***bronnii*** from Java, 41 mm, 30 ribs, is this species. It is also likely, that Dharma (1992's sp. 4) *Scapharca* (*Cunearca*) *pilula* non Reeve, 1843, 20-40 mm, in mud, shallow water, common, edible, is instead true *rhombea*.

The huge, common species named "*rhombea*" by most authors from India to the Andaman Sea, W. Thailand is markedly distinct. This species grows twice this size, has usually 1-3 ribs less, specimens are weakly carinate and have a distinct broad hinge, with broader teeth, the hinge line is at least slightly curbed. The ligament area in similar sized specimens is much smaller, radially arranged. From the material seen, there is no doubt that Dunker described a comparable juvenile specimen as ***A. aequilatera*** from the Indian Ocean (likely W. Thailand) and Lamy a very large specimen as ***pseudogranosa*** from India, Malabar Coast. Reeve's famous fig. 12 from Sri Lanka is this species, but not true *rhombea*. Lutaenko (2006)'s small "*rhombea*" text fig. 2 and pl. 1 fig. D-G, S. India fit instead *aequilatera*, his medium sized pl. 10 fig. E-F is in between, close to Reeve's "*rhombea*", and the huge specimens on pl. 16 fig. A-D "*pseudogranosa*" are large *aequilatera*. Chemnitz's *rhombea* is composite, none is Born's true *rhombea*, and Gmelin's ***rhomboidea*** is therefore treated as composite and nom. dub. None of Reeve's unresolved enigmas fits, thus, Dunker's *aequilatera* is the oldest available name for this very early confused, common *rhombea* auctt.

I am not convinced that ***A. bicors***, even more inflated, with narrower umbones and with 28 ribs and a broader dentition is indeed the same as *aequilatera*. Specimens seen from Sri Lanka have 26-27 ribs, are very inflated, and somewhat curbed ventrally. However, more material is needed for firm conclusions. For the time being *bicors* is treated as valid species.

NL16: ***Senilia***: From biogeography and morphology with a strong broad hinge plate, centrally marked, the unique ***subnitens*** strongly resembles *senilis*. However, the high number of 20 ribs was not encountered as yet in any *senilis* studied.

NL17: ***Lunarca***: I fail to recognize Lamy's ***canalicostata*** from Cayenne distinct from *ovalis*. Quite similar forms are found in N. Florida, and specimens intergrading to typical forms are known. Definitely, *ovalis* is one of the most variable arcids, in number of ribs, 26-36, in elongate to ovate shape, in moderate to strong inflation, in weak to strong rib indentation. The largest specimens seen are over 58 mm, but are reported up to 64 mm.

The 2 BMNH syntypes of ***Arca pectinoides*** King & Broderip, 1832 from Rio have been studied. As noted by Stevenson they have the typical *Lunarca* dentition. However, I fail to perceive these other than a further *ovalis* synonym. *Ovalis* is well known from Brazil, ranging south to Uruguay.

Inferring from Rost (1955 pl. 15) the Panamic ***brevifrons*** seems similarly variable. *Lunarca* appears restricted to the cognate American *ovalis* and *brevifrons*. Both species are easily recognizable in the unique divided series of teeth. Following Lynge (1909) Reeve's *indica* non Spengler appears inseparable form *ovalis*.

NL18: **BATHYARCINAE**: Whether this group is correctly placed or belongs rather in **PARALLELODONTIDAE** is open. However, this old question, pending for more than 100 years (LAM07 p.8) should be easily solvable with genetic comparisons.

Bathyarca: This is another difficult genus, which is crying out for a global review with type material and larger series.

Globally, approximately 25 species are perceived valid.

It appears that various groups are discernible. Iredale's ***Microcucullaea*** with marked myophoric flanges seems to have been synonymized too hastily with *Bathyarca*. The species are well depicted in Lamprell & Healy (1998); Reinhard (1935) discussed their distinctiveness. It is here at least subgenerically recognized.

Iredale's ***Thronacar***, higher than long, narrow hinge line with fairly regular dentition seems more difficult to distinguish from *Bathyarca*. However, the type, OD *corpulenta*, as well as *inaequisculpta* or *glomerula* have another dentition than the type species *pectunculoides* (or *inaequisculpta*, *cybaea*, and others). It is not completely excluded that in the future *Thronacar* may also be resurrected.

According to Repetto et al. (2005) ***B. glacialis***, 28 mm, also occurs rarely in the Med, W. Med and Ionian Sea.

Whether the huge, 16.8 mm, more rounded ***B. grandis*** with a stronger periostracum from Arctic waters is indeed the same as the minute, 3-5 mm *pectunculoides* from GB-Med should be verified with modern methods. Ockelmann (1958) treated *grandis* as subspecies, most modern authors synonymize these two. ***B. anomala*** appears in size, hinge configuration and habitat not distinct from *grandis*. *B. inaequalis* described from a single valve from S. Georgia has never been depicted. However, from the OD, I doubt that it is anything other than a juvenile *grandis*; *grandis* is longer than *frielei* and has a long edentulous hinge space.

All evidence indicates that Knudsen (1970) confounded the small Atlantic ***orbiculata*** with the large Pacific ***corpulenta***. Coan et al. (2000) did not accept synonymy. The NZ records (Otago) appear referable to *corpulenta*.

Older Japanese authors synonymized ***B. kyurokusimana*** with ***anaclima*** from the Indian Ocean. Okutani (2000) kept it distinct; it indeed appears that these two are not the same. The latter has comparatively few broad ribs, the former numerous fine ribs. *Anaclima* also has a distinct sculpture on either valve and seems to grow approximately 3 mm, whereas the Japanese species reaches 6 mm. Thiele & Jaeckel (1931) reported *anaclima* from Indonesia, and specimens from Phil, Cebu are here attributed as well; Prashad's larger "*anaclima*" does not seem conspecific. On the other hand, ***B. kyurokusimana*** is in size, shape and sculpture reminiscent of *orientalis* and series of these two should be compared. Prashad's less oblique ***sibogai*** is perceived as distinct from both.

Okutani (2000) depicted as Sagami-watazoko-egai *B. sagamiensis* Okutani, 1962 from 550 m, Sagami Bay. However, this is an error for ***B. nipponica*** Okutani, 1962 from 550 m, Sagami Bay (MAA04). The type is depicted in HIG01 B220.

The Antarctic ***Bathyarca sinuata*** should be reexamined. It is neither in shape, size, sculpture nor in dentition close to the type species and does not seem to belong in *Bathyarca*.

The identity of the preoccupied ***Arca minuta*** Reeve, renamed by the also preoccupied *minima* Nyst, 1848 from the Philippines is open. Stevenson (1972) stated it as valid *Bathyarca* from the Philippines; the type is present in BMNH.

NL19: ***Bentharca*** contains very few minute, rather solid, slightly inequivalve, cancellate deep water species with an oblique dentition at both ends, living byssally attached. The type OD, ***asperula*** seems one of the exceedingly rare bivalves with Cosmopolitan distribution. Deeper water specimens, 9.9 mm, studied from NSW, Wollongong appear indistinguishable, adding, apart from Kermadec Islands (Otago) another nearby location to the list. Coan et al. (2000) gave the synonymy; Kay (1979) earlier considered *hawaiensis* and *kauaiensis* from Hawaii synonymous, accepted by Japanese authors, but apparently not by Coan et al. From the OD, ***B. hawaiensis*** seems close to *asperula*; ***B. kauaiensis*** appears distinct, closer to Kuroda's *xenophoricola*.

The Arabian ***avellanaria*** was described as *Acar*, and placed in *Barbatia* by Oliver (1995). However, Stevenson (1972) analyzing the type material considered it a *Bentharca*. Her view seems to better fit the OD and is followed. The type material should definitely be reassessed.

NL20: ***Samacar***: I fail to recognize both of Viader's species ***Arca approximata*** and his ***acupicta*** other than ***Samacar strabo***. Both were described from single dredged valves off Mauritius. His ***acupicta*** matches ***strabo*** studied in sculpture, the worn ***acupicta*** fits ***strabo*** in shape.

P. pacificus, the type OD ***Paragrammatodon*** is generally recognized as junior synonym of *strabo*. Interestingly, Newell in Moore (1969) considered it closely related to the parallelodontiid *Porterius*. Obviously, this enforces the question homologue or analogue with respect to BATHYARCINAE.

NL21: La Perna (1998) removed ***Asperarca*** from its earlier unwarranted synonymies, confirmed Lamy's *nodulosa* synonyms, and described two further minute Med species. *Asperarca* seems restricted to European waters.

The Caribbean ***A. sagrinata*** (type: DAL02 pl. 31 fig. 2) fits neither in shape, texture, sculpture, color, nor in dentition in *Bentharca*. The internal erect myophoric flanges even resemble the *Cucullaea* condition. In shape and dentition it shares some traits with *Asperarca*. As far as is known, this species is unique, it may merit generic distinction.

The large Caribbean ***A. ectocomata*** was originally placed in *Barbatia*, others placed it in *Bathyarca*. It fits neither. It shares some traits in shape and sculpture with *Asperarca*. However, the distinct dentition and periostracum recommend distinction.

"Faute de mieux" both species *sagrinata* and *ectocomata* are misplaced in *Asperarca*, awaiting new conclusions.

NL22: ***Xenophorarca***: As indicated by La Perna (1998) *xenophoricola* is closer to *Asperarca* than to *Bentharca*. However, the disjunct biogeography to *Asperarca*, the considerably stronger radial than commarginal cancellation, the lacking carina, the markedly inequivalvity in large specimens, the more fragile texture, the dehiscent periostracum, and the distinct dentition, virtually edentate centrally, indicate a new group than an unwarranted extension of an Atlantic genus. Here ***Xenophorarca*** is proposed, and the Japanese ***xenophoricola*** is designated as type species.

Xenophorarca is perceived as related to *Deltaodon*, which, however, differs markedly in dentition, and somewhat less to *Bentharca* with more solid shells and a stronger periostracum. *Xenophorarca* is treated feminine; the name follows the type species, which expressed the attachment to *Xenophora* carrier shells.

4 species are included, giving *Xenophorarca* a range from the Philippines through Japan to Hawaii. The Hawaiian ***B. kauaiensis*** is in dentition, texture and periostracum very close and also placed in *Xenophorarca*.

Hayami & Kase (1993) described 4 *Bentharca* from subtidal caves. However, none is perceived as true *Bentharca*. *B.* ***tenuis*** and the quite similar *B. irregularis* are placed in *Xenophorarca*, close to *xenophoricola*; ***B. decorata*** is placed close to *agulhasensis* tentatively in Acar; ***B. excavata*** is strongly reminiscent of juvenile *Arca* and is tentatively placed near *navicularis*.

NL23: ***Deltaodon***: The type species OD, ***tugelae*** has been described from Natal. The strongly inequivalve Japanese ***rubrotincta*** (type HIG01 B214), also known from the Philippines, has a unique, divided dentition; a deltoid complex of a few anterior teeth and a regular row of posterior, rather oblique teeth. *Rubrotincta* closely approaches in dentition and coloring the rare ***Deltaodon tugelae***. Whereas Japanese specimens were originally described less than 10 mm, in the Philippines, Bohol *rubrotincta* grows more than 16 mm, but has also been found in deeper water, 180 m.

NL24: ***Scaphula***: This never revised group definitely needs more work. Variability, number and distribution of species have to be stabilized.

As far as could be ascertained, 6 species have been described in the last 250 years. *S. bensoni* was indicated synonymous with *pinna* by Lamy (1907), confirmed by Stevenson (1972). The other species seem to be valid and specialized to certain river systems, where they are locally commonly found. All known records refer to a limited area, from India to the Gulf of Thailand.

The slightly larger, more parallel sided ***S. celox*** is recognized as distinct by experts from ***S. deltae*** (SUB89, NES03, and JANAK). Both species are found in the Ganges River. *S. deltae* also occurs in the Irrawaddy Delta, from where originally described. The illustrated Zürich University collection specimen is from "Burmah", bought in 1868 by Mousson from Sowerby as *celox*. However, instead, morphology and biogeography match *deltae*. *S. celox* is not reliably known outside of India.

The dorsally strongly raised and anterior very narrow, subtrigonal ***pinna*** (ADAMH58, SUB89) appears to be only reliably known from the type locality SE. Myanmar, Tenasserim River system. The illustrated *S. pinna* from "Burmah" from the Zürich University collection was received by Mousson in 1857 from Benson and may represent a paratype.

It is unlikely that Brandt (1974)'s large parallel sided "*pinna*" from N. Thailand, Bangkok area, also from nearby Lam Ta Khong River, is the same. It shares few traits with *celox*, but seems **undescribed**. Brandt's "*pinna*" represents the largest *Scaphula* at present known and measured 13 mm.

Swennen et al. (2004) depicted "*deltae*" from SE. Thailand. However, their record is not perceived conspecific with the Andaman species. From exactly this area, and stated to be widely distributed in E. Thailand, Ghosh, 1922 described his ***S. minuta***; the type-series is in ZSI. From the OD it appears that Swennen's *deltae* is instead a large *minuta*.

The recently described small and thin ***S. nagarjunai*** is apparently restricted to India, Krishna River. Janaki et al. (1984) gave a comparison to 3 other scaphulids.

Ghosh added to the anatomy of this group of untypical arcids. Overall, it appears that 6 *Scaphula* are valid, but 1 species as yet undescribed.

6.12 NOETIIDAE

NO1: This is a little known family. Few authors except Oliver contributed significantly. His views are largely shared.

Following Oliver (1987) the subfamilies are mainly based on the name giving genera and appear of little value. These are here abandoned as obviously also done by Vongpanich and Matsukuma (2004). Oliver et al. (2006) resurrected distinction; however, most really crucial species were not included in the presented analysis. That *Striarca* and *Arcopsis* together with *Mulinarca* and *Ribriarca* are close to each other, but considerably distinct from *Noetia* is obvious. However, why *Estellacar*, true *Noetiella* or *Verilarca* should be remote from *Didimicar* or *Stenocista* is less obvious. It is arguable, whether true *Noetiella* is closer to *Arcopsis* or to *Eontia*. More work and analyses seem necessary to reveal true relations and justify subfamilies.

Another topic is *Litharca* which Thiele & Jaeckel (1931) placed in noetiids. Indeed ***L. lithodomus*** shares only a few traits with arcids; some morphological affinities with noetiids are obvious, but the mode of life does not fit this soft bottom infaunal or epifaunal family well.

NO2: ***Noetia***: The Panamic ***magna*** seems to be exceedingly rare. Only 2 specimens have been seen from off Manta Ecuador from 480 m, the largest is 23.3 mm.

NO3: ***Congetia***: Unfortunately, Oliver (1987 p. 263) misinterpreted ***Noetiella***. Thiele & Jaeckel (1931 p. 173) wrote: "*A. pectunculiformis* Dunker sieht recht verschieden aus [from the before treated *Noetia*-group] und kann zum Vertreter einer Sectio *Noetiella* gemacht werden, die vielleicht mit *Noetia* nicht unmittelbar verwandt ist. Ihr dürfte eine kleine neue Art von der Kongomündung am nächsten stehen". As recognized by Reinhart (1935 p. 49) and Iredale (1939, p. 289) there is no doubt that the type OD *Noetiella* is *Barbatia pectunculiformis* Dunker, 1866 from Borneo (DKR sp. 99). *Scelidionarca* Oliver, 1987 is an objective synonym. The species from the "Kongomündung" mentioned in the text has later on p. 176 been described as *Arca* (*Noetiella*) *congoensis*.

As shown by Oliver (1987 p. 286) *congoensis* is quite distinct from *pectunculiformis*. *Congoensis* is the type OD *Noetiella* Oliver, 1987 non Thiele and Jaeckel, 1931. *Noetiella* Oliver is here renamed ***Congetia***, meaning a *Noetia*-like bivalve from the Congo Delta. Oliver (1987) gave the diagnosis and considered *Congetia* as of full generic rank. Following Oliver (1990) and Oliver & Chesney (1994) also *vivianae* from Hong Kong and *chesneyi* from Arabia are referable to *Congetia*, as well as a few fossils.

Vongpanich and Matsukuma (2004) synonymized *Scelidionarca* (= *Noetiella*) with *Verilarca*. However, the two type species are not close and Oliver (1985)'s view is shared. He stated it distinct in "fine decussate sculpture, narrow dorsal area and much larger size". The largest *pectunculiformis* seen from Phuket is 34 mm. The type is depicted in Oliver (1987 pl. 27 fig. 3-4).

NO4: ***Verilarca***: Oliver (1985) depicted most species. He considered both species of Thiele & Jaeckel, 1931, namely ***sinensis*** and ***aequilateralis*** as valid, a view recently shared by Robba et al. (2002). However, both of Thiele & Jaeckel's names are preoccupied. The very equilateral, larger *Arca* (*Barbatia*) *aequilateralis* has been renamed *thielei* by Schenck & Reinhart, 1938. The more inequilateral, higher, much smaller *Arca* (*Fossularca*) *sinensis* Thiele & Jaeckel, 1931 non *Arca sinensis* Philippi, 1851 remained apparently without new name. It has originally been described from Java, Surabaya, NE. Thailand, Padang and Hong Kong. However, Oliver (1990) stated the Padang material as belonging to *mortenseni*; leaving Java and Hong Kong as type localities for *sinensis*. Oliver (1985) depicted *sinensis* from Pakistan, Karachi, Thailand and Hong Kong. Additionally, specimens have been studied from Thailand, Phuket. All these appear too close to Iredale's ***bivia*** from N. Qld (types Lamprell & Healy, 1998 sp. 105, IRE39). Thus, a new name for *sinensis* seems currently not necessary and *Verilarca bivia* is applied for this regularly ribbed and widely distributed *Verilarca*. Vongpanich & Matsukuma (2004's pl. 1 fig. l-m "cf. *mortenseni*") appears instead to represent *bivia*, their *thielei* synonymy is erroneous, but the depicted specimen fits.

The related ***Spinearca***, treated here subgenerically, is similar in shape and dentition, but has a stronger ribbing, especially posteriorly. The type OD, ***S. deliciosa*** (Lamprell & Healy, 1998 text 104 and fig. **103**) from Australia and ***mortenseni*** from E. Thailand are close, the Japanese *fausta* has an even stronger sculpture.

Verilarca seems to live in rather deeper water, most members are quite uncommon and rarely found.

NO5: ***Estellacar***: Oliver (1987) treated this genus and recognized 3 species, a view shared. Without doubt the Australian ***saga*** is the largest species, found in sizes not nearly reported in Asia. Reeve's *olivacea* (type HIG01 B249) is reliably known from the Philippines, India and the Gulf of Thailand. The most common species, *olivacea* of modern Chinese and Japanese authors seems instead referable to Benson's more tumid ***galactodes*** with a rougher ribbing and a stronger periostracum. *Galactodes* also appears to be the smallest species.

NO6: ***Sheldonella***: Oliver & Cosel (1993) revised the diagnosis and placed the Caribbean ***A. bisulcata*** in *Sheldonella*. The Panamic ***olssoni*** is considered congeneric. It shares the byssal gap, the myophoric ridges, as well as shape and color with *bisulcata*. Oliver (2006) demonstrated a close relation of *olssoni* to *ponderosa*. However, as just these two species were included, the genetic results may change by a widening of the scope.

Petuch described ***Noetia*** (***Noetia***) ***lindae*** from Nicaragua. The ribbing exactly fits *bisulcata* studied from Brazil. The extension of the ligament in *bisulcata* is variable. In some, the umbones are in the middle of the ligament, in others, the ligament is mostly anterior. The colors, the dentition and the shape are as found in other *bisulcata* specimens throughout the range. BRASIL depicts a particular colorful specimen from Ceará. Furthermore, *bisulcata* is known from E. Panama, Colombia and N. Venezuela. I see no arguments to keep *lindae* distinct from *bisulcata*; *lindae* does not fit *Noetia* (*Noetia*).

Lamprell & Healy (1998 sp. 99) depicted the worn type of Iredale's ***venustopsis*** from N. Qld. They considered the preoccupied *Arca venusta* Dunker, 1852 as synonymous. However, Lamy (1907) had earlier synonymized *venusta* with Reeve's ***lateralis***. Following Vongpanich & Matsukuma (2004) the Australian *venustopsis* is considered the same as the widely distributed *lateralis*.

Oliver & Cosel (1993) listed *cafria* from SAF, Jeffreys Bay eastwards, and depicted *lateralis* from SAF, Natal. Kilburn (1983) compared local SAF material with two syntypes of *lateralis*, found them to agree exactly, confirming his earlier synonymy of *cafria* with *lateralis*. I do not fully understand Oliver & Cosel's arguments for a separation. For the time being Kilburn's view is followed.

NO7: As recognized by Iredale (1939) and later elaborated by Oliver (1990) ***Didimicar*** is not the same as ***Sheldonella***. Oliver (1990) accepted two species as distinct. He depicted many *tenebrica* forms throughout its range. *D. tenebrica* is extremely variable in shape. The more elongate Indian

Ocean forms seem at first glance distinct from the very humped, inflated Chinese and Japanese forms, but Australian specimens (= *repenta*) are just in between and intermediate well.

Oliver also depicted the uncommon, larger and tumid, posteriorly extended ***nigra***, currently only known from the Philippines.

Based on type material Oliver excluded the Japanese ***soyoae*** from noetiids, an opinion shared with Kilburn (1983). Here *Striarca* (*Spinearca*) *soyoae* Habe, 1958 is placed in *Calloarca*.

Oliver further demonstrated close affinities of *Didimicar* to *Striarca*, which obviously further diminishes the strength of subfamilies.

NO8: ***Striarca***: The type, OD ***centenaria*** is depicted in Newell in Moore (1969 fig. C10 1a-b). This shows an elongate-ovate, rounded shape, the continouous, uninterrrupted dentition and the very large muscle scars. The extension of the diamond shaped ligament is variable (e.g. *lactea*, *symmetrica*). As concluded by most authors ***Gabinarca*** has the same concept as *Striara*.

Important is the regular, uninterrupted dentition. This is not found in *Arcopsis*.

In the Med ***lactea*** the diamond shaped ligament may be very narrow, only covering a small area between the umbones or covering almost equally the whole dorsal area. In shape *lactea* is quite variable regarding height-length ratios and inflation. Kobelt (1888 sp 6. pl. 9) gives good examples. Whereas older authors recognized *lactea* along the WAF coast, Oliver & Cosel (1993) separated 2 ssp. However, in addition to "typical" short, inflated *lactea* in Ghana also typical, elongate ***epetrima*** forms have been found, but there just ***scoliosa*** should occur. On the other hand, quite similar shapes as found in the Gulf of Guinea are known from Greece or Italy. Furthermore, as characterized by Lamy (1907), *epetrima* closely resembles Payraudeau's *quoyi*, whereas typical *lactea* approaches Payraudeau's *gaimardi*. However, these forms have been synonymized by many authors. Considering the high variability seen in MED specimens, I fail to recognize these WAF ssp. other than expressions of a highly variable E. Atlantic species. Thus, Kobelt (1888), Lamy (1907) and Thiele & Jaeckel (1931) views are shared.

The number of IND *Striarca* is disputed. At least 8 names are available.

Oliver (1985) listed 6 *Striarca* species from the Indopacific and depicted 3 species. Later, Oliver (1995 sp. 930) depicted a specimen from the Gulf of Oman as *symmetrica*. It is assumed that this is the long ligamented 1985 sp. A (= pl. 1 fig. b) and probably also sp. B from his 1985 list. Oliver made a strong case against Kilburn (1983)'s monospecific opinion, and stated that in the W. Indian Ocean two distinct species occur. Iredale (1939) as well as Lamprell & Healy (1998) saw two distinct species in Australia, as usual also with distinct names. Reeve, 1844 based on the huge Cumingian collection saw two species in the Philippines – *symmetrica* and *zebuensis*. Vongpanich and Matsukuma (2004) saw only one species in Thailand waters and synonymized Reeve's *zebuensis* with the earlier *symmetrica*. Japanese authors quite uniformly only record *Striarca symmetrica* from Japan and unanimously synonymize *oyamai*.

Without larger series and the type material at hand, only tentative conclusions are possible. In the Central Western Indian Ocean (Kenya, Tanzania) indeed two distinct species occur, one fits the type ***symmetrica*** (HIG01 B245), Oliver (1995's sp. 920 *symmetrica*) and also Iredale's ***Gabinarca protrita***. As Oliver (1985) listed *symmetrica* also from Japan, it seems that *oyamai* is indeed the same.

Another species is more inflated, thicker, less regularly shaped, the myophoric ridges are lacking, the ribbing is finer and closer set, the diamond between the umbones seems consistently small. This second species fits Iredale, 1939's ***Gabinarca pellita***, Lamprell & Healy (1998's sp. 101 erroneously as "*afra*"), but also Krauss' ***gibba***, and is perceived as identical to Lamarck's ***pisolina*** (type: LA040 fig. 6-7 from Australia).

The third *Striarca*, Reeve's ***zebuensis*** from the Philippines has been considered distinct by Oliver (1985) with a much finer sculpture and anteriorly reduced shape compared to the more robust, rougher sculptered *symmetrica*. This view is shared; *zebuensis* appears to be quite uncommon and only a single specimen from N. Borneo fitted well.

Issel's Red Sea ***erythraea*** appears close to *symmetrica*. However, Oliver (1995) kept it distinct. Due to lack of sufficient material his view is followed.

Arca navicella is virtually never treated. It was described from the Philippines and placed by Reeve, 1844 near true *Arca*. Most older authors considered it as juvenile *navicularis*, but *navicella* has no byssal gap. Stevenson (1972) considered it as valid *Arcopsis*. However, the straight hinge line with about 35 teeth in the type series (4 syntypes, 6.9 - 8.8 mm) is weakend centrally, but uninterrupted, which fits instead *Striarca*. *Navicella* is closest to *zebuensis*, also finely sculptured, but posteriorly much more extended, the ventral side almost parallel and growing smaller than *zebuensis*. Numerous *navicella* specimens have been found in Punta Engano, Mactan Isl., at depths from 10 to 60 m, but all less than 10 mm. It is a whitish species, brownish speckled in some and considered to represent a valid Philippine *Striarca*.

Thus, currently 5 IND *Striarca* are recognized, of which 3 extend into or only occur in the Indian Ocean.

NO9: ***Mulinarca*** was placed in *Striarca* by Oliver (1985) and in *Arcopsis* by Newell in Moore (1968). As exemplified by divergent expert opinions, *Mulinarca* does not fit either well in hinge, shape or in sculpture.

Following Iredale, 1939 *Mulinarca* is here separated. The type species, OD ***aceraea*** (type: Lamprell & Healy, 1998 text sp. 103, fig. **104**) may be much wider distributed than only in tropical Australia; Vongpanich & Matsukuma (2004 fig. 1f-g) from Thailand and Matsukuma (1984 pl. 1 fig. 2) from Micronesia, Ponape may represent this species.

NO10: ***Arcopsis***: The type, SD ***limopsis*** is depicted in Newell in Moore (1969 fig. C10 6a-b). This represents a species similar to *Striarca* in shape, sculpture and diamond shaped ligament, but a centrally interrupted dentition. In general the diamond ligament is smaller than in *Striarca*.

Arca afra Gmelin, 1791 belongs here and is found in WAF only, as demonstrated by Oliver (1985) and Oliver & Cosel (1993). The IND species termed so by authors is distinct.

In addition, 2 American species, ***adamsi*** and ***solida*** are recognized by modern authors, not posing any issues.

Arca sculptilis Reeve, 1844 belongs also here, as stated by Oliver (1985) after examination of the types. *Sculptilis* was originally described from the Philippines, but is widely distributed from the Red Sea to Japan. It is a typical *Arcopsis* with a very narrow ligament, a strong cancellate, radial and commarginal sculpture, a comparatively broad hinge and pronounced divided, notched dentition, with the double number of posterior teeth. *Sculptilis* is the smallest of the global *Arcopsis*, not known larger than 8 mm, locally commonly found. Comparing with the many Red Sea, N. Borneo and Philippine specimens studied, the Chinese/Japanese ***A*. *minabensis*** (type HIG01 B247) is perceived also the same, as well as Melvill & Standen's ***margarethae*** from the Gulf of Oman. Habe in Koyama et al. (1981) just compared to *Striarca symmetrica*, but not with *Arcopsis sculptilis*. Melvill & Standen (1907) just compared to the remote *Acar domingensis*, but not with any of Reeve's species. However, the hinge reveals the arcopsid characteristics of *margarethae* as stated by Oliver (1995). *Minabensis* is distinct from the Indian Ocean *Ribriarca polycymoides* (syn. *Pectunculus ornatus*), as recognized by Vongpanich & Matsukuma (2004); Okutani (2000 pl. 425 sp. 48 "*polycymoides*") is instead Habe's *minabensis* (= *sculptilis*).

NO11: ***Ribriarca***: Following Vongpanich & Matsukuma (2004) Viader's ***Pectunculus ornatus*** seems indeed only a well preserved specimen of the partly worn ***Arca*** (***Fossularca***) ***polycymoides*** Thiele & Jaeckel, 1931. Kilburn (1983) further synonymized *Ribriarca okinawensis* with *ornata*. *Okinawensis* was described as Pliocene Okinawa fossil. It is open, whether *okinawensis* is indeed the same species or closely related only. At present, extant *polycymoides* is well known from the S. Indian Ocean, but is not recorded living further east than Thailand and N. Borneo. *Polycymoides* has a narrow ligament between the umbones and a weakly divided dentition with a small vertical slit. Compared to the easily confounded *sculptilis* the valves are generally higher, less carinate, larger and more inflated, the hinge indentation is just a vertical slit, not notching the hinge line as in *Arcopsis*. Most importantly, the surface sculpture is considerably distinct from the homogenous group of global arcopsids. Basically *polycymoides* has smooth valves with a commarginal sculpture. A tuberculed, dehiscent sculpture adheres, which is easily rubbed off and is usually only partly preserved. This is visible in Thiele & Jaeckel's type picture or in Vongpanich & Matsukuma (2004 fig. 2) and has also been found in all articulated valves collected off N. Borneo. This feature somewhat analogues *Granicorum*. *Ribriarca* is perceived as distinct lineage.

Mienis (2003) reported *ornata* from the Red Sea. Unfortunately, he gave no photos, just copied Kilburn's fig. 58. No true *polycymoides* was as yet seen from the Red Sea, but *margarethae* (= *sculptilis*) is found there (e.g. Egypt, Soma Bay, 6.8 mm). As described by Mienis *sculptilis* has a slit like ligament, and the hinge line is markedly notched as visible in the OD of *margarethae*. This indention of the hinge line is absent in *Ribriarca*, as is the presence of a dehiscent instead of a solid cancellate surface sculpture. It may be that Mienis characterised *sculptilis* instead of *polycymoides* from the Red Sea, as *sculptilis* was commonly found from Suez to Aden by Jousseaume in Lamy (1917).

6.13 CUCULLAEIDAE

NN1: ***Cucullaea***: Iredale (1939) included this group in arcids. Indeed, there are many similarities, but an extended phylogenetic analysis is lacking. For the time being, convention is followed.

The number of valid species is disputed. Lamy (1907) considered 2 species valid - *concamerata* and *granulosa*. Iredale, (1939) described two further species from E. Australia (*vaga* and *petita*) and considered 4 species distinct. Nicol (1950) discussed the genus and considered only *labiata* as valid, divided into 4 biogeographic subspecies. Oliver et al. (2006) stated 3 living *Cucullaea*, but gave no details. Here, 4 species are recognized.

C*. *granulosa described from China, recorded from Vietnam, Taiwan to Japan, is recognized as valid by virtually all modern authors. This is the smallest and a comparatively thin shelled species, additionally, with a strong commarginal feature giving the typical granulose appearance.

C*. *vaga described from NSW, was synonymized by Lamprell & Healy (1998) with the depicted northern *petita* and the specific data were confounded. However, *vaga* has been recognized as distinct by Nicol (1950) and by Allan (1962). The only *vaga* pictures found are Iredale (1936 pl. 20 fig. 1, NSW, small specimen) and Lindner (1975 pl. 52 fig. 9, Qld, Keppel Bay, medium size). Large specimens are even more elongate and measure more than 108 mm (NSW). Characteristic is the stronger, coarser sculpture of radial ridges and the shape in larger specimens, very elongate, posteriorly and anteriorly marked distinct in height. The hinge area is slightly narrower. Iredale (1930) further mentioned a much denser, silkier periostracum than in *petita*. *C. vaga* is restricted to NSW and S. Qld and from the data available lives much deeper than *petita*. It is not common.

The two other *Cucullaea* were first recognized by Chemnitz. It also appears that Abbott & Dance (1986 pl. 294 fig. 2 and 3) illustrated these two. Both species are found in the Indian Ocean and in the Philippines. Chemnitz 526-7 from Nicobar Isl. represents the heavy, solid, dark brown, boxlike species, with broad myophoric flanges and high prominent umbones, mainly found in the Indian Ocean (Arabia, India, Andaman Sea), rarely extending to the Gulf of Thailand and S. China, Beibu Gulf. His 528 from India, Tranquebar represents a distinct, generally smaller, generally lighter, whitish and reddish blotched or zigzagged species, with narrow myophoric flanges and low umbones. Unfortunately, Chemnitz gave no separate name to his species 528; he only characterized it as variety. This species is widely distributed, at least found from EAfr, Mozambique, Seychelles, tropical Australia and the Philippines. Chemnitz 528 is not, as usually assumed the Chinese/Japanese *granulosa*, but a valid species with a correct type locality.

Sowerby II in Reeve (1869) well recognized these two species from the same Indian Ocean locality and stated color and myophoric flanges as distinct. Unfortunately, he used the wrong names. Both names ***concamerata*** and ***auriculifera*** refer originally to the same species. *A. concamerata* was first validly used by Dillwyn, 1817. Dillwyn, 1817 included formally Chemnitz 526-528, and then characterized the heavy, brown, Andaman Sea species. Lamarck (1819) differentiated and only included Chemnitz

526 and 527 in his *auriculifera*, but characterized also the heavy brown species from the Indian Ocean. Gmelin and Röding did not differentiate and considered 526-528 the same. As well demonstrated by Iredale (1939) *concamera*, *concamerata*, *auriculifera*, *cucullata* and *cucullus* all represent the same species. The true identity of Lightfoot's earliest name *labiata* is unknown. However, all authors consulted (IRE39, NIC50, and REH67) consider it the same as *concamera*. Thus, ***C*. *labiata*** is applied for Chemnitz 526-527. *Labiata* represent *Cucullaea* typically and grows largest of the 4 *Cucullaea*.

Chemnitz 528 was not validly named until Iredale recognized the tropical Australian species distinct from *vaga* and named it ***C*. *petita***. *Petita* as studied from Qld and depicted by Iredale (1939) or Lamprell & Healy (1998 sp. 97) is indistinguishable from Philippine or Mozambique specimens and fits Chemnitz 528 and Sowerby's *concamerata* well. Iredale's is the earliest, valid name for this old, but usually confounded IND species.

Three main differences exist between *labiata* and *petita*. As early recognized by Chemnitz a clear distinction is found in the myophoric flanges, which are markedly narrower and less extended in *petita*. Furthermore, the extension of the umbones above the dorsal line is significantly lower in *petita*, *labiata* has more prominent, broader and higher umbones. In addition, *labiata* has generally stronger colors, often dark brown or orange brown, whereas *petita* is whitish, generally with zigzag lines.

6.14 GLYCYMERIDIDAE

NS1: This family has been treated by many authors, notably Reeve (1843), Angas (1872-9), Lamy (1912-16), Nicol (1945-1984), and Matsukuma (1979-84). Nonetheless, glycymeridids are still difficult. Some species (e.g. *glycymeris*, *striatularis*) display a mind-boggling variability; others are very homogenous. At least in some species juveniles differ markedly in shape and sculpture from adults, and I am not convinced that all small "species" are indeed valid adults. Furthermore, a couple of "well known" glycymeridids, e.g. *pectinata* or *reevei* are instead composed of 3-4 distinct species. The European *G. glycymeris* and *pilosa* are distinct as well and could even be attributed to distinct subgenera, due to their distinct ligament position. Some species are still barely understood, a couple others were properly described, e.g. Reeve, 1843 or Röding, 1798 but are as yet not identified.

Here 4 genera are considered distinct, encompassing more than 100 species, some species are undescribed.

NS2: ***Glycymeris***: Only 2 subgenera are perceived unambiguous: *Tucetilla* and *Glycymerula*.

Tucetilla Iredale, 1939 is nowadays accepted by most authors for rather fragile, narrowly ribbed, beaded species, usually with finer radial interribs, subequivalve, somewhat angled. Iredale restricted *Tucetilla* to the type OD, *G. capricornea* and ***G*. *tenuicostata***, and considered *crebreliratus* a synonym of the latter. From the Australian material (Shark Bay-Qld) studied, Lamprell & Whitehead (1992) is followed. They considered *G. tenuicostata* a quite variable species and the juvenile, white *capricornea* a further synonym. Other than pretended by Iredale (1939), Hedley (1906) had accepted a 27 mm Caloundra specimen conspecific with *capricornea*. Lamy (1912) based on *capricornea* material, sent to him by Hedley, identified *capricornea* also as *crebreliratus*. *G. tenuicostata* is variable in shape (ovate-elongate), in color (all white, almost brown, white with mottled and blotched brown), and in details of ribbing (from five strong radial interribs to none). *P. setiger* described from a juvenile NW. Australian specimen is the same, as concluded by Lamprell & Whitehead. Following Higo et al. (1999) I also fail to consider Kuroda's *amamiensis* as distinct. Zhongyan (2004 pl. 117 f H) depicted *Tucetilla tenuicostata* from China, which appears indeed very close to smaller Australian forms. *Tucetilla* is considered restricted to a few IND species; in addition to the type species *tenuicostata*, also including the uncommon ***mayi***, ***arabica*** and ***adenensis***. The rare ***pertusa*** may belong here, somewhat less the SAF ***connollyi***, but in juveniles above characteristics are present. Other species included here, e.g. the JAP *pilsbry*, but also the quite similar SA *radians* appear better placed in *Glycymeris*.

Glycymerula Finlay & Marwick, 1937 is accepted by NZ authors for the trigonal ***modesta*** without ribs, which appears superficially almost smooth, but has instead an exceedingly fine radial sculpture with deeply incised interspaces.

Veletuceta was introduced by Iredale, 1931 for smooth shells opposing the ribbed ***Tucetona***. Iredale did not accept *Glycymeris* for any Australian species. Although the type species, OD *G. flammea* Iredale, 1931 non Reeve, 1843 (= *grayana* Dunker, 1857) is a particularly smooth species, the concept of *Veletuceta* fits *Glycymeris* well, the microsculpture is the same. Following Beu (2006) *Veletuceta* is here understood synonymous to *Glycymeris*.

Axinola is considered intergrading to *Glycymeris* and also synonymized. The key to *Axinola* are the Japanese species. Typically *Axinola* is chalkier, and the shape in general somewhat more compressed, often trigonal, the umbones more pointed than in *Glycymeris*. Coan et al. (2000) placed here, in addition to the type species *septentrionalis*, also *keenae* and the Japanese *yessoensis*. However, another Japanese species fitting even better in *Axinola* is Dunker's *rotunda*. On the other hand both, *yessoensis* and *rotunda* are very close in sculpture and dentition to *aspersa*. Furthermore, *aspersa* shares many traits with the European forms, especially *nummaria*. Consequently, *yessoensis*, *rotunda* and *aspersa* have consistently been placed in *Glycymeris* by Japanese authors, and usually *imperialis* and *albolineata* as well. It is highly arbitrary to draw a line somewhere in between. Thus, *Axinola* is considered as neatly intergrading to *Glycymeris* and here synonymized.

At present the distinguishing features of ***Tucetonella*** are unclear. It has been variously treated by Japanese authors. Most placed here *munda* (syn. *planicostata* = type, OD) and some also *hanzawai* (Habe, 1971; HIG99). Higo et al. (1999) applied *Tucetonella* generically, Matsukuma (1984) accepted it subgenerically within *Glycymeris*, and Okutani (2000 pl. 427 fig. 5) placed *munda* in *Glycymeris* s.s., however, his depicted species is unlikely *munda*. Hylleberg & Kilburn (2003) recently reported *munda* as *Tucetona* from Vietnam, which makes understanding more difficult. Unfortunately, no growth series of *munda* were available for study. Matsukuma (1984) depicted a 14.1 mm specimen with flat, radial ribs and stated it rather common around SW. Japan and S. Korea. From the photos, *munda* (type

HIG01 B275, also Habe, 1971 pl. 50 fig. 5) and *hanzawai* (Okutani, 2005 fig. 2E, Habe, 1971 pl. 50 fig. 4) are not congeneric. The *munda* type 11.5 mm appears somewhat similar to juvenile *septentrionalis*. ***G. hanzawai*** has been placed as *Tucetona* by Matsukuma (1979) and recently by Okutani (2000 and 2005), a view here followed.

Glycymerella Woodring, 1925 is recognized by most authors, due to the unique condition of the umbones in the type species, OD *pennaceus* (= ***decussata***). The umbones are not central, but in front of the ligament (prosodetic) and the ligament almost inset. Lamy (1912 pl. 3 fig. 7 and 8) well depicted the conditions found in the CAR *decussata* and *undata*. Otherwise, however, *decussata* is extremely close to ***undata***. Both species attain a similar maximum size, share the same microsculpture, the same periostracum, and may have the same colors and the same shape; neither dentition, nor marginal crenulations offer distinguishing features. In some specimens studied the ligament condition is even not that clear cut. Due to its slight prosodetic umbonal position the 43.1 mm MHNG type of ***P. angulatus*** Lamarck, 1819 is placed as further synonym of *decussata*, but the distance to *undata* is slim. The Caribbean type locality is correct.

Another species known with a prosodetic ligament is the uncommon ***boucheti*** from the Indian Ocean. It has been described from the Seychelles and is also well depicted in Jarrett (2000 fig. 549 *tenuicostatus*). Furthermore, also the Med ***pilosa*** has a prosodetic condition, very clear in juveniles, less expressed in fully adult specimens, but still enough to differentiate *pilosa* from *glycymeris* and *bimaculata*. As this prosodetic ligament condition is the only justification for *Glycymerella*, Röding's ***Tuceta*** based on *pilosa*, SD Dall, 1909 would be older. It could even be construed that Poli's animal *Axinaea polyderma* lives in *Axinaeoderma pilosa*, and that the rejected ***Axinaea*** of Poli (Nicol, 1945) is the oldest name for the *Glycymerella* concept. However, the importance of a prosodetic ligament is not obvious. As otherwise *undata* is very close to *decussata* and *pilosa* very close to *glycymeris* and as *Glycymerella* is a junior synonym of *Tuceta*, these features are only mentioned specifically, *Glycymerella* is not recognized subgenerically.

The type species ***G. glycymeris*** proved highly astonishing. I long considered Linnaeus' "gibba" Atlantic *glycymeris* 1758 and the "aequilatera" Med *pilosa* 1767 synonymous, following here most European authors, apart from Poppe & Goto (1993). Particularly so, as very heavy forms, identical to Brittany specimens, are well known from the Mediterranean, and as quite inflated, inequivalve, but light forms are known from Italy and equivalve specimens are found in the Atlantic.

Then small true *pilosa* from Italy have been studied and an almost complete prosodetic condition with the ligament inset has been observed. Although the photos are not very good, it appears that these distinct hinge conditions are captured in Poppe & Goto (1993 pl. 3 fig. 10d and 12b). However, their *pilosa* and *glycymeris* shapes are rather untypical. This prosodetic condition in *pilosa* becomes weaker by age, but is still recognizable and served as the key to separate. On the other hand, in *glycymeris* the larger umbones are central, the ligament amphidetic. In addition, *pilosa* is typically more regularly ovate and has a lighter valve; the hinge line is usually weaker. Color is unreliable, both species may be white or brownish inside, also both are "pilosus", shape is not reliable and both may be inflated (uncommonly *pilosa*) or compressed (uncommonly *glycymeris*). ***G. pilosa*** is predominantly known from the Med and also appears to grow larger, the largest seen is more than 80 mm, but records go to 96 mm. ***G. glycymeris*** is more variable in shape and color and may even approach shapes seen in *reevei*, some specimens have quite strong commarginal lines, giving the valves a ribbed impression. Especially large specimens are quite inequilateral, as typified by Linnaeus. It is also much wider distributed from Hebrides, Scotland to at least Med, France and Italy, Sicily. However, it is only very common in the Atlantic, especially in Brittany and GB. It is not astonishing that approximately 10 names and a dozen of varieties have been created, most for the type species, Lamy (1912) treats many. The relation *glycymeris-pilosa* is identical to the relation *decussata-undata*. Both pairs are typically well recognizable, but in extremis difficult. A subgeneric or even generic separation appears exaggerated.

In Geneva (MHNG) the holotype of ***Pectunculus rubens*** Lamarck, 1819 MHNG 1086/33 could be studied, curated as *G. pilosus*. It indeed proved to represent a slightly inflated 70 mm *pilosus* with a still well recognizable prosodetic condition. *Rubens* is a new synonym of Linnaeus' species and its type locality is here clarified as Mediterranean. Unfortunately, Lamy never studied Lamarck's type and Reeve's interpretation is erroneous.

The third and most common Med species has a quite similar microsculpture. It is more inflated, rounded ovate in shape and the radial lines are more strongly expressed; it is purplish-reddish-brown, the maximum size studied is 79 mm, but it grows over 86 mm (Spain). The taxonomy is highly confused and many names have been applied in the past. Reeve (1843) used *P. violascens* (err. pro *P. violacescens* Lamarck, 1819); Hidalgo (1867) applied *P. gaditanus*; Lamy (1912) applied, based on fossil MNHN-types *Pectunculus cor* Lamarck, 1805; Nicol (1945) applied *G. nummaria* Linnaeus, 1758; Poppe & Goto (1994) applied *Arca insubrica* Brocchi, 1814. Finally, CLEMAM used *violacescens*, but listed 4 older names with question marks: Linnaeus' *nummaria* and *pallens*, Gmelin, 1791's *Cardium gaditanum* from Cadiz and Brocchi, 1814's fossil *insubrica*.

Here ***Arca nummaria*** Linnaeus, 1758 is selected as the valid, earliest name:

- It is highly unlikely, that Linnaeus should not have described the most common Med glycymeridid.
- Linnaeus' original locality fits well; *nummaria* is a predominantly Mediterranean species, from Gibraltar area to Israel, with only one lot seen from Canary Isl.
- Linnaeus' short OD is accurate enough to recognize the characteristic traits of a juvenile Med specimen
- In box 165 marked *nummaria* in the Linnean Society Collection a single valve ink marked 152, 30.2 mm represents the holotype.
- Nicol (1945) and Dodge (1952) clearly admitted identity of *nummaria* and *violacescens*. However, Dodge, ignoring Lamy (1912)'s analyses and against Nicol's statement, did not accept Linnaeus name. He believed better serving nomenclatural stability in adopting Lamarck's *violacescens*. Nowadays, Dodge's non-decision endangers stability as

exemplified by CLEMAM's 4 question-marks. To accept Linnaeus' London type renders doubts, whether Gmelin's 1791 *gaditanum* was the same, or whether Lamarck's 1805 *cor* was the valid, earlier name, or whether Brocchi's 1814 *insubrica* was the earlier name for *violacescens* irrelevant and stabilizes the nomenclature of this common Med species.

Arca pallens Linnaeus, 1758 must be considered a nom. dub. The two complete specimens in the Linnean Society box 158 represent also *nummaria*. However, these are unmarked and unlikely Linnaeus' original material. In Sweden no type material is available.

G. violacescens (= *nummaria*) is the type species, OD of ***Pseudaxinea***. Indeed, there are other specimens closely resembling *G. nummaria*; notably the Indian Ocean *livida*, the Japanese *albolineata* and somewhat less, also the Japanese *imperialis*. However, the characteristics are intergrading and *livida*, *nummaria*, *albolineata* and *imperialis* have been placed by virtually all authors in *Glycymeris*.

The fourth Med species is Poli's huge, ovate, uncommon ***bimaculata***, which represents, with 115 mm, the largest glycymeridid currently known. The umbones are central, also in juveniles, the hinge line much broader and the shell heavier than *pilosa*. It has a quite regular, fine radial sculpture, even better visible in juveniles. This species is not known outside the Med. Likely *Pectunculus lineatus* Philippi, 1836 may have been a juvenile specimen. *Bimaculata* is reliably known from Italian waters, Aegean Sea and Sea of Marmara, and has recently also been reported from Israel. The Gibraltar, Algeciras record of Aartsen et al. (1984) and doubtfully of Salas (1996) could not be confirmed.

The WAF species are not particularly well known either. ***G. scripta***, well depicted by Born, 1780 pl. 6, is a species found in the northern part of WAF in shallower water. The type is still present in Vienna. Reeve, 1843 depicted the correct *P. scriptus* (fig. 6) as also confirmed by Brauer (1878), but Caribbean or Asian localities are erroneous. Unfortunately, Lamy (1912) placed *scripta* in the Caribbean and did not correctly recognize Adanson's Le Vovan. He considered it distinct from *scripta* and created *Pectunculus vovan* "Adanson" Lamy, 1912 with reference to Adanson, fig. 10. However, in the 1940's Adanson's collection was rediscovered and published by Fischer-Piette (1942). In accordance to Adanson's text and picture his No. 10 Le Vovan proved indeed to be the same as Born's *scripta*. Lamy had a quite distinct species in mind; his pl. 3 fig. 5 is instead ***Venus stellata*** Gmelin, 1791 "V. testa orbiculari laevi aurea, stella ad umbonem candida". This is a characteristic, ovate WAF-species, extending to Canary Isl. and Madeira, brown-reddish with the white star umbonally. This species was known to Adanson, but he did not attribute a name, nor did he depict it. The earliest use of *stellata* was as *Arca* by Bruguière, 1789 (Enc. Meth., EAS85). Reeve (1843) depicted the correct *stellatus* (fig. 5), but with an erroneous locality. Smith, consistently used *P. stellatus*, characterized it 1885, compared it with European species and reported it from Canary Isl. Tomlin & Shackleford (1914) applied *Glycymeris stellatus* (Gmel.) and reported it from S. Tomé, further also from Principe, Senegal and Madeira. I see no reason not to accept ***G. stellata*** (Bruguière 1789) for this species. *Pectunculus vovan* Lamy, 1912 is an unnecessary nom. nov. with an erroneous reference, synonymous to *stellata*. From sculpture and shape both species *scripta* and *stellata* belong in *Glycymeris* s.s. *G. stellata* is more compressed, has more teeth, and seems less common. It does not occur in the Med, nor is it known from Portugal.

G. formosa is probably best known from the Cap Verde Isl., but is also found in the Gulf of Guinea.

The fourth WAF-species, with a known range from Mauritania to Angola is the most difficult. It is not excluded that Chemnitz 7 57 564 *Arca mutabilis* represents this species. At least *G. concentrica* from Senegal, well depicted by Ardovini et al. (2004) is very close. However, as far as is known, Chemnitz' species has never been latinized. Both, Röding (1798) and Lamarck (1819) considered it the same as "*glycymeris*" L., the latter though with a question mark. Usually ***P. concentricus*** Dunker, 1853, conditionally "described" from a single valve found in Angola, Loanda, is applied. Reeve, 1843 described earlier *Pectunculus spadiceus* from unknown locality. Subsequently *spadiceus* was placed throughout the globe: in Japan, in New Caledonia, in WAF and in CAR. Smith (1872) recognized Reeve's ***spadiceus*** as from WAF, living in Benin. Tomlin (1926) confirmed this WAF presence of *spadiceus* and compared it with *connollyi*. The two BMNH 196727 syntypes of *spadiceus* are still present. They clearly have a prosodetic ligament condition which excludes *concentrica* with central umbones. From the other known species, *pilosa* and *boucheti* are marked distinct; but the Caribbean *decussata* shares indeed many traits with *spadiceus*. Thus, *G. concentrica* is considered the 4th valid WAF species and *spadiceus* synonymous to the Caribbean *decussata*.

Despite Prashad (1932)'s comments, together with Lamy (1912) and Oliver (1992 and 1995) I fail to discern *heroicus* from ***lividus***. Specimens dived in Eilat are indiscernible from Arabian specimens. Also more ovate, less inequilateral forms are found in the Red Sea as well depicted by Oliver (1992 fig. 4); Persian Gulf specimens may indeed internally be all white (Oliver, 1995 sp. 937), but often reddish brown blotches are visible. The color is usually uniform brownish, but may turn into brown-yellow or brown-red, occasionally whitish around the umbones. *G. livida* is a variable species in shape, less so in color, quite widely distributed in the Indian Ocean and known to India, Mozambique (coll. auth.) and Mascarenes. The largest specimens, more than 80 mm, are reported from the Red Sea.

A.* (*P.*) *arabica has been described by H. Adams from the Red Sea and is unanimously understood as small, inequivalve, angulated species with *P. savignyi* as synonym (Oliver, 1992; DEK00). The largest specimens seen are approximately 15 mm; Oliver (1992 pl. 4 fig. 8) depicted a similar sized species, but gave 20 mm as maximum size.

However, in the Red Sea a second species might occur. It is stronger ribbed, also stronger beaded, more compressed, inside vividly deep purplish brown, white at the margins. Jousseaume in Lamy, 1916 recognized it as distinct and reported it as ***P. adenensis*** from Suez to Aden. Specimens dived in Eilat, 7 m, conform well to Jousseaume's OD. According to Jousseaume *adenensis* is more common than *arabica*; certainly, more material is necessary for a better understanding.

In Arabian and Indian waters a closely similar species occurs, but it is more rounded, larger and more variable in colors. Oliver (1995 sp. 938) depicted it as *cf. arabica*. However, this fits Angas' ***G. taylori*** well. Angas, 1879 (upper, left fig. 3) gave 31.8 mm, but no locality. Lamy, identified specimens from Karachi and Mumbai as *taylori* and stated a very fine regular radial sculpture. Kundu (1965) depicted *taylori* from NW. India. Melvill & Standen (1907) reported it as *taylorianus* from Oman and Karachi; specimens from Sri Lanka have been studied as well.

A quite uncommon, large species has been described as ***Pectunculus queketti*** Sowerby III, 1897 from Natal, Durban. It is solid, ovate, with a pronounced radial, flat ribbed sculpture, white hinge with comparatively few broad teeth and quite typically vividly colored brownish scars as adult. As such it is very close to Reeve's enigmatic ***Pectunculus perdix*** described from the Strait of Malacca, but not reported since. Possibly *perdix* is the earlier name for *queketti* with an erroneous type locality. However, as no type could be located at BMNH and as the Strait of Malacca is not particularly well known, patience is indicated. *G. queketti* is currently only reliably known from a restricted area North and South of Natal, from Port Alfred to Mozambique, Nacala Bay. Barnard (1964) gives 78 mm as maximum size, the largest seen from Mozambique, Nacala Bay is 77 mm.

For the very numerous Australian species, the excellent work of Lamprell & Whitehead (1992) is largely followed. Two issues, namely ***cotinga*** sp. 4 and ***hedley*** **var**.? sp. 9 are discussed.

All evidence indicates that 4 similar, but distinct species are usually termed ***reevei***. Reeve's *angulata* (= *reevei*) is the glossy, largest, brownish species mainly known from the Philippines to Okinawa (Reeve, 1843 fig. 30; Kira, 1972 pl. 45 fig. 6; coll. auth.). In the many dozens *reevei* seen shape, coloring and microsculpture are quite constant. The species depicted by Okutani (2000 pl. 427 fig. 8) from Japan, Kii appears distinct and as yet **unnamed**. The ribbing is finer, the divided colors distinct. This species extends at least to the Marianas, Saipan; it is closer to the Australian *cotinga* and the Indian Ocean *hanleyi* than to true *reevei*. As stated by Iredale, 1939 ***G. cotinga***, the species known from NE. Australian and Coral Sea is markedly distinct from *reevei* in red-white color, rougher sculpture, and only about half the size of *reevei*. Another species confounded with *reevei* occurs in the Indian Ocean. This shares many traits with ***Axinaea hanleyi*** Angas, 1879. Iredale (1939) stated *hanleyi* not found in Australia, a view shared. Against Prashad (1932)'s comment on identity with *reevei*, *hanleyi* is perceived distinct. Neither this color, or pattern, nor the narrower shape is found in *reevei* and the chevron groove is broader. Nonetheless, Angas' BMNH 29.4 mm holotype described from unknown locality is only represented by a single specimen and the specimens identified so from the Indian Ocean (Andaman Sea to Madagascar) are close, also in sculpture, but not exactly the same. Definitely, the *reevei*-complex needs more work and material.

Axinaea fringilla described by Angas, 1872 from Qld, Port Curtis was not treated by Lamprell & Whitehead (1992), but mentioned by Lamy (1912) and by Iredale (1939). Angas described it as whitish with commarginal orange lines and small red spots. It was long thought to be identical to Lamprell & Whitehead (1992 sp. 9 *hedleyi* var.) from NWA. However, the BMNH holotype revealed a distinct sculpture with very low, broad, flat ribs and a markedly distinct dentition with very few, only about 15 separated white teeth in a curbed row; in shape and marginal sculpture, *fringilla* resembles *queenslandica*. I am neither fully convinced that Iredale (1939) discussed the same species, nor that the original locality is correct. Apart from the holotype no other specimen was seen to date. It is listed where originally described, but its true distribution is still somewhat enigmatic.

Lamprell & Whitehead (1992 sp. 9 *Glycymeris* (*Veletuceta*) *hedleyi* var.?) is distinct from *hedleyi*, but also from *fringilla*. It has been well characterized and stated 25 mm, NWA and living in littoral sand. It is here renamed ***Glycymeris*** **(*G.*)** ***lamprelli***. Compared to *hedleyi*, *lamprelli* remains markedly smaller, generally less than 20 mm, exceptionally up to 25 mm. The usually brown and more than 30 hinge teeth lie in adult *lamprelli* in a strongly curbed arc, whereas the dentition in similar sized *hedleyi* is white and above a gentle curbed bow. Adult *hanleyi* stay equilateral-ovate, whereas adult *lamprelli* become inequilateral and broader. Compared to *fringilla*, *lamprelli* is generally broader in shape and has many more, smaller, often brownish teeth. *Lamprelli* is found in a variety of brownish-white combinations, but is generally brownish inside, whereas *fringilla* is pure white. All specimens studied were found in NW. Australia (Broome - Port Hedland), where it is not uncommonly found intertidal.

One larger, elongated specimen from Port Hedland closely resembles Reeve's figure and OD of ***P. spurcus***. However, as Reeve's species was described from Central W. America and the type material is lost (MAA81), *P. spurcus* is considered a nom. dub. Matsukuma, 1981 demonstrated that the Japanese "*spurcus"* is instead a new species and named it ***shutoi***. The "*spurcus"* specimen depicted by Lamy (1912) is not identical to Reeve's type. Furthermore, *P. spurcus* was reported by Melvill & Standen (1907) from Karachi and Sri Lanka. Indeed, a few loose valves are known, which do not fit *taylori*, but are similar to *lamprelli*, though with an equally curbed hinge line and fewer teeth. This appears to be an **undescribed** species, which occurs at least from the S. Persian Gulf (coll. auth.) to Sri Lanka. Two strange records Odhner (1919 *radians*) from Madagascar and Majunga & Aungtonya et al. (1999 *pilsbry*) from Andaman Sea, Phuket may possibly refer to this undescribed species.

A mainly Chinese species, often confounded with *aspersa* is Dunker's ***P. fulguratus***; Koyama et al. (1981) or Higo et al. (1999) assumed *fulguratus* synonymous to *vestitus*. However, Okutani (2000) depicted it well as distinct from Amami Isl. Dunker, 1877 described and (1882) depicted *fulguratus* from a single specimen from "Japan". Dunker, 1877 described and (1882) depicted also *Pectunculus vestitus*, which is clearly distinct. The smaller and lighter *fulguratus* is not known from mainland Japan, but quite common in S. China, East China Sea including Amami Isl. and Southern Yellow Sea (N. Shanghai, coll. auth.). Dunker (1882)'s main differentiating feature of *fulguratus* against Reeve's earlier *flammeus* was shape; however, shape is quite variable in *flammeus*, as is color (whitish, whitish with red brown marks, blotches or flames, yellowish white with red brown marks, almost all red-brown). Specimens fitting Reeve's form and colors precisely are often found in the Southern part of China, Dunker's more ovate form is more commonly encountered in the North-eastern part of the distributional range of *flammeus*. The internal coloring and the dentition of *fulguratus* fits *flammeus* well. Thus, *fulguratus* is here synonymized. ***G. flammea*** has recently been found in large quantities in the South and East China Sea. It may be that Zhongyan (2004 pl. 117 G "*vestita*") is instead a small *flammea*. Reeve, 1843 did originally not give any locality. Here Taiwan is proposed, which is in the center of the distributional range. Iredale (1931) erroneously considered it Australian and created on *flammeus* non Reeve (= *grayana*) his *Veletuceta*. These two are congeneric, but the SE. Australian species is heavier, glossier, with more ribs, Reeve's characteristic colors are not found in Australian specimens. The largest *flammea* studied is 52.1 mm (S. China). ***Pectunculus scutulatus*** Philippi, 1851 described from Taiwan fits *flammeus* well, and is considered a further synonym.

Dunker's larger ***Pectunculus vestitus*** which reaches more than 70 mm is a well known Japanese species. However, Matsukuma (1979) considered *Pectunculus aspersus* as possible earlier name for Dunker's Japanese *G. vestita*. Higo et al. (2001 B264) depicted the type of ***G. aspersa*** and formally synonymized these two. Adams & Reeve's *aspersa* is another "Samarang" species. *G. aspersa* is not reliably known outside the biogeographic Japan. The original type locality Philippines, Sulu Arch. is considered erroneous and here corrected to Japan, Honshu.

G. longior from Brazil to Argentina is unique. The affinities to other species, except to the NZ *modesta*, are perceived as low and it may merit subgeneric distinction. It appears that just one, highly variable species is present. It is currently understood as *Glycymeris* s.l.

On the S. American coast another large, old species is found, namely ***Arca marmorata*** "Chemnitz" Gmelin, 1791. Macsotay et al. (2001) depicted it as cf. *maculata*. These two are indeed close and represent cognate species. Reeve's worn BMNH *marmorata* syntypes without locality appear to represent instead the Chinese *flammea*; but Philippi's ***hirtus*** described from Venezuela is this species. It appears that also Diaz & Puyana (1994 sp. 37 "*undata*") represents instead a small *marmorata*; currently *undata* is not reliably known south of Panama.

Röding's *Tuceta* remained largely enigmatic. However, ***Tuceta lentiginosa***, ***inflata*** and ***mytiloides*** Röding, 1798 have been accepted as validly proposed by Sherborn. A study of Bolten's type material in Gotha is pending.

NS3: ***Tucetona***: Following Nicol, *Tucetona* is applied for species with a commarginal base sculpture, prominent radial ribs, but no superimposed radial sculpture; the periostracum is weak.

In Lamarck's "Prodrome" of 1799 the genus ***Pectunculus*** was erected for this group, with *Arca pectunculus* Linnaeus as example (Dodge, 1947 p. 139). This species was formalized as type *Pectunculus*, SD Dall, 1909. Lamy (1912) understood it equally for today's *Tucetona* and used *Axinaea* for today's *Glycymeris*. Thus, Lamarck's preoccupied *Pectunculus* is a synonym of *Tucetona*.

Tucetopsis Iredale, 1939 refers to Gmelin's *amboinense* which is the same as Linnaeus' *Arca pectunculus* (MAA840). Though stronger, more nodulose ribbed than *flabellata*, *Tucetopsis* has been synonymized with *Tucetona* by virtually all authors.

Grandaxinea is indistinguishable. Iredale, 1931 did not give any characteristics and only named the type; possibly impressed by the huge size of more than 100 mm. However, large *magnificens* (= *laticostata*) are very close to the type species of *Tucetona* and do not display any significant structural differences. Juveniles are more compressed, with fewer teeth and more ovate. Consequently, *Grandaxinea* was not recognized by modern Australian or NZ authors.

Bellaxinea was introduced for the American fossil *intercostata*, which is identical in sculpture to *Tucetona*, but the prominent ribs radially split. Nicol & Jones (1984) included here the extant Panamic *T. multicostata*, *bicolor* and *chemnitzii*. However, Keen (1971) observed these split ribs in Panamaic specimens only occasionally. Furthermore, slit ribs are found in many more species occasionally, e.g. in adult *T. diomedea*, in *T. planata* or in some *T. guesi*, but were not seen in *chemnitzii*. *Pectunculus maskatensis* has been described with split ribs, but *maskatensis* (= *guesi*) is not particularly close to *multicostata* and has been placed in *Tucetona* s.s. by Matsukuma. *T. planata* has been described with divided ribs as well. However, Nicol (1951) stated for the synonymous *clarki* often with a shallow central groove, and in some specimens studied split ribs are virtually inexistent. A splitting in ribs is obviously neither a constant, nor a decisive trait and occurs in many quite distinct *Tucetona* globally. This trait is usually more strongly expressed in juveniles. As all structural features of *Tucetona* are present, *Bellaxinea* is here synonymized. Following Matsukuma (1979 and 1984) *Tucetona* is therefore understood homogenous without any extant subgenera. Genetic data, however, is lacking.

Following Lamprell & Whitehead (1992) Iredale's *superior* is the same as Angas' ***T. gealei***. It is a larger, solid, trigonal-ovate species, with almost square ribs, strongly imbricate. The sculpture is well depicted in Iredale (1939 fig. 15b). *Pectunculus robustus* Sowerby III, 1883 from unknown locality was compared by Lamy (1912). It is almost identical to Iredale's figure of *superior*. In shape the Qld forms appear more ovate, whereas the NSW forms studied are slightly more trigonal. *T. gealei* is uncommon, but is widely distributed on the S-E coast. ***T. hoylei*** from N. Australia is more regularly ovate, and appears to grow smaller (type: MAA82 fig. 9). Closely related is *T. subpectiniformis* from Japan (type MAA80 fig. 1). However, Matsukuma kept them distinct. Reeve's less broad, strongly nodose ***T. nodosa*** appears to represent an uncommon Indian Ocean species only. It is well depicted in Jarrett (2000 p. 123 as "*hoylei*") from the Seychelles. Chinese and Japanese *nodosa* records should be reanalyzed.

T. scalarisculpta is found also in SA, where it grows slightly larger with a few more ribs. It appears that Cotton (1961 fig. 40) from SA, Whyalla is instead this species and just his fig. 42 true ***broadfooti***. Lamprell & Whitehead (1992) depicted both species well.

G. prashadi has originally been described as 19.6 mm, ovate species with 23 ribs from Indonesia, *montrouzieri* as larger, 29.9 mm, trigonal-ovate with 19 ribs from New Caledonia. Iredale (1939) considered *montrouzieri* close to *amboinense* and placed it in *Tucetona* (*Tucetopsis*).

Matsukuma (1980) considered *montrouzieri* and *prashadi* as *Tucetona* and only accepted *vitrea* and *planata* as *Melaxinea*. However, in 1982 Matsukuma depicted the holo- and paratype of *prashadi* and placed *prashadi* in *Melaxinea* due to a shallow groove at the center of the ribs. Higo et al. (1999) synonymized *prashadi* with ***montrouzieri*** (type HIG01 B282) and placed both in *Melaxinaea*. Neither view is shared. Compared with the unique *Melaxinaea vitrea*, a position in *Melaxinea* is difficult to accept. For the time being, both species are considered distinct and placed in *Tucetona*. This complex needs growth series for a better understanding.

T. planata is sometimes placed in *Melaxinaea*, due to similarities in ovate shape or inner ventral crenulations. *Axinactis* (*Melaxinaea*) *clarki* was described as much larger, 50 mm species from the Philippines; the holotype is depicted in Abbott & Dance (1983 p. 295 fig. 11). Matsukuma (1980) synonymized *clarki* with *planata*. This, but not the placement in *Melaxinaea*, is shared. The low number of 24 rather broad, somewhat square, slightly grooved ribs, the moderately inflated shell in full adults, with a convexity to height even slightly above 0.5, and also dentition approach *planata* to the *pectunculus*-group. *Melaxinaea* is perceived as distinct in ribbing, convexity and dentition. The largest *planata* studied is 50.5 mm (Phil, Bantayan).

In the ***pectunculus*** complex 5 related species are differentiated: *pectunculus*, *audouini*, *maskatensis* (= *guesi*), *kilburni* and *tsugioi*, excellently treated by Matsukuma (1984). He identified true *pectunculus* as the species with the white hinge plate, comparatively few, often nodulose ribs, and comparatively small interstices. Thus, Gmelin's *Cardium amboinense* and Lamarck's *Pectunculus pectiniformis* are the same. This species is commonly found in Indonesia and the Philippines, extending to Okinawa and tropical Australia.

In the Indian Ocean (Red Sea-Natal-WA) a distinct species occurs, equally large, hinge plate brownish, ribs further apart. This is Smith's famous "*pectunculus*" and Kilburn's *maskatensis*. It was described as new subspecies *audouini* by Matsukuma, 1984 from Mozambique. However, ***Pectunculus audouini*** was already applied by Jousseaume in Lamy, 1916 and has been well characterized. Oliver (1992) accepted Jousseaume's name and thus, 1916 instead of 1984 stands. As stated by Dekker & Orlin (2000) the species depicted by Oliver (1992 pl. 4 fig. 5 as "*pectunculus*") is instead *audouini*. In Arabian waters *audouini* becomes quite colorful, also living there very shallow in muddy sand. True *pectunculus* is not known from the Red Sea, or from Arabia. The largest *audouini* studied came from Kenya and Port Hedland, WA, both more than 56 m, but from Kenya *audouini* is recorded up to 64.3 mm.

The smaller, more colorful species, usually more compressed, with a finer dentition, broader and almost square, occasionally split ribs, from Aden and Arabia was identified by Matsukuma (1984) as *maskatensis*. However, Jousseaume, 1895 earlier described this species as ***Pectunculus guesi*** from Aden and Lamy (1916) corrected his 1912-view and synonymized these two. Another, much smaller species ***T. odhneri***, somewhat similar in shape and color, but with a much finer dentition is reliably known from NW. Australia. The species so named by Swennen et al. (2001 sp. 43) from the Gulf of Thailand appears distinct, umbonally broader, larger and more vivid in color and squarer ribbed. Iredale reported *odhneri* up to 22.5 mm, Lamprell & Whitehead (1992) gave 20 mm, the largest studied from Port Hedland, is 25.7 mm.

In the Andaman Sea, offshore coral reefs, a species, 31.7 mm very similar in unique shape to *T. auriflua* has been dived. It has about 25 ribs, a very broad hinge plate, outside white with pink, inside all white. A juvenile 16.7 mm Andaman specimen approaches *mindoroensis* described by Smith, 1916 from a 9 mm Philippine specimen. Matsukuma (1980) placed it as *Tucetona*. The shape, the number of rounded ribs, the strong hinge plate, the strong dentition, the highly unusual and rare pink color, the fine lamellae on and between the ribs of the Andaman specimens fitted the minute BMNH holotype of ***Tucetona mindoroensis*** well. *T. mindoroensis* appears to be a rare species, currently only known from offshore islands in the Philippines and Andaman Sea, living in 20-25 m.

All Hawaiian species appear to belong to *Tucetona*. Closest affinities exist to Panamic species. Dall, Bartsch & Rehder (1938) recognized 8 species. Kay (1979) accepted 6 as distinct and depicted the 4 common ones. Furthermore, Severns (2000) depicted a sp. which might be *T. kauaia*. As the number of ribs may vary significantly in *Tucetona*, it is not excluded that *kona* is a synonym *kauaia*. The USNM types could be studied. Both, species have been described from a single left valve only, the *kauaia* valve twice the size of the *kona* valve; their variability is currently not known. However, it is most likely that these two are conspecific and that only 5 *Tucetona* occur in Hawaiian waters.

In juvenile Panamic ***T. multicostata*** the ribs are very narrow and almost smooth, in full adult they are stronger separated and densely commarginally lamellate ventrally. Colors seen are wood-brown, violet-brown, blackish-brown. Lamy (1912) synonymized Angas' *P. cardiiformis* described from unknown locality. Matsukuma (1980) confirmed Lamy's view. At present, no other *Tucetona* is known fitting Angas' OD better. ***Pectunculus parcipictus*** Reeve, 1843 (March) syn. *P. raripictus* Reeve, 1843 (Oct.) was early synonymized (Carpenter) with *multicostata*, accepted by subsequent authors, e.g. Lamy (1912), Bernard (1983), Skoglund (2000). In the BMNH general collection a wood board with 3 glue points, but only 2 large specimens present from M.C. was found, labeled *parcipictus* Reeve, loc. - ?. Reeve's depicted specimen, which may have been the third, is missing. Concluding from the 2 remaining species, the synonymy matches.

Keen (1971)'s view, that Dall's ***chemnitzii*** nom. nov. *minor* Orbigny is conspecific with *multicostata* is not shared. Also not shared is Olsson (1961)'s view, that *chemnitzii* is a synonym of *strigilata*. Instead *Tucetona chemnitzii* is a smaller valid species as recognized by Dall (1909), cognate to the CAR *pectinata*. Orbigny's BMNH-type of *minor* has been studied. Reeve (1843 sp. 28) depicted it well from Ecuador as "*pectinata*". *T. chemnitzii* also occurs uncommonly in the Galapagos Isl.

In the *strigilata-tesselata-pectinoides* complex 2 species are perceived distinct. ***T. strigilata*** (syn. *tesselata*) is smaller, with approximately 20 low ribs, often strongly colored rose-brown or yellow-brown; the PAN *strigilata* is considered cognate to the CAR *sericata*; *strigilata* is generally more inflated, stronger ribbed and higher in shape.

The other species, ***T. pectinoides*** has approximately 30 stronger ribs, grows larger, and is only known in white profusely variegated and spotted with red brown. All specimens of *pectinoides* seen so far came from Panama Bay, whereas *strigilata* is much wider distributed. Lamy (1912) considered *pectinoides* valid as well. However, his date of 1836 for Cuvier's pl. 87 is replaced by Sherborn's 1843.

In the CAR at least 7 *Tucetona* species occur. Most of Reeve's unresolved *Tucetona*, described from the "Indian Ocean" revealed instead a CAR origin.

T. sericata is not well known, it is mainly found in the West Indies, where it grows more than 25 mm. It is moderately (juv.) to strongly inflated (adults) with 25-30 ribs, finely commarginally striated passing the ribs and the interstices. It is usually found in rose, rose brown or yellow brown colors. However, it also is found in Florida, e.g. West side, Cayo Costa Isl. The number of ribs is only about half of *subtilis*, which also remains much smaller. Lamy (1912) stated that *P. morum* was never reliably reported from Madagascar. Reeve's figured BMNH type of ***Pectunculus morum*** from "Madagascar" proved indeed to be a comparatively large, 21.4 mm, rose colored *sericata*. Identical specimens are known from the Grenadines. Nowell-Usticke, 1959's ***Glycymeris gordoni*** from St. Croix is *sericata* as well. In 1969 Nowell-Usticke recognized this by himself and named it *sericata var. gordoni*. The syntype of *Glycymeris gordoni var. tobagoensis* from the same author is depicted in BOYKO fig. 6. From sculpture, umbonal and marginal ribbing it also matches *sericata*. Similar shapes are known from Florida and the West Indies.

T. pectinata is variable in number of ribs, but quite constant in color and sculpture and grows to approximately 25 mm.

In addition to the minute, porcellaneous ***T. subtilis*** at least one other small *Tucetona* occurs, known from Brazil, Bahia, 25-35 m, 13.7 mm. This appears **undescribed**. For another small species from E. Panama, 6-8 m also no name was found as yet. Furthermore, Diaz et al. (1994 sp. 40) depicted another small *Tucetona* from Columbia.

The larger, deeper living *Tucetona* from Espirito Santo, Brazil, named *pectinata* by Brazilian authors is distinct from Gmelin's species. It is higher than typical *pectinata* which is almost round; it grows larger, more than 30 mm. The hinge line is much broader and internally it is generally all white, whereas *pectinata* is mottled brownish white. The ribs average 25 and the interstices are broader. Whereas true *pectinata* is commonly found subtidal within 10 m, the Espirito Santo species lives sublittoral 10-75 m. This Brazilian species fits Reeve's BMNH-holotype of ***P. pallium*** precisely. Lamy (1912) mentioned, that Reeve's species has never been reliably reported from the original type locality "Zanzibar" or elsewhere from the Indian Ocean and stated a Caribbean species identical. In the BMNH general collection there is indeed a further identical species labeled St. Johns, Antigua. As conspecific specimens from Brazil have been studied, here Vitoria, ES, Brazil is corrected as **type locality**. *Tucetona pallium* appears to extend much wider, also throughout the lower West Indies.

Finally, a quite large *Tucetona* is known from the Grenadines, E. Panama and Venezuela, measuring almost 40 mm. Very likely, this species has also been included by authors in "*pectinata*". However, it grows almost twice the size of true *pectinata*, is trigonal ovate, white base-color with golden brown to dark brownish marks. Reeve's remark that the base-color is dark is in reality reversed, larger specimens have even weaker brownish golden blotches. The hinge line is much broader than in *pectinata*, but instead of white, characteristically rose-purplish to brown colored beneath the comparatively few and large white teeth. This species fit's Reeve's BMNH syntypes of ***P. oculatus*** precisely. Admittedly, Reeve's fig. 38 is not very precise, but at least the type locality West Indies is correct. It is possible that Macsotay et al. (2001 cf. *tessellata*) is instead a juvenile *oculata*. *Tessellata* itself is Panamic only, synonymous to *strigilata*.

The true identity and locality of ***T. aureomaculata*** Angas, 24.6 mm, with 25 strong ribs described from Eastern Seas is still open. The type in BMNH did not fit anything as yet seen closely.

6.15 LIMOPSIDAE

NR1: This family is not well known and was even included in glycymeridids by early authors. In modern literature, due to the small differences among species, many errors are found. Furthermore, limopsids heavily suffered under early statements, e.g. Smith (1885), Lamy (1912) or Prashad (1932) who synonymized too many species and confused subsequent authors. Here *multistriata*, *forskalii*, *woodwardi*, *japonica*, *compressa* and *excancellata*, or all of A. Adams, 1863 species except *philippii* are considered valid with a clear biogeography.

Especially Habe (1953), Tevesz (1977), and outstandingly Oliver (1981) contributed to this difficult family of mostly smaller and uncommon species.

In generic groupings various opinions persist. Iredale (1929-39) created a multitude of genera, most not accepted by subsequent authors. Modern Australian authors use two subgenera: *Limopsis* and *Pectunculina*, the latter for radially sculptured species, following here Newell in Moore (1969). Modern Japanese authors use 5 genera for their 10 extant species (*Limopsis*, *Crenulilimopsis*, *Empleconia*, *Nipponolimopsis* and *Oblimopa*). Tevesz (1977) accepted two genera, the dorsally indented *Empleconia* as monospecific and placed all other species in *Limopsis* s.s. In turn Oliver (1981) sunk in *Empleconia* based on growth series, transferred *Nipponolimopsis* in PHILOBRYIDAE and defined 13 classes for approximately 50 recognized species. Coan et al. (2000) and Beu (2006) retransferred *Nipponolimopsis* in *Limopsis* and Beu (2006) only accepted one genus. Oliver & Allan (1980) did not report significant anatomical differences among species from 4 groups.

Going through the global limopsids three conclusions occurred; first, quite distinct groups exist, and Oliver's analysis proved to be an excellent base; second, almost all of Iredale's groupings are useful; third, no feature is perceived convincing enough for a generic distinction. As concluded by Beu (2006) a split into various genera appears without strong genetic data premature.

LIMOPSIDAE is a large family of more than 80 species globally, and, additionally, at least 5 undescribed species. Subgenera are perceived useful to highlight specific features and similarities in limopsids. Comparatively, 13-16 subgenera are well justified. Thus, Oliver's approach is largely followed and here approximately 15 subgenera are considered useful. *Pectunculina* itself appears as fossil European group only. None of the extant species encountered was perceived very close, nor is any of Lamprell & Healy's "*Pectunculina*". Well preserved species of the Oligocene *L. retifera* Semper, 1861 (= type *Cosmetopsis*) with a weaker radial sculpture, or the Eocene *P. nuculatus* (= type *Cnisma*) were not available. These are currently considered fossil only.

Fortunately, most of **Oliver's groups** had been named previously and many of his concepts could be translated in existing taxonomical units, some already applied in modern literature. All of Iredale's genera, except *Circlimopa* are restored as subgenera; *Versipella* and *Senectidens* are not well known. In two clear cases new subgenera are proposed. In three cases more material and research is necessary for firm conclusions.

- Oliver's group I equals ***Felicia***. As diagnosed, it is quite distinct from the minute *Limopsis* s.s. which is restricted to very few species.

Oliver (1981) tentatively included in this group also the minute, smooth NSW *paradoxa*, allocated to ***Glycilima*** and, for once, well described by Iredale, 1931. However, *paradoxa* does not fit the quite homogenous *Felicia* group and is kept separate. It is most likely that *L. penelevis* is the adult form and the earlier name. *L. crassula* from Japan appears close. Both species are placed in *Glycilima*.

- Oliver's group II is close to group I. However, differences in solidity and convexity, hinge type, and marginal crenulations at least in *chuni* and *sansibarica* exist. Unfortunately, the extent of variability in *belcheri* is still too little known for a firm decision. The included 3 species *chuni*, *belcheri* and *sansibarica* are for the time being placed as **unnamed** (**II**).

- Oliver's group III = ***Empleconia*** has a clear diagnostic as adult: indentation. Otherwise, *Empleconia* is extremely close to *Felicia* as stated by Oliver (1981); when genetic data is available, it may even fall in synonymy. A generic distinction is perceived exaggerated. *Empleconia* is perceived as weak subgenus.

- His group IV equals ***Limopsis s.s***.

- Group V encompasses *L. erecta*, which has been designated type, OD of ***Aspalima*** by Iredale. The Japanese *crenata* and *Crenulilimopsis* have the same base concept and fit, though larger, group V quite well.

- His group VI appears too close to group V; additionally, 2 former group VI species *panamensis* and *juarezi* have in the meantime been synonymized with 2 group V species *diazi* and *stimpsoni* (Coan et al., 2000); *galatheae*, the single species left, shares many traits with the *cristata* complex and is included in group V.

- Group VII, including *natalis* and *marerubra*, is recognized as distinct and here named ***Paracratis***. It shares some features with *Cratis*, but a cap and perpendicular denticles are lacking. The SAF ***L. natalis*** is here designated as type of this new subgenus. All species are small, less than 14 mm, subquadrate-oblique, have special postero-ventral internal ridges, a reduced dentition, a heteromyarian condition, and a finely crenulate margin. The periostracum is rather sparse. At present the biogeography of *Paracratis* is around Africa.

Lamy (1912) placed here also the very juvenile *L. davidis* from Micronesia. However, here even the familial attribution is unconfirmed. Less similar seems Prashad's *dautzenbergi* from Indonesia; here the ventral margin was said to be partly smooth, which, when confirmed, would rather approach *Nipponolimopsis*. Both species were not treated by Oliver (1981) and both are virtually unknown.

- Oliver's Group VIII is an assemblage of 3 unrelated species and is dissolved. *Limopsis antillensis* is superficially similar to *Limopsis natalis*. However, ***antillensis*** belongs in philobryids. It has small perpendicular denticles left and right of the trigonal ligament pit and beneath few teeth. Except cap, which is not visible in adults, it fits the condition found in *Cratis*. It has been placed there together with *L. pentodon* by Moore (1977). Oliver (1981) placed in group VIII also ***L. elachista***, but this species is not particularly close to *natalis*. Therefore, Oliver & Zuschin (2000) removed it from this group. It is not well understood and placed as s.l.

- Group IX encompasses *Oblimopa macgillivrayi actaviva*, termed type, OD ***Oblimopa*** by Iredale. This name is in constant use in Japanese literature for this well known group.

No author is known, who followed Iredale (1939)'s distinction in *Oblimopa* and *Circlimopa*. Japanese and Australian authors synonymized and Oliver (1981) diagnosed both types as belonging to his group IX.

- Oliver (1981) placed in Group X a wide Australian assemblage *loringi*, *soboles*, *dannevigi* and tentatively also *eucosmus*. Iredale created for these ***Loringella***, 1929, ***Versipella***, 1931 and ***Senectidens***, 1931. Lamprell & Healy (1998) even synonymized *dannevigi* with *soboles*, but gave no arguments for their action. Lamprell & Healy (1998 sp. 119) depicted the *dannevigi* lectotype, with the misleading depth of *soboles*. The syntypes of *V. soboles* are AMS c24366 (TEVES), but these were never figured (IRE62). From Iredale's remarks *Versipella* is a bathyal species from 550 m and closely resembles May (1958 pl. 1 fig. 12 *tenisoni*). ***Loringella*** is perceived restricted to *loringi* only. Oliver's analyses may have been based solely on this species. His bathymetric range from 40-70 m just fits the depicted *loringi*, but excludes *soboles* and *dannevigi*.

Versipella, on the other hand, is applied for *soboles* and *tenisoni*; ***Senectidens*** fits *dannevigi* and *eucosmus* well and somewhat less *bassi*.

- Group XI encompasses another difficult SA pair. Cotton (1961) and Oliver (1981) kept ***vixornata*** and ***occidentalis*** separate, Lamprell & Healy (1998) synonymized without arguments. They only applied the smaller size and the restricted SA locality and depicted a small *vixornata* (sp. 107). However, Oliver (1981 fig. 23) shows a 10 mm SA-*vixornata* which does not appear identical to Cotton (1961)'s 11.5 mm *occidentalis* from quite distant SWA, Bunbury. Obviously, larger series are not available, and for the time being both species are considered distinct. Oliver (1981) diagnosed this group XI as marked distinct, with a lacking byssal gland. However, as the precise features of *Versipella* and *Senectidens* are currently not known, a taxonomic unit seems premature. However, if the lack of a byssal gland is confirmed, this could even lead to generic distinction in this conservative group. For the time being *vixornata* and *occidentalis* are placed **unnamed** (**XI**).

- Group XII is identical to Iredale's ***Phrynelima***. Amamo and Lutaenko (2004) recently placed their newly described *oliveri* here.

- Group XIII is unique in biogeography, dense pilose and persistent periostracum and ovate, inflated shape. It is neither close to *Limopsis* nor to *Felicia* and here named ***Oliveropsis*** as defined by Oliver (1981). The name honours the author who contributed most to our knowledge of this difficult family. The ARG/MAG *L. hirtella* is herein designated as type of this new subgenus; quite close is the ANT *lilliei*. Oliver (1981) also included here the other southern pair *scotiana* and *enderbyensis*.

- Furthermore, the similar, but uncommon MED ***L. tenuis*** and ***L. angusta***, as recently analyzed by La Perna (2000) do not well fit any group and require further distinction. These two are placed as **unnamed** (**XIV**).

Very roughly main features are here condensed. Oliver, 1981 gives more details.

I	***Felicia***	Large, compressed, ovate, smooth margined, hinge type A,B, dense periostracum
-	***Glycilima***	Medium, smooth shell, smooth margins, weak periostracum
(**II**)	unnamed	close *Felicia*, more inflated, usually crenulated margins, hinge type C
III	***Empleconia***	posterodorsal indentation
IV	***Limopsis s.s.***	Small, cancellate, smooth margin
V	***Aspalima*** (syn. *Crenulilimopsis*)	Small, cancellate, crenulate margin
VI	-	integrated in *Aspalima*
VII	***Paracratis*** subgen. nov., type herein *L. natalis*	Quadrate-oblique, cancellate, margin weakly crenulate, internal posteroventral ridges
VIII	-	dissolved
IX	***Oblimopa*** (syn. *Circlimopa*)	Medium, trigonal-ovate, strong radial ribbing, margins smooth
X	***Loringella***	Large, trigonal-quadrate, solid, finely cancellate, rose white
-	***Senectidens***	Oblique-ovate, broad ligament; largely unknown
-	***Versipella***	Trigonal-ovate; largely unknown
(**XI**)	unnamed	Small, thick, equilateral, smooth margins, bladelike foot without byssal gland
XII	***Phrynelima***	Small, special hinge, produced prosogyrate umbones, smooth margin, hinge type A
XIII	***Oliveropsis*** subgen. nov., type herein *L. hirtella*	Medium, ovate, inflated, pilose and persistent periostracum, hinge type D, margin smooth
-	***Nipponolimopsis***	Small, prodissoconch capped in juveniles, marginal grooved and smooth
(**XIV**)	unnamed	Small, ovate, decussate, deep byssal notch, brown tinged umbonal area, margin largely smooth

NR2: ***Limopsis***: The types of *japonica* and *forskalii* are depicted in HIG01 B2161 and B261s. Despite the synonymization by most Japanese authors, Oliver (1981) kept them separate. Both have been found in Japan and conform well to Adam (1863)'s quite precise OD's and to his comparisons. As stated by Adams ***L. forskalii*** is more trigonal in outline, the cancellation is stronger and regular and the hinge is more arcuate. Furthermore, the ligament pit in *forskalii* is larger and *forskalii* grows up to 17 mm. ***L. japonica*** in turn is ovate to oblique, more compressed, shouldered, the cancellation weaker and the hinge plate straighter. *L. japonica* has only been found smaller than 14.5 mm. In color they may be very close; the margin in both may be virtually smooth. Dunker (1882 pl. 16 fig. 5-6 "*woodwardi*"), Tsuchida et al. (1991 pl. 3 fig. 3 "*japonica*") or Okutani (2000 pl. 426 fig. 5 "*multistriata*") are instead *forskalii*. As stated by Higo et al. (1999 *L. soyoae*) (type HIG01 B261s) appears as juvenile *forskalii*. *L. japonica* seems restricted to the Japan Sea and to off Taiwan, whereas *forskalii* is wider distributed. Zhongyan (2004 pl. 117 fig. k "*japonica*") from S. and E. China are perceived as *forskalii*.

Reeve's preoccupied *cancellata* was described as minute *Pectunculus* from Singapore. As recognized by Iredale (1939) Sacco, 1898 renamed it *L. excancellata*. Material, 5-14.6 mm found in nearby N. Borneo, 35-40 m fits *excancellata* well. ***L. excancellata*** appears to be the only *Limopsis* found in the enlarged Gulf of Thailand as also observed by Lynge (1909). Smith (1916) reported *cancellata* also from the Philippines. Adams compared Reeve's minute *cancellata* with his small ***japonica*** and considered them distinct, a view shared. *L. excancellata* is similar to *forskalii*, but even stronger sculptured and with more teeth in similar sized specimens. All three species remain small, only *forskalii* surpasses 15 mm. The often confounded *woodwardi* and *multistriata* are both distinct, growing much larger and are biogeographically restricted. Oliver (1981) considered all involved species, even *soyoae*, distinct and placed them in his class IX (= *Oblimopa*).

Forsskål's type material of ***multistriata*** is lost, but a specimen collected by him is depicted in Chemnitz 7 58 573 (YARO). This figure is taken to represent Forsskål's ***species***. It shows a larger, solid, oblique-trigonal, somewhat inflated, strongly sculptured, orange brown species, with a smooth margin and a darker colored hinge line. Specimens closely resembling have been found in Egypt, Soma Bay. Thus, true *multistriata* is quite close to *forteradiata* from S. Australia (COTT fig. 30), but marked distinct from the species depicted by Lamprell & Healy (1998 sp. 112, = **fig**. **113**, see errata) under this name. *Multistriata* is also known from Kenya (Oliver, 1981 fig. 18), Mozambique, Maputo Bay (coll. auth.) and Durban Bay (Steyn & Lussi, 1998 sp. 789). It is variable in convexity. Rather compressed as well as strongly inflated forms are known. There is little doubt that Adams' *philippii* meant an inflated *multistriata*. His OD fits *multistriata* specimens found in Mozambique well. True *multistriata* is a comparatively large limopsid, living quite shallow, reaching more than 26 mm. It seems restricted to the Western Indian Ocean; Philippine, Australian or even Japanese records refer to other species.

Oliver (1981) stated another *Oblimopa*, described from the Andaman Sea as valid: ***Limopsis compressa*** G. & H. Nevill, 1874. The Nevill brothers described their species as compressed, ovate with prominent central umbones. Outside it is whitish, with a dense periostracum, inside whitish, usually brownish around the hinge or even marginally. This fits neither *philippii*, nor *multistriata*, or *cancellata*. *L. compressa* appears widely distributed in the Indian Ocean. Specimens well fitting have been studied from Tanzania and W. Australia, but not from the Red Sea. Oliver (1992 pl. 4 fig. 7 "*multistriata*") does not conform to Forsskål's species, but may be a misplaced *compressa*. Furthermore, Lamprell & Healy (1998 sp. 112, = fig. 113) with a highly misleading synonymy is perceived as *compressa* as well. Specimens from WA have been studied, but a Qld presence could not be verified. Close to *L. compressa* is *L.* ***tenuiradiata*** from SA.

From the OD and biogeography, it is very likely that ***densestriata*** Thiele & Jaeckel (= *cancellata* Martens, 1889) is a further synonym of the tropical E. Australian *woodwardi*.

L. erecta from NSW appears to remain small, approximately 6 mm. However, I fail to discern *Aspalima solator* also described from NSW, but of smaller size. Oliver (1981) included *erecta* and *idonea* in his group V (= *Aspalima*). He did not mention *solator*, possibly not recognizing it as valid

L. bassi, *tenisoni*, *soboles*, *danneviga*, *penelevis* and *eucosmus* is a very difficult assemblage. The reddish-brown tinted ***L. bassi*** was early synonymized by Australian authors with the white *tenisoni*. Both have been described from Tasmanian waters. However, Smith's OD and the specimen depicted by Oliver (1981 fig. 19) do not fit the syntype of *tenisoni* (Lamprell & Healy, 1998 sp. 117). ***L. bassi*** was properly described by Smith, 1885 from Tasmania, Bass Strait, but not recognized by May. However, May (1958 pl. 1 fig. 11 "*eucosmus*" non Verco) appears instead to represent true *bassi*. *L. bassi* is here considered a valid sublittoral species, quite large with 22 mm, clathrate sculpture and smooth margin, reliably known from Tasmania.

The identity of ***L. eucosmus*** Verco, 1907 has been variously interpreted. Cotton (1961 fig. 28) depicted, if not the type, then at least a topotype from Cape Jaffa. This is a solid, compressed, cancellate, 8 mm specimen with a smooth margin and sparse dentition. Oliver (1981 fig. 22) depicted a huge 21 mm Australian Bight specimen which may be the adult *eucosmus* form. Lamprell & Healy (1998 sp. 120) a 6.5 mm, very distinct brownish ovate species with crenulate margin appears as juvenile glycymeridid, probably *hedleyi*. *L. eucosmus* is considered a valid species, possibly reaching 21 mm, reliably known from SWA and SA.

Closely related to *eucosmus*, somewhat less to *bassi* is the NSW-species depicted by Lamprell & Healy (1998 sp. 119) which fits Iredale's OD of ***Senectidens dannevigi***. According to Tevesz (1977 p. 60) this is indeed the lectotype of *dannevigi* from off Gabo Isl. (AM E4832). Oliver placed *bassi* close, but outside of his Class IX. *L. dannevigi* was placed in his Class X, but Oliver's analysis was focused on *loringi*. *L. eucosmus* was placed close, but outside his class X. Here ***Senectidens*** is considered as fitting well for *dannevigi* and *eucosmus*, and somewhat less for *bassi*; all three SAU species are placed in *Senectidens*.

Tenisoni has a distinct shape (type Lamprell & Healy, 1998 sp. 117), but occurs also in Tasmania (May, 1958 fig. 12). However, Cotton (1961 "*tenisoni"*) is quite distinct and appears to be the same as his *tenuiradiata*. Iredale, 1931 created for ***soboles Versipella***. Oliver (1981) considered *tenisoni* as member of his group IX, and *soboles* in group X; but his analysis of group X focuses on *Loringella* and does not fit *soboles*, described as bathyal species. Shape and sculpture of *tenisoni* do not match group IX, which otherwise contains strongly radially sculptured species, instead *tenisoni* appears similar to *soboles*. Thus, tentatively ***Versipella*** is applied for these two species, *tenisoni*, living shallow and growing larger, and *soboles*, living deeper and remaining smaller.

Cotton (1961) depicted a topotype of ***penelevis*** from Beachport; Lamprell & Healy (1998 sp. 106) is conspecific. The smooth *L. penelevis* fits Iredale's *Glycilima* well. However, it should be confirmed, that *paradoxa* is indeed a distinct species. From Iredale's OD and type (Lamprell & Healy, 1998 sp. 108) ***paradoxa*** is perceived as the juvenile form, giving *penelevis* a full S. Australian distribution from SWA, Eucla to NSW, Wollongong. May (1958 pl. 1 fig. 13) depicted it from Tasmania, said to be rather commonly found there. Oliver (1981) placed *paradoxa* tentatively near class I and *penelevis* tentatively near class X. However, both fit neither *marionensis* nor *loringi* and ***Glycilima*** is applied for this smooth species. *L. crassula* from Japan with a sparse periostracum appears close and is tentatively also placed here.

Definitely, the very numerous Australian limopsid fauna with more than 15 species needs more work and above conclusions need confirmation.

Smith's ***indica*** as originally described and depicted (ANA09 pl.3 fig. 4) is a solid, medium sized, lower bathyal species from Indian waters. As stated by Knudsen (1970) it appears that larger and deeper records from the Indian Ocean are instead referable to *tenella*. On the other hand, Thiele & Jaeckel, 1931 described a solid, similar sized bathyal species from Indonesian and their ***siberutensis*** should be compared to *indica*. Obviously, Oliver (1981) considered these two related as well. *L. indica* and *siberutensis* appear closest to *Felicia*.

Sowerby III's ***L. tajimae*** has been synonymized by Koyama et al. (1981) with the earlier ***L. tokaiensis*** Yokayama; a decision followed by Higo et al. (1999), but not by Okutani (2000). Yokoyama described *tokaiensis* as common fossil and in 1920 reported it also living off Boso. In shape, sculpture and hinge *tajimae* is perceived as very close and Koyama and Higo are followed. They also synonymized Oyama's *uwadokoi* with *tokaiensis*. However, 500 m deep, ovate, densely ribbed and quite heavy specimens from Kuril Isl., Iturup, also from 400-450 m Hokkaido have been studied. These have been identified as *uwadokoi*. In addition to the more inflated, heavier shell, and the distinct periostracal hairs, also the hinge line, is quite distinct; instead of a restricted, centered ligament as Oliver's type A, an enlarged type B is found, a condition close to *marionensis*. Following Habe (1953) ***L. uwadokoi*** is considered a valid species; it appears as cold water, deep living instead of tropical and shallow. In ovate shape and in broad, smooth margin it is closer to *tokaiensis* than to *belcheri*, where Evseev and Yakovlev (2006 p. 40) recently synonymized it. As stated by Coan et al. (2000) *uwadokoi* is close to *akutanica* from NW. USA. However, the periostracal hairs in *akutanica* appear even finer, the ligamental pit rather approaching type A than B and the shape somewhat more rounded-ovate. In addition, biogeographically no intermediaries are known, thus, these two are kept separate. Modern Japanese authors place *tajimae* (= *tokaiensis*) and *uwadokoi* in *Limopsis* s.s. However, these two are not close to the European type species. Yokoyama (1920) considered *tokaiensis* very close to *marionensis*. Consequently, Oliver (1981) placed *tajimae* in his group I (= *Felicia*) and this course is also shared for *uwadokoi*.

Pectunculus belcheri is difficult. The type is depicted in HIG01 B255. Oliver (1981) placed *belcheri* and *chuni* in his class II and accepted a "Korean Sea" distribution for *belcheri*. At first, *Pectunculus belcheri* was attributed by Adams and Reeve, 1850 to SAF (Cape of Good Hope). A. Adams (1863) later corrected "believed, to be obtained from the Korean Isl." Prashad analyzed the type specimen and compared to shells from the Sulu Sea, obtained by the Siboga expedition. He came to the conclusion that they were synonymous and proposed a Philippine distribution. However, his shells were "dead and worn" and the specimens depicted measure only slightly more than 10 mm. On the other hand, Evseev and Yakovlev (2006) placed *belcheri* as cold water species in Russian waters and considered *uwadokoi* the same. Japanese authors saw *belcheri* in Japan. Okutani (2000) named his limopsid No 1, p. 857 *L. belcheri*, but the depicted species pl. 426, No. 1 has been correctly named *L. tajimae* (= *tokaiensis*). ***L. belcheri*** grows at least 28.5 mm, has a ligament type C, is obliquely ovate, has acute umbones, the periostracum is yellowish and the ventral margin is typically very finely crenulate. Species well fitting are known from the East China Sea, off China, Zhejiang. Zhongyan (2004 pl. 117 L "*tajimae*") depicts instead a small *belcheri*. No *belcheri* was seen from Russia, or from Korea, or from Japan. Philippine material was not available, but a tropical distribution EChi-Phil is not excluded. The crucial point in *belcheri* is the marginal crenulation. This is in most Chinese specimens very weak or even absent, but at least in some *chuni* studied the anterior marginal crenulation is almost absent as well; otherwise, *belcheri* closely resembles *chuni* in shape, inflation, rather rough sculpture, dentition and narrow, central ligamental pit. Oliver's view is followed and both are placed in the unnamed group (II). The Japanese *L. tokaiensis* has a broader ligament type A, is typically more compressed, more elongate, less solid, the periostracum brown and finer, and generally the umbones broader and less acute.

Oliver & Allen (1980) split the *cristata* complex in 4 forms. Oliver (1981) recognized them specifically; namely ***cristata***: Norway to Canary Isl.; ***affinis***: Massachusetts-Florida; ***intermedia***: Suriname; ***lanceolata***: Angbas, Angola, 11°S to Namibia 23°0'S, 12°45'E (= type locality). Although small Floridan *affinis* are very close to European *cristata*, obviously in full adults the differences become more pronounced. Furthermore, apart from biogeography, Oliver & Allen added differences in maximum size and in periostracal bristles. I see no reason not to follow their precise view. Thus, *cristata* does not occur in US waters, but is European only.

L. aurita from Europe and similar specimen from the West Indies are depicted in Oliver & Allen (1980), obviously considered conspecific. However, although similar sized, clear differences are perceivable in hinge, scars, and periostracum. Whether therefore ***L. a. paucidentata*** Dall, 1886 from Jamaica is indeed the same species, should be analyzed with larger series. The latter is only with reservation listed in synonymy.

Unresolved are Dall's minute ***radialis*** and ***onchodes*** from N. Fla/S. Georgia; these appears neither close to *antillensis* nor to *affinis*, or to *paucidentata*. Oliver did not mention them.

Oliver (1981) placed his ***L. surinamensis*** in group I (= *Felicia*). Deep water specimens from Venezuela, off Orinoco Delta have been studied and his view is shared. On the other hand, ***L. janeiroensis*** appears in sculpture, dentition and periostracum closer to the type species and is placed in group IV (= *Limopsis* s.s.). Both are superficially close and smooth margined. The sculpture is stronger cancellate in *janeiroensis* and the dentition posteriorly regular.

Specimens from northern WAF, at least the crenulated, ovate "*aurita*" depicted by Ardovini et al. (2004 p. 259) from Mauritania matches Philippi's OD of ***minuta***. Salas (1996) could neither detect major differences between recent and fossil material. She considered, as before Lamy (1912), *borealis* the same and gave for *minuta* a range of 309-1527 m and a size of 7.5 mm. Oliver & Allan reported it from 390-2938 m and gave a maximum size of 9 mm. Whether, on the other hand, Verrill & Bush (1898) and Rios (1994) ***minuta*** are indeed referable to this species is doubtful. At least their pictures are barely fitting, but Smith (1885) reported *minuta* also from WInd, 713 m. Certainly, the Caribbean "*minuta*" need clarification. Adams' SAF ***abyssicola*** is close to the European *minuta*, but is found shallower (usually 55-180 m), grows larger (13.6 mm), is more oblique, and broader than the European species. *Anceps* from the same area is considered synonymous, described from a smaller, less oblique specimen. Thiele & Jaeckel (1931) remarked in *anceps* close similarities to philobryids, but considered *anceps* a true *Limopsis*. Oliver placed *minuta*, *abyssicola* together with *natalis* in group VII (here termed *Paracratis*).

The Mediterranean species have been well discussed by Salas (1996) and La Perna (2000). Unfortunately, they did not treat ***Limopsis concinna*** H. Adams, 1870 from the Canaries, an ovate species, with few teeth, 4 mm, crenulate margin. *Concinna* may have been the earlier name for *L. friedbergi*, which commonly occurs there. Lamy (1912) briefly mentioned it, but could not resolve it. However, the type could not be located in BMNH and *concinna* is treated as nom. dub.

Beu (2006) discussed the NZ species. He separated ***lata*** from ***tasmani*** (depicted in POW fig. 89 1-3), stating the latter as more circular, having a periostracum with shorter, more curled bristles and with a stronger radial sculpture, whereas in *lata* the commarginal ridges are more prominent and the bristles longer. He mentioned an undescribed small species with smooth margin from the Tasman Sea and at least two other undescribed small species from Northern NZ. Specimens studied from off E. S. Isl., 47.1°S, 178.2°W somewhat resemble *lata*, but were outside the reported range and from much deeper water 2100-2170 m.

Dell (1964 and 1990) treated the ANT species. ***L. longipilosa*** is still somewhat shaky. Dell concluded it first as synonymous to *marionensis* and later either synonymous to *marionensis* or then valid. Pelseneer, 1903 described in the same article *laeviuscula*, considered nowadays synonymous to *marionensis*. Pelseneer further collected a couple living *longipilosa* and compared them with minute, ovate, crenulated species. A synonymy of *longipilosa* with *marionensis* appears unlikely. Oliver (1981) considered *longipilosa* as valid and placed it in his group V with crenulated margins. Another species, biogeographically quite close, ***L. perieri***, also barely known, has been placed by him also in group V. Oliver (1981) obviously considered both as close, but distinct. Lamy stated these two close as well, but distinctly shaped. Soot-Ryen (1951) depicted an 8 mm more oblique *longipilosa* from Palmer Archipelago, which leaves some doubts in distinctness. For the time being both species are listed in *Aspalima* as distinct, but further work is here necessary.

6.16 PHILOBRYIDAE

NU1: This is a difficult and underestimated bivalve family. Largely, Tevesz (1977) is followed. He depicted the type species of 9 genera and his definitions are perceived as accurate. Dell (1964 and 1990) treated ANT philobryids. Very unfortunately, Dell (1990)'s announced family revision was never published.

Philobryids are closely related to limopsids, as evidenced by *Cratis*, *Nipponolimopsis*, and *Paracratis*. Hayami & Kase (1993) even considered *Cratis* as "intermediate genus between the PHILOBRYIDAE and the LIMOPSIDAE".

The inclusion of ***Lissarca*** in philobryids by Tevesz (1977), Oliver (1981) and Dell (1990) is followed. *Lissarca* is not perceived close to limopsids in texture and dentition, sharing also some philobryids features in anatomy.

Verticipronus was not accepted by Tevesz (1977 p. 29) as philobryid genus due to an external ligament and the dentition with a strong cardinal, which is indeed atypical. He stated vague relations to CYAMIIDAE. However, this alternative appears even less fitting. Furthermore, *Verticipronus* is mytiloid, capped, shows an anatomy close to *Philobrya* and is brooding (SOO60). Soot-Ryen (1960), Dell (1964) and modern NZ authors kept it in this family and unless a better alternative is proposed, this course is followed.

One extant species appears best attributable to ***Limarca***. Consequently here 10 recent genera are applied for global philobryids. The number of species is usually massively underestimated. At present approximately 100 species are recognized, but the number may, due to their mostly minute size, even be larger. Especially from WAF currently none are reported, but philobryids may be expected to be found in the southern part (Angola, Namibia) as well.

NU2: ***Philobrya***: Tevesz (1977) analyzed the hinge configurations of ***Notomytilus*** and ***Micromytilus*** and showed them variation of the philobryid hinge. Furthermore, *Notomytilus* and *Micromytilus* have the same commarginal sculpture and the mytiloid shape as found in the type species, ***P. setosa***. Tevesz also confirmed synonymy of ***Philippiella*** and ***Stempellaria***, earlier established by Dell (1964). The pinctadoid ***Hochstetteria aviculoides*** was early synonymized with *Philobrya* by Bernard (1897), confirmed by Tevesz (1997) and Dell (1990). Soot-Ryen (1959), Dell (1990) and Forcelli (2000) considered Odhner's preoccupied ***Stempellia*** synonymous to *Philobrya*. Odhner's type designation *aequivalvis* is OD, not MT.

This is an extremely difficult genus, especially the ANT species are close to each other. Dell (1964) listed the species, probably belonging to *Philobrya*; here the large majority is perceived as valid. Dell (1964 and 1990) treated many philobryids and elaborated the sculpture of the prodissoconch as decisive. Furthermore, Hain (1989 pl. 12) illustrated a growth series of *P. sublaevis* with a quite remarkable change of shape during its growth. However, in this case the pinctadoid shape is preserved during its growth. On the other hand, Soot-Ryen (1960) stated for his newly described ***P. sivertseni*** a marked variability in shape from mytiloid to quadrate.

Smith, 1885's preoccupied ***Mytilus meridionalis*** was recognized by Thiele (1912) to be a philobryid, confirmed by Soot-Ryen (1951). The BMNH types (2 single valves, 1887.2.9.3154) were depicted by Dell (1990 pl. 4 fig. 10 and prodissoconch: p. 164 fig. 2, 2) and recognized as distinct from *sublaevis* and from *kerguelensis*. In addition to the pinctadoid shape, with prominently erect, flattish umbones, the prodissoconch has strong raised radials. The type locality of the depicted larger 6 mm specimen is off Prince Edwards Isl., in 100-150 fathoms. The smaller specimen was found between Kerg and Heard Isl., 52.1°S, 71.4°E in 150 fathoms. However, *Mytilus meridionalis* was applied earlier by Krauss for the well known SAF *Choromytilus*. This was recognized by Barnard (1964), but his solution, Lamy's *desolationis* is instead a true *Mytilus*. On the other hand, Powell (1957) considered Thiele's ***P. laevis***, originally described from Kerg, as within the variability of the preoccupied *meridionalis* and synonymized these two. Although there are slight differences in prodissoconch sculpture in the OD's, for the time being Powell is followed.

Philobrya kerguelensis Thiele & Jaeckel, 1931, weakly pinctadoid, with an almost central umbo seems to be a true *Philobrya*. However, it is preoccupied by *Mytilus kerguelensis* Smith, 1885 (= *Philobrya*, type DELL64 pl. 4 fig. 11). These two were described from the same locality, but are quite distinct, also in marked mytiloid shape of *kerguelensis*. *P. barbata*, also from Kerg has a distinct position of the umbones. *Mytilus laevis* also known from Kerg has the same pinctadoid shape. However, the prodissoconch in these two might be distinct, strongly radial for *meridionalis*, whereas for *kerguelensis* it was stated smooth. The type of *kerguelensis* is not listed from MfN and probably lost. Thiele & Jaeckel's preoccupied species is currently considered a nom. dub.

Forcelli (2000) well depicted ***P. antarctica***. He synonymized ***magellanica*** from the Magellan Strait, but also ***Avicula*** (***Stempellia***) ***aequivalvis*** from Juan Fernandez Isl. Ramorino (1968) reported *brattstroemi* from Valparaiso and Malchus (2006) analyzed ***P. brattstroemi*** from Chile 41.5-41.9°S. Malchus just compared *P. brattstromi* (sic) with *magellanica*, but not with the more obvious *aequivalvis*. Odhner (1922) considered both, his new ***aequivalvis*** and the distinct *magellanica*, as belonging to his new subgenus *Stempellia*. From the OD's, biogeography and morphology *magellanica* is perceived as junior synonym of ***antarctica*** and *brattstroemi* as junior synonym of ***aequivalvis***. *P. aequivalvis* is a Peruvian species 33-41.9°S; the broader and larger *P. antarctica* seems MAG only.

Oliver (1915) reported 2 species *P. meleagrina* and *Cosa costata* from Kermadec Isl. Both records should be reanalyzed. Otago did not incorporate these.

NU3: ***Limarca***: ***Hochstetteria munieri*** Bernard, 1896 was described from an erroneous type locality Med, Cape d'Agde (CLEMAM). It is a unique pinctadoid 4 mm species, with a hinge close to *Philobrya* with an elongated ligament, but with two parallel teeth anterior and strong posterior marginal crenulations or "marginal teeth". The elongated ligament does not fit *Cratis* with a trigonal ligament and generally stronger sculptured species, nor does it fit *Auporia* with a trigonal ligament and solid, smooth valves. These two would have anterior teeth, whereas *Philobrya* is edentate. The condition found in *munieri* is closest to the Eocene ***Limarca angustifrons***. *Limarca* fits also in shape, somewhat less in surface sculpture. *H. munieri* is tentatively placed here, but may possibly need a new genus, once refound. Bernard's other species from the same erroneous Med locality *Arca vivipara*, has been analyzed by Lamy (1907) and stated the same as *miliaris*. Thus, it is not excluded, that *munieri* came also from MAG or ANT.

NU4: ***Adacnarca***: *Adacnarca and Lissarca* are close in ovate shape, weak sculpture, generally lacking a clear umbonal collar or cap as adults. However, *Adacnarca* has no teeth, just perpendicular denticles. *Lissarca* has anterior and posterior teeth, occasionally also weak perpendicular denticles.

Lissarca harrisonae and ***Lissarca pileopsis*** are perceived as very close. Both have been described from the same location, NZ, Puysegur Point. Fleming (1948) considered *pileopsis* close to ***Hochstetteria trapezina***. All three are usually placed in *Lissarca* by NZ authors, but these do not fit there. They share the same special hinge configuration: no hinge teeth but with perpendicular denticles and a broad triangular resilium in between. The margin beneath the hinge is strongly denticulate. The umbones are small rounded and smooth. All three are ovate in shape with a weak sculpture and fit well in *Adacnarca*. Similar features are found in *velaini* (well depicted as *decapita* in Thiele & Jaeckel, 1931, pl. 6 fig. 30, 30a) or in *limopsoides* (DELL90 fig. 44). The denticles in the type species MT, *A. nitens* are narrower, less expressed but structurally identical (DELL90 fig. 43).

A. ornata shares the same features, though with weaker marginal denticles. The umbones were said to be radially striated, a condition as similarly found in *limopsoides*.

NU5: ***Lissarca***: Bergmans (1970) concluded ***picta***, ***elliptica***, ***rubricata*** and ***rhomboidalis*** as congeneric, a view shared. He well depicted *elliptica* and stated also in juvenile *rubrofusca* (= *miliaris*) narrow, weak perpendicular denticles. As later Tevesz, he considered *Austrosarepta* synonymous and considered *Lissarca* philobryid.

Dell (1990) commented on ***L. notorcadensis*** and noted it absent from Kerg. Thiele, 1912 described from there ***L. kerguelensis***. Thiele compared equal sized *gourdoni* (= *notorcadensis*) with his new species and stated equality in color and sculpture, but marked differences in shape. He had 3 pairs and a single valve from 113 m for comparison (MfN 30013). The validity of Thiele's species was early doubted. However, unless larger series prove the contrary, these two are considered distinct.

Thiele (1912) depicted and compared ***rubrofusca*** from Kerg and ***miliaris*** from Magellan Strait and pronounced them distinct, an opinion followed by some authors. The 4 mm syntype of *L. rubrofusca* from Kerg is depicted in Tevesz (1977 fig. 9 A-B). Dell (1990 fig. 53-54) depicted a 5.2 mm *miliaris* from near its Magellanic type locality, 54.4°S, 64.7°W. However, comparing these two, I fail to recognize them distinct in shape, position of the umbones, sculpture or dentition. Furthermore, the stated difference in position of the teeth for *miliaris*, namely a longer ligament and the teeth remote is found exactly in the syntype of *rubrofusca*, whereas Dell's larger *miliaris* shows a regular dentition as stated by Thiele for his Kerg specimen of *rubrofusca*. The only conclusion possible is that these two are synonymous and display some variability in teeth position during its growth.

On the other hand, Thiele's ***L. media*** also from Kerg appears quite distinct in ovate shape and more central umbones compared to the only slightly larger Kerg syntype of *rubrofusca* (= *miliaris*). Dell (1990, aff. *miliaris* fig. 45) though larger (7.7 mm) and deeper (383-494 m) appears close and might even be the same. If this proves correct, then *L. media* might be the third widely distributed ANT *Lissarca*, intermediate to *miliaris* and *notorcadensis*. However, here much more material is necessary for firm conclusions.

Tevesz (1977) reduced ***Austrosarepta*** on teeth features and synonymized it with *Lissarca*. However, the type MT, *picta* has another special trait, namely strong postero-umbonal internal ridges, and externally a specific carina. As this trait is found in *notorcadensis* or in *benthicola* quite similarly, Tevesz' synonymy is shared.

The minute NZ ***Lissarca stationis*** fits *Lissarca* best, where originally described by Fleming. Nonetheless, it has a minutely granular surface sculpture and if additional characteristics are found, then it may need distinction.

Thiele & Jaeckel's ***Lissarca clara*** appears rather limopsid than philobryid. However, as no locality is known and the type not located at MfN it is currently considered a nom. dub.

NU6: ***Cratis***: *Cosa* and *Cratis* may be very close. Both are usually strongly capped, usually pinctadoid and similarly strong sculptured. However, *Cosa* has no teeth, just perpendicular denticles; typically *Cratis* has a couple of strong anterior and posterior teeth, whereas perpendicular denticles are virtually absent. ***Cratis delicata*** Bergmans, 1970 has prominent perpendicular denticles and a small ligament pit as required for *Cosa*. However, beneath the denticles there is a single strong anterior and a single weaker posterior tooth. This latter condition obviously fits *Cratis*. ***Cratis kanekoi*** has a quite similar condition, but with one strong anterior tooth only, otherwise it closely resembles *delicata*. ***Cratis ohashii*** has the same dentition as *delicata*, but a quite distinct, densely cancellate sculpture. It may be that *Cratis delicata* and *kanekoi* were described from juveniles; however, *ohashii* is with 2.8 mm comparatively large. To include these species in *Cratis*, Tevesz's definition of *Cratis* has to be adapted to at least one strong anterior cardinal, and prominent perpendicular denticles may not be excluded.

Hayami & Kase (1993) discussed differences, and similarities to *Nipponolimopsis*.

The Caribbean ***C. pentodon*** appears similar to *C. antillensis*, but narrower in shape, with more acute and prominent umbones, and with 5 instead of 6 teeth.

Cratis thylicus does not resemble *progressa* and barely fits in *Cratis*. In addition, a juvenile condition can not be dismissed. However, I currently fail to propose a better solution.

NU7: ***Cosa***: ***Cosa tholiata*** is perceived as very close to ***C. waikikia***, also in sculpture of the prodissoconch; habitat and size would fit as well. Larger series should be compared to ascertain distinctness. *Cosa* sp. from Cocos-Keeling, depicted by Maes (1967) appears to be the same. Thiele & Jaeckel's ***C. pacifica*** has been described from Samoa. Obviously, the type is somewhat distinct from the original drawing and closely approaches in sculpture the locally common *waikikia*, which has also been reported from Samoa (KAS93). Furthermore, the shape of the prodissoconch of *pacifica* is close to *waikikia*. It is very likely that only one widely distributed tropical species is present, which received three distinct names. However, lacking sufficient material hinders here further conclusions.

The Caribbean ***Philobrya inconspicua*** has a triangular ligament pit which excludes *Philobrya*. It is otherwise pinctadoid, edentate, flatly capped, and has 10-11 slightly beaded radial threads with commarginal interribs. It seems that just on the posterior top a long row of denticles is present. *Cosa* has usually denticles on both side of the ligament pit. The condition in *inconspicua* resembles the condition found in *Neocardia*, but *Neocardia* has two strong teeth posteriorly. Thus, *P. inconspicua* is tentatively placed in *Cosa* where at least some features match.

Both SAF species ***paramoea*** and ***pileata*** appear close. The dentition and the ligament were not described and the inside never depicted. Due to the pinctadoid shape, a strong cap, a marked radial sculpture and unmentioned teeth, both are tentatively placed in *Cosa*. However, both types should be reanalyzed.

NU8: ***Neocardia*** with two parallel posterior teeth beneath the ventral end of the perpendicular denticles is well known from SAF. The adult form of the type species MT, ***angulata*** is excellently depicted in Bartsch (1915 pl. 39 fig. 6-7 as *alfredensis*). Barnard (1964) depicted the undulate-radial sculpture of the Prodissoconch.

Another SAF species is enigmatic. ***Hochstetteria limoides*** Smith, 1904 with two teeth beneath the denticles does not match the *Philobrya* condition. The interpretation of Barnard (1964) and Thiele & Jaeckel (1931) assumed a neocardiid dentition, which does not fully conform to Smith's OD. Smith placed these teeth "posticam", but also stated "posticum curvatum", and "latus anticum oblique truncatum". Turton, who procured the material stated radial ribs only, and described the juveniles as collared. It is tentatively placed here. As far as is known, the inside was never depicted. The type should be reanalyzed.

The unique neocardiid hinge configuration is also found in Thiele & Jaeckel's 1.6 mm ***Philobrya sp.*** pl. 2 fig. 34 from Cape Town. If Barnard's interpretation of *limoides* is correct, this may then indeed be the juvenile form, which shows a flat, also slightly radially ribbed prodissoconch.

NU9: ***Limopsilla***: Turton (1932 figs. 1490-1492) used three names to show an impressive growth series of the unique SAF ***Limopsilla pumilo***, of which his sp. (1492) equals Smith's syntype, depicted by Tevesz (1977). Turton's beach finds of more than a dozen valves in Port Alfred indicate that this SAF species may live much shallower than reported by Barnard (1964).

6.17 PINNIDAE

NY1: This is a misunderstood family specifically in IND and even more so in global genera. An in-depth analysis of the genetic relations is in urgent need. The sparsely available data (e.g. MATSU) show a comparatively close relation among various members, monophyly of the family is likely.

An in-depth, but mainly morphological treatment with the illustration of most IND type material is in work under the lead of P. W. W. Schultz, Germany.

Generically, only 5 species are perceived as true *Pinna*, only 3 species as true *Atrina*, and 1 species as *Streptopinna*. Above 40 pinnids seem to belong in distinct lineages, some **undescribed**.

In pinnids a high variability among specimens is encountered, variously interpreted.

Especially Rosewater (1961 and 1982) and Fischer-Piette (1974) interpreted this as intraspecific variability, whereas Reeve (1858-9), Winckworth (1929-36), Iredale (1939-62) and modern Japanese authors discerned distinct species. Instead of *Atrina pectinata*, Iredale (1939) saw *strangei*, *assimilis* and *serra* as valid species, but true *pectinata* not living in Australia. Rosewater and Fischer-Piette saw all three, and many more as synonyms of a no longer recognizable *pectinata*. Winckworth (1929) saw *atropurpurea*, *bicolor* and *attenuata* as distinct species in India. Rosewater and Fischer-Piette saw all three, and many more as synonyms of a widely distributed, but no longer recognizable *bicolor*. Reeve depicted more than 60 global pinnids, Hidalgo (1905) recognized 19 pinnids from the Philippines only, and Habe (1953) excellently treated 13 Japanese species.

Fischer-Piette (1974) with 21 recognized "species" equaled Rosewater's 20 extant "species". Unfortunately, Lamy never reviewed this family. Based on a recent analysis of MNHG, MNHN, ZMUC and especially BMNH-type material, Reeve's view proved, despite some multiplications, much sharper and closer to reality than Rosewater's and Fischer-Piette's misinterpretations.

In many obvious cases, notably in *P. bicolor*, *P. muricata* and in *Atrina pectinata* Rosewater's lumping views have been broken up by Australian, European, and mainly by Japanese authors. Turner et al. (1958) assumed globally 45 to 50 pinnids. Here, more than 50 pinnids are recognized.

Generically, Rosewater's view is even more difficult. He based reducingly on a single morphological trait. However, it is likely that an in-depth genetic analysis largely contradicts.

At least 6 distinct lineages appear confounded in ***Pinna***. Close to the type species *rudis* are *carnea*, *rugosa*, *electrina* and *fimbriatula*. Whether the exceptionally large *nobilis*, with juveniles considerably sculpturally distinct from adults, is indeed a true *Pinna* is open.

One of the most distinct species, in habitat, texture, muscle scars, and very small strongly divided lobes *P. epica* was even synonymized by Rosewater as anomalous form with *P. bicolor*. However, together with the bathyal living *linguafelis* the distance to the *Pinna* type species is so significant that rather generic than subgeneric distinction is indicated. These two are placed as unnamed (**I**). Here at least a new subgenus is necessary.

The rare Japanese deep water *Pinna cellophana*, though with a muscle configuration similar to *epica*, seems to represent a further lineage; the similarities to the E. Atlantic type species are not close. *Cellophana* is placed as unnamed (**II**). *P. exquisita* shares some traits and may belong here or into a closely related group.

P incurva and a few related species are recognizable. A placement of ***Cyrtopinna***, where they belong, synonymous to *Pinna* is not shared.

Furthermore, shape, muscle scars and habitat of *deltodes* and therefore ***Exitopinna*** is hard to concile with the small group of true *Pinna*.

Iredale (1939) placed *menkei* in ***Subitopinna***. Although erroneously synonymized with *bicolor* by Rosewater (1961), *menkei*, the type species, OD is a characteristic E. Australian species, whereas *P. bicolor* is restricted to the NW. Indian Ocean. The *Subitopinna* group with rather fragile, radially sculptured IND species, sparsely or not squamate is perceived to represent a distinct lineage, not close to the Atlantic *rudis*.

Iredale, 1939 further proposed ***Quantulopinna*** for *delsa* (= *muricata*). Studying the IND pinnids it has been difficult to attribute other species, and for the time being *Quantulopinna* is treated monospecific. However, it is not completely excluded that genetic data will recommend inclusion of *Quantulopinna* in *Subitopinna*.

Atrina is here restricted to a few heavy species with non divided lobes and widely protruding muscle scars. Close to the type species *vexillum* are only *rigida* and *tuberculosa*.

Iredale's ***Servatrina*** is perceived as useful grouping for species close to the type OD, *assimilis*. This includes approximately a dozen species, carelessly muddled with *pectinata* by Rosewater (1961).

Further groups appear necessary. *A. tasmanica* is unique. It was placed by Iredale & McMichael (1962), followed by Lamprell & Whitehead (1992) in *Atrina* s.s., obviously because it does not match *Servatrina*. Rosewater (1961) placed it, solely due to the muscle condition in *Servatrina*, but *tasmanica* is neither close to *Atrina*, nor to *Servatrina*. It seems to represent an **undescribed** lineage, probably together with *squamifera* and *zelandica* and is here placed as (**III**).

The position and true affinities of *A. chautardi*, *oldroydii* and *texta* are open. Phylogenetic data might show a promising way. These 3 species are placed as *Atrina* ***s.l.***

Just the monospecific, panpacific ***Streptopinna*** from the Red Sea to offshore Panamic Isl. is unambiguous.

From the material studied, a dozen pinnids seem to live in **Australia**, instead of the 7 species recently mentioned by Beesley et al. (1998), but not true *bicolor*, or true *pectinata*.

In pinnids our knowledge seems not even to have scratched the surface, the views fogged by two extreme lumpers.

The value of a strict separation of *Pinna* and *Atrina* is doubted and new groups are deemed necessary. Specifically, the large majority of Rosewater (1961)'s synonyms is not shared. *Pinna "bicolor"* is here broken up in at least 8 distinct species. *Atrina "pectinata"* consists of at least 11 distinct species. *Pinna "muricata"* contains also numerous species.

NY11 Hawaii: Due to the confusing works and figures of Rosewater (1961) and Kay (1979) the pinnid fauna of Hawaii stayed long time enigmatic. Thanks to the help of Mike Severns and his excellent photos and specimens this issue could recently be solved. 4 distinct pinnids occur in Hawaii, but not *Pinna bicolor* and not *Atrina vexillum*.

Dall, Bartsch and Rehder, 1938 recognized 4 *Pinna*, 1 *Atrina* and 1 *Streptopinna*.

Little problem poses *Streptopinna nuttalli* which equals the panpacific ***S. saccata***. Kay (1979 pl. 165 fig. C and D) represent both *saccata*, *Atrina vexillum* does not occur in Hawaii and Kay's figure D is not remotely close to Born's species.

As concluded by various authors, *Pinna hawaiensis* and *P. semicostata* represent both the widely distributed ***P. muricata***. Kay (1979 pl. 165 fig. B is without doubt a narrow *muricata*).

Pinna exquisita, a rare deep water species, was well recognized by Dall, Bartsch & Rehder, 1938 and has been confirmed and figured by Rosewater (1982).

What stays are DBR's *Pinna oahua* and *Atrina* (*Atrina*) *recta*. Without doubt a 150 mm *Servatrina* occurs in Hawaii, which is according to M. Severns quite commonly found in between 20-40 m. This species is unknown from any other area and is perceived endemic to Hawaii. The adult shape, the rather fragile texture and the ribbing together with the rather narrow rounded lobes fit the *Servatrina* condition well. Quite remarkable are the morphological differences between juveniles and adults. Juveniles are indeed fragile yellowish and bear spines on marked longitudinal riblets. As such they match the OD of *A. recta*, originally based on a yellowish 36.5 mm specimen. However, the adult form becomes brownish-red, the spines are shorter, the ventral portion shows the longitudinal ribs with alternating finer and stronger scales in certain specimens. *Pinna oahu* was described from fragments only and the depicted two dorsal portions (pl. 18 figs. 5-6) fit the sculpture in adult *recta* specimens well. There stays very little doubt that *oahua* was based on adult *recta*. Against page priority ***Atrina recta*** is here selected to stand for this endemic Hawaiian *Servatrina* and *Pinna oahua* is synonymized.

It is not excluded that Kay (1979) fig. A with the text of fig. D meant *recta*; at least size and color would match.

NY2: ***Pinna***: Turner et al. (1958) restricted Linnaeus MED/IND type locality for ***Pinna rudis*** to the Mediterranean Sea and designated Cuba, Guantanamo Bay as type locality for ***Pinna carnea***. These two may be morphologically very close. Turner et al. (1958) considered *P. rudis* amphiatlantic, whereas Dodge (1952) restricted *rudis* to the E. Atlantic.

Caribbean *carnea* studied may occasionally have muscle scars and lobes as depicted by Turner et al. for *Pinna varicosa* Lamarck, 1819 from Trinidad; the weak ribbing, the translucent feature and the small size of these Caribbean "*rudis*", however, point in direction *carnea*. Without genetic analysis a presence of *rudis* in the W. Atlantic is not confirmed. For the time being Dodge (1952) and Weisbord (1964) are followed and *rudis* is restricted to the E. Atlantic. Typically, *rudis* is more robust, less translucent, grows larger, and has stronger spines, whereas color, shape, number of ribs and muscle impressions may be close to *carnea*. The largest *rudis* are found in WAF, whereas the Med specimens studied were smaller. Lamarck's 230 mm MHNG-type of ***P. flabellum*** has been studied. For once Fischer-Piette's view is shared and *flabellum* is understood as Caribbean *carnea* with an erroneous IND type locality.

The two BMNH syntypes of ***P. electrina*** (Maluku, amber-red, short scales) have been studied. *Electrina* is perceived as valid species; sharing the closest affinities to true pinnids and is placed as *Pinna* s.s.

Oliver (1995 sp. 980) depicted a broad "*bicolor*" from Arabia. The same species was studied from Aden. However, the fragile texture and the lobes exclude *bicolor*. On the other hand, Reeve, 1859 described ***P. fimbriatula*** from Japan. From there, nothing close is known (HAB53). *Fimbriatula* was synonymized with *bicolor* by Rosewater (1961), but Scheltema (1983) removed it from this unwarranted position. She analyzed the holotype and stated the configuration closest to *P. rugosa* and *P. rudis*. Indeed, the BMNH holotype is perceived congeneric with *rugosa* and *rudis*, and fits specifically these broad Arabian specimens.

As argued by Scheltema (1983) and earlier by Iredale (1939) Menke's ***P. deltodes*** is a valid species, widely distributed as well. It is not a stunted form as understood by Rosewater (1961). Hedley's ***scapula*** from Port Darwin and Iredale's ***Exitopinna deltodes ultra*** from Low Isl. have been synonymized by Scheltema.

Rosewater (1961) synonymized ***P. epica*** with *P. bicolor*. However, as stated by Japanese authors (e.g. MAA86), this is an uncommon deep-sea species. Habe (1971) depicted side by side on pl. 52 fig. 8 "*incurva*"= *attenuata* and fig. 9 *epica*. All *epica* analyzed from Japan, from Amami-Oshima and from the Philippines, Bohol are quite consistent in shape. A related, more expanded, even rarer bathyal species is ***P. linguafelis***, currently known from Japanese waters (MAA86) and from Vietnam (HYL03). The bathyal *P. linguafelis* with a clearly divided muscle configuration and small lobes was synonymized by Rosewater with the marked distinct, shallow water *vexillum*. However, both species *epica* and *linguafelis* do not match *Pinna*. They represent an **undescribed** group of deep-sea pinnids.

Rosewater (1961) misunderstood ***bicolor*** described from the Red Sea, his fig. 147 is instead *atropurpurea*. Erroneously, he synonymized ***Pinna attenuata*** and ***Pinna atropurpurea*** and many more with the unique and rare *bicolor*. Winckworth had all three species from India and depicted the main differences; Kundu (1965) recognized *bicolor* and *atropurpurea* from NW. India, Gulf of Kutch. Wilkins (1953) designated for *atropurpurea* a neotype, 230 mm, NE. Sri Lanka, Trincomalee; also depicted in HIG01 B333.

In shape these 3 species *bicolor*, *atropurpurea* and *attenuata* may in extremis be close and all three grow very large. However, *bicolor* is inside unique with its very low, but very widely separated lobes in adults. It is generally broader than *attenuata*. *Atropurpurea* and *attenuata* have both much longer, closer approaching lobes. However, *attenuata* is slender with a radial sculpture, whereas *atropurpurea* is broader also commarginally sculptured. Reliably, *bicolor* is only known from the original type locality Red Sea, from Djibouti and from India. As stated by Chemnitz *P. bicolor* is a rare species, to date just very few specimens are known; and in the rich BMNH collection just one true *bicolor* (India, Winckworth) has been found (11/08). Of the almost 25 *bicolor*-synonyms attributed by Rosewater (1961) just ***cochlearis*** is here recognized. Fischer's MNHN holotype from Djibouti proved indeed to represent this uncommon species. Winckworth (1929 and 1936) came to the same conclusion, and removed ***dolabrata*** from its earlier unwarranted synonymy.

The other two species are rather common. In addition to India, *atropurpurea* is also reliably known from East Africa, Tanzania. However, both species are much wider distributed, extending to Amami Isl. (*atropurpurea*) respectively Japan (*attenuata*) as well depicted by Taki (1951) and by Habe (1953). Habe (1953) placed *attenuata* in *Cyrtopinna*, and *atropurpurea* in *Subitopinna*, a view here shared. Reeve's small ***P. stutchburii*** holotype from S. Qld proved too close to *attenuata* to be separated. Iredale (1939) placed *stutchburii* also in *Cyrtopinna*. Modern Japanese and Chinese authors depict these two rather common species under various names, *atropurpurea* (e.g. Zhongyan, 2004 pl. 124 fig. A "*bicolo*r"; Habe, 1971 pl. 52 fig. 2 "*bicolor*"), *attenuata* (Okutani, 2000 pl. 441 fig. 3 "*bicolor*"; Zhongyan, 2004 pl. 125 fig. C "*incurva*"; Habe, 1971 pl. 52 fig. 2 "*incurva*").

Following Winckworth (1929) ***P. mutica*** (type: ROS61 pl. 152 fig. 3-4), ***P. euglypta*** (type: ROS61 pl. 153) and somewhat hesitantly also ***P. vespertina*** (type BMNH seen) are currently understood as too close to *atropurpurea* to be separated.

In the Indian Ocean a further species occurs. Oliver (1992 pl. 8 fig. 1, "*bicolor*", 345 mm) and Spry (1964 pl. 5 fig. 45, 350 mm, Tanzania) depicted instead this form. This species is much narrower in shape, with medium sized, slightly unequal lobes in length, placed close together and not marked divided centrally as in *bicolor*. The color is usually dark purplish-brown with white lamellae. Reeve, 1858 described ***Pinna regia*** from Indonesia. After studying the BMNH types together with large series of Indian Ocean pinnids it is concluded that *regia* fits above characteristics and is, or at least once was, one of the most common species in the Indian Ocean. However, Lamarck described ***Pinna angustana*** erroneously from the Mediterranean. The 205 mm holotype well fitting its name is present in MHNG. CLEMAM's *nobilis* synonymy is definitely false. Fischer-Piette studied *angustana*, recognized its erroneous locality, but misinterpreted it as *bicolor*. Instead Reeve's *regia* is perceived too close to be separated and *P. angustana* is understood as Indian Ocean species and as earlier name for Reeve's *regia*. Consequently, ***P. molluccensis*** Clessin (nom. nov. *angustana* Reeve non Lamarck) is an unnecessary nom. nov. Compared to *fimbriatula*, *angustana* remains narrower, is more solid, has higher lobes and seems to occur much more commonly.

Winckworth (1929) further considered Smith's ***P. natalensis*** distinct and valid. The unique BMNH holotype shares some features with *muricata*, but is more regularly sculptured, stronger colored with very small, low lobes. In addition, this Natal species has been compared to the unique holotype of Reeve's ***sanguinolenta***, described from unknown locality and not recognized since. Shape, sculpture and position of the lobes are very close to *natalensis*. Consequently, *sanguinolenta* is perceived as valid species living in Natal's waters, and *natalensis* a synonym. It seems that the small "*bicolor*" from Natal (Steyn & Lussy, 1998 sp. 839) is instead referable to *sanguinolenta*.

The rare ***incurva*** is acute and sharply centrally ridged, but not known from China or Japan, nor from Australia. The radial sculpture of *attenuata* is replaced by commarginal or oblique weak rounded ridges; the central keel is even more acute in adults than in *attenuata*. *Incurva* also remains smaller than *attenuata*; the largest specimen found is slightly more than 340 mm. *Incurva* has been described from the Andaman Sea, a BMNH specimen has been studied from the Macassar Strait and one was personally found in the SW. Gulf of Thailand. True *incurva* is exceedingly rare and lives only in a very restricted area, East and West of Malaysia and S. Thailand and possibly in parts of Indonesia. Reeve's syntypes of ***P*. *rumphii*** from Indonesia, Maluku proved to represent juvenile *incurva*.

Virtually all *incurva* records in literature are false and refer to distinct, more common species. Many, especially Chinese and Japanese records are referable to *attenuata*. Others, as the Australian "*incurva"* records of Lamprell & Whitehead (1992) refer to an **undescribed** species, which is identical to Reeve's *incurvata* from Indonesia. ***Pinna incurvata*** Reeve, 1858 non Sowerby I, 1825 (= *incurva*), nec Born, 1778 (= *nobilis*) proved to be significantly distinct in texture, lobes and shape from true *incurva*. This species will be described as **new** *Cyrtopinna*.

P*. *trigonalis from Micronesia was considered a valid species by Winckworth (1929) but was later included in the *muricata*- medley by Rosewater (1961 pl. 145 lectotype). However, *trigonalis* is easily recognizable and not close to any *muricata* form. Specimens found in Polynesia, Marquesas in 20 m, silty and fine muddy sand proved too close to be separated. Especially juveniles are almost square in diameter and very strongly keeled. The affinities with *Cyrtopinna* are stronger than with *Quantulopinna*.

Pinna madida, described from NT, Darwin, was accepted by Iredale (1939) as valid, found in tropical Qld, to at least Port Curtis. Rosewater synonymized *madida* with *bicolor*. Reeve's type and further lots from tropical Australia have been studied and Iredale's opinion is here confirmed. *P. madida* is as valid tropical Australian species.

Whereas Iredale (1939) sharply differentiated between ***menkei*** and *madida*, Rosewater synonymized *menkei* also with his *bicolor*-medley. Reeve's BMNH holotype has been studied. Iredale's view is here confirmed and the type species *Subitopinna*, OD is considered a further valid Australian species from NSW and Qld. Iredale (1939) stated *menkei* as the only common pinnid around Sydney and gave a size of 360 mm. *P. isosceles* and *caviterga* (Qld) have been synonymized by Iredale (1939). It appears, that Scheltema's "*bicolor*" from Qld, Keppel Bay represents instead *menkei*.

Most Australian authors before Rosewater (e.g. Hedley, 1924; Cotton, 1961; Allan, 1962) recognized a further species in S. Australia, depicted as ***P*. *virgata*** by Hedley (1924) from S. Australia and by Cotton (1961) from SA, Spencer Gulf and St. Vincent Gulf. However, Iredale (1939) dismissed this view. Menke's type is lost, and thus, *virgata*, as stated by Fischer-Piette (1974) is best considered a nom. dub. On the other hand, the depicted type of Lamarck's MHNG *dolabrata* (HEDL24 fig.15; ROS61 pl. 151) matches Hedley's and Cotton's *virgata*. Live taken specimens studied from S. Australia, Spencer Gulf, Telowie are marked distinct from *menkei* and *madida*. As originally stated by Lamarck (1819) this SA species is "eminently lamellate in the upper part". This strong lamellation represents the most distinctive feature for Hedley's "*virgata"*. *P. dolabrata* mainly occurs in the Adelaide-Port Lincoln area, extending occasionally to Beachport East and West at least to Albany. ***P*. *dolabrata*** Lamarck, 1819 is here reinstated as valid SA species, as concluded by Winckworth (1936). Cotton & Godfrey (1938) restricted Lamarck's type locality to Gulf St. Vincent and synonymized Tate's *P. inermis*.

Winckworth (1929) acted as first reviser for ***P*. *muricata***. Rosewater's later restrictions are without any value. Winckworth selected Conrad's small *P. semicostata* described from Hawaii as best representing Linnaeus *muricata* and fitting Linnaeus reference Rumphius pl. 46 fig. M. Winckworth saw *muricata* also living in the Indian Ocean and depicted a *muricata* from India. Fortunately, the huge BMNH general collection had ample *muricata* material throughout the IND including Australia and Hawaii. No marked differences were detected between East African, Indian, Australian and Hawaiian material. Thus, Winckworth's conclusions are here confirmed. *P. muricata* is perceived as very widely distributed and one of the most common IND pinnids. It is typically narrowly trigonal, whitish, and rather thin with longitudinal threads which may develop into strong scaly ribs in adult forms. A maximum size of approximately 250 mm is possible, but generally *muricata* is a small species. Winckworth considered specimens from Lord Howe Isl. (= ***delsa howensis***) identical. ***Pinna cancellata*** Mawe, 1823 pl. 17 fig. 2 is quite distinct from *A. pectinata* (= pl. 17 fig. 1). It is a narrowly shaped species from Sri Lanka. Recognizable are 9 strong, rounded ribs, obviously with an additional commarginal sculptural element to justify the name. It does not resemble any *pectinata* seen, but is strongly reminiscent of *muricata* and is here understood to represent also Linnaeus' species. The type of Reeve's ***zebuensis*** from Phil, Cebu was studied and appeared also too close to *muricata* for separation.

The huge, as adult almost smooth ***P*. *philippinensis*** Reeve, 1858 (type: ROS61 pl. 144) from the Philippines is a distinct species. Adults are considerably larger in size, and differ in shape and sculpture from *muricata*. A growth series from the Philippines, mainly Bantayan, revealed that Dunker, 1852's earlier ***P*. *trigonium***, described from IND, labelled Java, is a medium sized *philippinensis*. It shares sculpture and ventral undulation of smaller specimens. ***P*. *fumata*** Reeve, 1858 from the Philippines was confused with the *bicolor*-medley by Rosewater (1961), whereas Winckworth (1929) followed by Higo et al. (1999) considered it synonymous to *atropurpurea*. Instead, large specimens, 348 mm, studied from the Philippines reveal, that *fumata* is very close to *trigonium*. *Fumata* represents narrower, darker *trigonium* specimens, otherwise identical in sculpture. The type is depicted in Rosewater (1961 pl. 152). It is here synonymized.

Clessin's type of ***atrata*** described without locality is lost and considered nom. dub. Clessin's broken fragments of ***rollei*** also without locality are in MfN. *Rollei* is currently considered a nom. dub.

Röding's *P. violacea*, *inflata*, and *striata* were declared nom. nud. by Sherborn and this course was followed by subsequent authors. Thus, ***P*. *inflata*** Dillwyn, 1817 is a valid name.

P*. *densecostata is one of Turton's "Lucky Log"-species, in all probability not from SAF. An identity with *bicolor*, as purported by Rosewater, is unlikely but its true identity is currently unknown.

NY3: ***Atrina***: Born's type of ***vexillum*** in Vienna is a characteristically rounded, somewhat smooth-worn, solid, brownish-yellowish, small species. Lamarck's larger, blackish syntype of *Pinna nigrina* depicted in Rosewater (1961 pl. 156) fits well in shape. Born's type species most closely resembles specimens from the W. Indian Ocean and from Arabia. The specimens depicted from Australia (Lamprell & Whitehead (1992 sp. 30) and from Japan (Okutani, 2000 pl. 441 fig. 7) are perceived too close and also represent this widely distributed, shallow water species, as well as Chemnitz 783 (= *gubernaculum* Röding) and likely also 774 (= *nigra* Dillwyn). In *vexillum* the muscle strongly protrudes from the lobes, also in juvenile specimens. This condition is generally not seen in other small IND "*Atrina*". There, this protrusion only evolves with age.

However, there is a second species, often muddled with *vexillum*. It is trigonal, not rounded, curbed, brownish to yellowish instead of blackish, somewhat less solid and the muscle scars approach the condition of *Servatrina*. It also seems to remain smaller than *vexillum*. ***Pinna gouldii*** Reeve, 1858 as well as the earlier Chemnitz 782 (= ***adusta*** Dillwyn, = *exusta* Gmelin, 1791) fit. Habe (1953) accepted *gouldii* also as distinct from *vexillum* and located it in Kyushu, Shikoku and Honshu; in 1971 pl. 52 fig. 7 he depicted a specimen from Japan. However, this view was not confirmed by subsequent Japanese authors and a presence of *exusta* in Japan needs verification. Otherwise, ***A. exusta*** is known from SE. India, the Andaman Sea, Philippines and Melanesia. *A. exusta* appears to remain smaller, more uncommon and living deeper than *vexillum*.

Without a doubt, Rosewater (1961)'s masterpiece was the reduction of a dozen distinct IND *Atrina* (*Servatrina*) species into a single ***pectinata*** making Linnaeus' species unrecognizable. He concluded that *pectinata* "cannot be easily confused with any other Indo-Pacific species…". Of course not, as none was left. Few authors, except Fischer-Piette (1974) came to the same results. Here at least 11 species are discerned, some personally collected, most types studied.

Rosewater selected instead of the missing *pectinata* type Linnaeus' sole reference Gualteri pl. 79 fig. A as plesiotype. Then he selected as typical representative *pectinata pectinata* pl. 161 from Japan, Awaji a huge, dark, olive-green to brownish, rather smooth, weakly ribbed, rather inflated species with a very large, central, round muscle scar (= Okutani, 2000 pl. 442 fig. 8 "*pectinata*"). This is the adult form of Reeve's juvenile ***japonica*** as recognized by Japanese authors. Zhongyan (2004 pl. 125 fig. D "*pectinata*") well illustrates this large species from the Yellow Sea and East China. As such, Rosewater made of Linnaeus' narrow, rather fragile brownish *pectinata* from India, a huge, broad, rather inflated species from China and Japan. *Pectinata*, as selected by Rosewater (1961) is found exclusively in Japan, Yellow Sea and East China; nothing close was encountered outside this area.

Fortunately, Winckworth (1929) reviewed *Pinna* earlier. He located Linnaeus' species in India p. 288 and wrote on p. 294 "PECTINATA, Linné, 1767 … I have given reasons for identifying this with *hanleyi*". This is taken as the earliest and valid designation, fitting Linnaeus OD, locality and reference, and antedating Rosewater's choice. Reeve, 1858 sp. 15 depicted ***Pinna hanleyi*** from Amboina, assuming Linnaeus' species European. As well analyzed by Chemnitz 8 87 770 (India, Coromandel) and also confirmed by Iredale (1939) the Indian form is the species which fits Linnaeus' sole reference Gualteri for *pectinata* best. The European ***fragilis*** may be superficially close from an outside view. However, *fragilis* has been described from European waters; its larger size, deeper water habitat, and the lobes differentiate *fragilis* at once from *pectinata*. Mawe (1823) accepted *pectinata* also from India, pl. 17 fig. 1 and his narrow species with numerous weak ribs and moderate small spines ventrally represents Linnaeus' species well. Oliver (1995 sp. 983) depicted *pectinata* from Arabia. No type material of *pectinata* is present. Hanley (1855) stated that Linnaeus did not possess *pectinata*, but in the supplementary material of the Linnean Collection in London the specimen analysed by Winckworth has been found. To stabilize the concept of *pectinata* this 206 mm specimen will be selected as **neotype**. Linnaeus' ***A. pectinata*** occurs in the Indian Ocean, at least from Seychelles, Arabia, India to Indonesia. It is tan to brownish, rather fragile, narrower and weakly ribbed, compared to the broader, more inflated, almost smooth *japonica*. Occasionally in *pectinata* small spines are present ventrally. The muscle scars fit the *Servatrina* condition.

Consequently, all species not fitting *pectinata* are considered distinct. Comparing Oliver (1992 pl. 8 fig. 4, = *hystrix*) with Oliver (1995 sp. 983, = *pectinata*), Lamprell & Healy (1992 sp. 32, = *strangei*), Rosewater (1961 fig. 163 1-2, = *assimilis*) and Okutani (2000 pl. 442 fig. 8, = *japonica*) it is obvious that morphologically and biogeographically distinct species are involved; all except Oliver (1995) are erroneously termed *pectinata*.

The type species of ***Servatrina***, OD Reeve's ***assimilis*** from NW.-NE. Australia is significantly distinct, as well recognized by Iredale (1939). Reeve's type is depicted in Rosewater (1961 pl. 163). *Assimilis* is stronger and rather densely scaly ribbed. Full adults from WA have broader valves, extended posteriorly. However, due to Rosewater's medley the type species of *Servatrina* is virtually unknown in exact habitat and precise distribution.

A. strangei is a weaker ribbed, broader species from Qld to NSW and well depicted by Lamprell & Whitehead (1992 sp. 32 "*pectinata*"). Iredale (1939) considered both, *assimilis* and *strangei* valid with distinct growth series; his view is shared. As stated by Iredale true *pectinata* is not known from Australia.

A. lischkeana described by Clessin from Yokohama was synonymized with *japonica* by Koyama et al. (1981) and Higo et al. (1999). However, Okutani (2000 pl. 442 fig. 9) as before Taki (1951 as *lischkei*) kept it distinct based on genetic results. *Lischkeana* is known from Ariake Bay and Seto Inland Sea. Clessin's two syntypes are in MfN.

A. lamellata Habe, 1961(type: Habe, 1971 pl. 52 fig. 5; Okutani, 2000 pl. fig. 12) is widely distributed from Japan to E. Thailand. It has consistently been recognized by Japanese authors and also depicted by Swennen et al. (2002 sp. 56) from the Gulf of Thailand. It has also been found in E. Malaysia and in the Philippines. However, from there earlier ***P. chemnitzii*** Hanley, 1858 (July) and ***P. lurida*** Reeve, 1858 (May, ROS61 pl. 162) were described. Based on BMNH type material I failed to differentiate *lamellata* from these Philippine species. Furthermore, Winckworth

(1936) stated Deshayes in Cuvier, 1841's ***chinensis*** the same as Reeve's *lurida*, whereas Japanese authors synonymized *chinensis* with *japonica*. *Pinna chinensis* is well depicted in Cuvier's disciple edition pl. 85 fig. 3. From sculpture, size and shape and from the implicit locality, China, *P. chinensis* matches Reeve's *lurida* instead of Reeve's *japonica*. Thus, Winckworth view is here confirmed and *lurida*, together with *chemnitzii* and *lamellata* are synonymized. The ribbing in *chinensis* is markedly stronger than in *japonica*, the valves more compressed, the commarginal sculpture is of variable strength, as well as the prickles. As such *Atrina* (*Servatrina*) *chinensis* is here recognized as the common species from Japan to the Gulf of Thailand. Reeve's juvenile ***P. papyracea*** fig. 14 proved to be the same as *chinensis*. True *papyracea* "Chemnitz" Gmelin, 1791 is a juvenile pinnid, not an *Atrina*. This species, the type present in ZMUC, is as yet unresolved.

A. hystrix requires attention. It has been described by Hanley, 1858 from Amboina, as close but distinct from *strangei*. Rosewater (1961) stated the holotype lost, but two paratypes present, depicted by Reeve (1859 fig. 60 and fig. 61). Rosewater selected the larger fig. 60 as plesiotype. However, the BMNH type lot 1952.8.29.28-30 contains three instead of two specimens, the large and the small species have been depicted by Reeve, the medium sized specimen fits, also in size, Hanley's OD and is the "missing" holotype. *Hystrix* is misunderstood. It was considered synonymous to *strangei* by Winckworth (1929), whereas Rosewater stated it synonymous to *Atrina vexillum*. Iredale (1939) set the issue right. He accepted *strangei* from where originally described, namely as common Qld shell, but stated *hystrix* as distinct in shape and prickly sculpture, not found in Australia. Based on type material, Iredale's view is confirmed. Oliver (1992 pl. 8 fig. 4) depicted "*pectinata*". As recognized by Oliver himself, his "*pectinata*" is not close to Linnaeus' species. Instead it represents a typical large *hystrix*. It fits Reeve's depicted larger specimen closely in shape, brown-purplish color and especially in sculpture with prickly ribs centrally and a much weaker sculpture on the side. Obviously, *hystrix* occurs also in the Red Sea, Wilkens (1953) *strangei* records from Oman, Muscat may be referable instead also to *hystrix*. Furthermore, specimens seen from the Philippines have been identified as *hystrix*, giving *hystrix* a predominantly Indian Ocean distribution, extending to the Philippines. The illustrated juvenile specimen is from the Philippines.

Another species, early recognized by Chemnitz 8 87 771 is ***A. inflata***. Swennen et al. (2002 sp. 55) well argued and depicted it as valid. Reeve (1858 fig. 5) illustrated a specimen from the Philippines, from where material has been studied. This species is centered on Thailand extending west to the Nicobars and east to the Philippines. It is not known from China or Japan. *A. inflata* is a quite fragile, highly inflated uncommon species from rather deeper water. Superficially *inflata* is closest to *japonica*, but the consistent stronger inflation, distinct biogeography and the deeper habitat differentiate.

Another, rare, quite deep living species is ***A. teramachii*** Habe, 1953. Originally, it was described from deep water off Shikoku, Tosa Bay. Specimens found off Mozambique in 450 m are indistinguishable. It is a trigonal, pale, fragile species, generally with few, small spines.

Furthermore, a rather small, strongly scaled, pale species is recognizable, as adult similar to the Caribbean *serrata*. The first author recognizing this unique sculpture was Reeve, 1858 as ***Pinna penna*** from the Philippines. Prashad (1932 pl. 4 fig. 14-15) reported it from Indonesia and Habe (1953) from Honshu. Specimens have been studied from the Philippines, from Okinawa, and from Japan. The type is depicted in Rosewater (1961 pl. 163) and HIG01 B338. The opinion of Wilkins (1953) who considered *penna* the juvenile of *strangei* is erroneous as concluded by Habe (1953). The two adults are markedly distinct. However, I am not fully convinced that Habe's ***kinoshitai*** is indeed a valid species, distinct from *penna*. But too little material is available for a firm conclusion. The shape in juvenile *penna* from Okinawa is moderately variable regarding width. *Penna* is generally a rather small species, usually measuring 100 mm; large adults, 190 mm, Phil, Calitoban, 40-50 m become more trigonal in size, but share the sculptural characteristics of the more slender juveniles.

Lamprell & Healy, 1997 described a closely related, also comparatively small species ***palmensis*** from N. Qld, Palm Isl. They compared to the ***penna*** type material and stated it distinct. Surprisingly, they did not compare *palmensis* with *P. serra* Reeve, 1858 described from Qld, Moreton Bay. Iredale (1939) analyzed a series of *serra* from nearby Keppel Bay, accepted the type locality and stated them distinct by "its fine prickly sculpture" in juveniles from *assimilis* and *strangei*. Iredale also mentioned the affinities to *penna*. ***P. serra*** Reeve, 1858 is depicted in Rosewater (1961 pl. 161). The holotype is much larger than *palmensis*. Nonetheless, biogeography, shape and sculpture leave very little doubt that *palmensis* is only a small offshore synonym of *serra*. Iredale's *serra* growth series should be compared to the *palmensis* type series to confirm this tentative conclusion. According to Iredale (1939) and Iredale & McMichael (1962) *serra* occurs occasionally in NSW waters. Hanley (1843) *P. serrata* record from NSW might have been this species.

Needless to say, all above species were lumped by Rosewater (1961) followed by Fischer-Piette into *pectinata*. Very sadly, this action fogged the view on the exact distribution, the habitats and the variability of the species involved during the last almost 50 years. Except the Japanese species, excellently captured by Okutani (2000), most of the other pinnids are currently little known.

The CAR ***A. seminuda*** appears as one of the most variable species encountered globally. Huge, broad, densely ribbed extremes occur in the West Indies and narrow, smooth forms in Argentina. The strongly spined specimen depicted is from Martinique, the smooth specimen from Argentina. However, typical Brazilian specimens, as Lamarck's type, seem to connect these extremes. Nonetheless, a genetic confirmation that indeed only one species is available is lacking. BMNH-Wilkens (1953) removed Reeve's ***d'orbigny*** from Turner et al.'s earlier synonymy stated it erroneously located and identical to the SAF *squamifera*. The small holotype is depicted in TUR58 pl. 169. A comparison of *d'orbigny* with *squamifera* and *seminuda* in London however, made Turner et al.'s conclusion more likely than Wilkens' and is here reinstated. At present *seminuda* is placed in *Servatrina*; but a genetic confirmation is not available.

While in Senegal in July, 1997 I visited as usual M. Pin in Dakar. He had a few pinnids, live dredged from Cayar, Senegal in 100 m. 2 fine, unidentified specimens 210 and 180 mm could be acquired. These specimens were long understood as *lavezzarii*. Fischer-Piette, 1974 described ***A. lavezzarii***, originally collected from unknown location, and placed it in WAF. The depicted type is present in MNHN and has been identified as the Caribbean *seminuda* by Cosel in sched. Cosel's view is shared. The other specimen referenced by Fischer-Piette is instead a juvenile *chautardi* as earlier concluded by Nicklès and confirmed by Cosel in sched. Consequently, these Cayar specimens are **unnamed**; they represent a densely ribbed species with more than 30 low spined ribs. It is close in sculpture to *serrata* and *penna*, but the slightly protruding muscle configuration and the moderately divided lobes at the top approach somewhat the *rigida* condition. Compared to *seminuda* the spining is much denser and the muscle impression much broader. This unnamed species is tentatively placed in *Servatrina*.

The following species do not appear related to the IND *Servatrina-group*.

The WAF ***A. chautardi*** is unique. The adult shape and texture is close to juveniles of *rigida* and *maura*, fragile and thin, but grows larger than 200 mm and is stronger spined. The muscle scars are large, rounded ovate and almost centrally placed. The hollow spines are long and rather appressed. The adult form does not closely resemble any other species known.

Rosewater (1961) synonymized ***dumosa*** with *tasmanica*, but gave no arguments. However, Cotton (1961) considered it distinct and gave arguments. Certainly, *dumosa* needs to be reanalyzed. ***Tasmanica*** possibly with two other temperate water species, ***zelandica*** and ***squamifera***, seems to belong to an **undescribed** group.

Both ***A. texta*** and ***A. oldroydii*** are uncommon. Furthermore, Guzman et al. (1998) depicted a huge brownish black species with a large, central muscle scar from Chile, Antofagasta tentatively identified as cf. *oldroydii*. Instead, this Chilean species appears **undescribed**. On the other hand, Alamo & Valdivieso's *oldroydii* from N. Peru, Punta Foca seems better referable to *texta*. Coan et al. (2000) depicted both specimens.

Overall, only *vexillum*, *tuberculosa* and possibly *rigida* are perceived as **true *Atrina***. For many IND species Iredale's *Servatrina* matches, whereas *chautardi*, definitely *squamifera*, *tasmanica*, possibly *dumosa* and *zelandica* may represent distinct lineages. The closest affinities of *oldroydii* and *texta* are unresolved.

In pinnids we are generations away from a satisfying, broadly shared global picture. Much more work is necessary to achieve a differentiated view of this unique, for the last 50 years misunderstood family; a family with highly fascinating species, uniquely disposing of waste channels, enigmatic eyes of Will, and sulfuric acid adsorbing pallial organs.

6.18 PTERIIDAE

OA1: Due to a high intraspecific variability this is one of the toughest families, especially in the Indo-Pacific. A large number of species has been named, often based on single specimens or weak characteristics, especially by Philippi, Reeve, and Dunker. Reverse, older authors, especially Lamarck, combined very distinct species as varieties under the same name.

Interesting is the comparison of the species concepts of Fischer-Piette and Dunker. Whereas Fischer-Piette (1982) detected with 5 *Pteria* globally, far too less species, Dunker (1872-80) accepted approximately 100 *Pteria* and *Pinctada*, but quite often based on single specimens, on juveniles, and in many cases on specimens from unknown locality.

From the BMNH, MNHN, MHNG, and MfN types studied, in reality the number of species lies in between. Here more than 40 species, less than 20 *Pinctada* and more than 25 *Pteria*, are recognized. The large majority is IND, but there are still some IND species unidentified and the real number may finally approach 50 pteriids.

For this group Shirai (1994) is indispensable; he depicted many type specimens and well demonstrated the variability of these shallow water forms. Many of his synonyms are shared. All 9 pteriids recognized by Iredale (1939) from Australia are valid species, but 5 have older names.

Iredale (1939) demonstrated that some of Reeve's dubious names are preoccupied, notably *Avicula radula*, *muricata*, *crocea*, *argentea*, *eximia*, *marmorata*. *A. irrasa* has no type material and no locality and is also a nom. dub. A couple of Dunker's names are without type and locality, notably *Avicula atrata*, *plicatula*, *gruneri*, *nigrofusca*, *undata*; whereas *pallida* is preoccupied. These species are placed as nom. dub. in pink.

OA2: The 68 mm BMNH holotype of ***Avicula vitrea*** Reeve, 1857 from the West Indies has been studied. *Vitrea* has been reported by various American authors from Massachusetts, Bermudas, and Florida to Tortuga in a bathymetric range from 51-350 m. However, size, morphology and habitat fit the East Atlantic ***Pteria hirundo*** Linnaeus, 1758 precisely and *vitrea* is considered indistinguishable. Thus, both species *P. hirundo* and *P. colymbus* occur panatlantic. The blackish ***P. colymbus*** is more solid, living shallower, whereas the yellowish-brown-cream *P. hirundo* is very fragile and often deep living, up to 350 m, even reported from 1550 m.

Abbott & Dance (1996) applied Lamarck's names correctly, but confounded Röding's and Linnaeus's names.

Reeve, 1857 sp. 73 further described a juvenile ***A. cornea*** from Jamaica. As this name is preoccupied, Dunker, 1879 renamed it ***A. jamaicensis***. Reeve's original could not be located at BMNH. From the OD a synonymy with *colymbus* is more likely than with *hirundo*, as also concluded by Fischer-Piette (1982).

Recently from Venezuelan waters 2 new *Pteria* have been described. First, ***P. attilatomasi*** Macsotay & Campos, 2001 (Margarita, shallow water; 52 mm, MACS); earlier, Dunker described ***A. venezuelensis*** from Venezuela, not considered by above authors. *P. attilatomasi* seems too close to the earlier *venezuelensis* to be separated. Dunker's species appears to be an uncommon, but valid *Pteria* from South America. Dunker (1872) compared it with the Panamic *sterna*.

Second, ***P. pictura*** Okutani, 1983 (W. Trinidad, 10.6°N,61.6°W, 97 m, 58 mm, OKU83). The Caribbean locality of *pictura* is not completely without doubts. Okutani's next described species, *Spondylus jamarci* also from "Suriname", proved to be of IND origin and is now considered a synonym of *S. occidens* (LAK06). However, from the IND nothing particularly close to *pictura* is currently known. Accepting Okutani's locality as correct, then *pictura* is quite distinct from *colymbus* and from *venezuelensis*, but the thin texture and the deep habitat 93-97 m would not completely exclude *hirundo*. At least from the Med, yellowish colors in *hirundo* are known; but the presented shape, unless ventrally broken, is not typical. More material is necessary to verify whether *pictura* is a valid Caribbean species or a further synonym of *hirundo*.

OA3: ***Pteria loveni*** Dunker, 1879 (DKR80 p.67) is widely distributed, known at least from Japan to the Andaman Sea and to Australia. As in other species, the wing is usually long, but occasionally shorter, the shell is usually bulbous, but occasionally rather compressed. Characteristic is a fine, dense commarginal microsculpture overlain with fine periostracal lamellae, or as Reeve (1857) termed "minutely serrated festooned fibrous epidermis". Often purplish streaks or blotches are found on the cream-brownish body. ***Pteria bulliformis*** Wang, 2001 appears as short winged, bulbous form, whereas ***Pteria howensis*** Lamprell & Healy, 1977 is quite close to typical forms found in Philippine and Chinese waters. True ***P. sibogae*** Prashad, 1932 is very likely also the same, as concluded by Jiuan & Okutani (2003). As *loveni* occurs commonly and is widely distributed, it seemed highly unlikely that Reeve, disposing of Cuming's rich IND collection, one of the largest ever assembled, should not have described this widespread species. Indeed, ***Avicula gregata*** Reeve, 1857 (Samoa Isl., Tutuilla, REV575f63), with gregarious juvenile BMNH syntypes still adhering to the typical gorgonian habitat proved conspecific. Furthermore, Reeve's ***Avicula libella*** from China Seas proved to represent small *loveni*. Here the earlier *A. gregata* is selected to represent this species. *P. loveni* is a junior synonym.

Avicula fibrosa Reeve 1857 (Phil, Luzon, REV575f50) shares some traits with *gregata* but is more compressed, shorter, also distinct in pastel colors. It is perceived as a valid species found in the Philippines, Cavite and Luzon (HID) and possibly in Vietnam (LUT00).

Lamprell & Healy (1998 sp. 236-7) depicted a much larger "*sibogae*" from Australia. This specimen is distinct from Prashad's species. Instead it closely approaches the preoccupied *A. heteroptera* Reeve, 1857 sp. 67 non Lamarck, 1819 from Australia. For this species Iredale, 1931 proposed the nom. nov. ***Austropteria saltata*** and reported it from Qld, Caloundra and from NSW. In 1962, Iredale and McMichael selected a type locality, namely NSW, Port Jackson. Lamprell & Healy's proposed synonymy of *saltata* with *lata* is not shared. *Saltata* is the type species ***Austropteria***, OD, which, however, is considered by most authors a synonym of *Pteria*. *Saltata* itself is a valid E. Australian *Pteria*.

As originally stated, a similar species to *saltata* is Reeve's ***formosa***. The OD and also Reeve's 103.5 mm BMNH holotype bear no locality. However, recently Jiuan & Okutani (2003) convincingly demonstrated that this large species is uncommonly found in Taiwan. It is not excluded that Zhongyan (2004 pl. 127 fig. A) the 141 mm "*P. loveni"* from Guangdong and Guangsi is instead *formosa*. At least *P. loveni* (= *gregata*) is a much smaller species, uncommonly surpassing 70 mm and is not known larger than 89 mm.

Sometimes confounded with *saltata* and *formosa* is Gray's ***Avicula lata*** originally from Australia. However, this is a much broader and flatter species, uniformly dark reddish in color. It has been well depicted by Lamprell & Healy (1998 sp. 226) from tropical Australia or by Dunker (1872 pl. 5 fig. 1-2) as ***Avicula serrulata*** from Maluku. As stated by Lamprell & Healy (1998) all *lata* seen are uniformly deep red, even juveniles share this characteristic color.

However, in NW. Australia, Broome area a second species is found, close to *lata*. This species is consistently dark brown-yellowish and in adults, less broad than *lata*. The commarginal sculpture is somewhat finer and very regular. The BMNH holotype 1953-3-2.46 of Reeve's ***Avicula reticulata***, described from Australia matches well. Other than Lamprell & Healy (1998), I do not share the opinion that these two are conspecific, but follow instead Reeve's original view and Dunker (1879). According to Sherborn, Reeve's name is preoccupied by a fossil *A. reticulata* from Hisinger, 1831. Here ***Pteria broomei*** is proposed as nom. nov., clarifying Reeve's original type locality Australia to NWA, Broome.

Pteria admirabilis Wang, 2001 from Hainan shares many traits with *lata* but is shorter in shape and darker in colors. 2 specimens from the Gulf of Thailand are here placed. It is possible that *admirabilis* represents also Lynge (1909)'s record of "*lata*" from the Gulf of Thailand, which according to Lynge did not fit Gray's species well.

At least in color and somewhat in sculpture ***A. brunnea*** Pease, 1863 from Hawaii approaches *broomei*. Dall, Bartsch & Rehder, 1938 compared their synonymized (Kay, 1979) small *P. laciniata* specimen with *reticulata*. However, the shape in large *brunnea* is quite distinct with a long wing (Severns, 2000 p. 229); this feature was never seen in *broomei*. Earlier, another *Pteria* was named by Röding, 1798 No. 141 as ***Pinctada brunnea***. This name, as well as No. 142 ***P. apus*** Röding are by most authors considered valid (e.g. Sherborn) and synonymous to *hirundo* (e.g. CLEMAM). However, Röding, 1798 designated No. 140 as true *hirundo* (= Schwalbe), which he correctly referenced to Chemnitz 725. With *brunnea* (= das braune Vögelchen) obviously a distinct small, brown species was meant, whereas *apus* (= *die Geierschwalbe*) designated another larger, obviously somewhat hooked species. However, no localities and no references were given. It is impossible to identify Röding's species. Unless Röding's types of *P. brunnea* and *P. apus* could be unambiguously identified at Gotha, both names are understood as nom. nud. Pease's well known Hawaiian name stands for the time being.

Following Sherborn, Röding's *lata* and *pterigiata* are considered as mere shape designations, but not as generic nouns.

Lamprell & Healy (1998 sp. 230) depicted ***A. coturnix*** Dunker, 1879 from Australia and synonymized the earlier *A. maura* Reeve, 1857 originally described from Sydney. However, Iredale (1939) reported the small *maura* from Qld, Port Curtis and Iredale & McMichael (1962) accepted it as valid NSW species. The BMNH holotype is present. Dunker did not have a *maura*, just copied Reeve's not particularly well figure and described the same species as *coturnix*. From shape, size, habitat and from the material analysed throughout the IND there is no doubt that *maura* is the earlier name for Dunker's originally Japanese species. As such, ***Pteria maura*** (Reeve, 1857) is the valid earlier, not preoccupied name. *P. maura* is a rather fragile, smaller species, uncommonly exceeding 50 mm, but it is quite variable in color blackish, cream, reddish, but always maculated with white. Characteristic is a very broad anterior wing. It is widely distributed, at least from Arabia, Gulf of Oman, where a specimen has been personally collected, to Australia and Japan.

Lamprell & Healy (1998 sp. 232) accepted Reeve's ***Avicula scabriuscula*** originally described from Australia and synonymized Iredale's ***Austropteria calosoma***. Indeed, comparing Iredale's OD with Reeve's BMNH holotype these are sufficiently close. However, Dunker, 1852 described earlier his ***Avicula straminea*** from unknown locality. In 1872, Dunker depicted this species and added "Indiae orientalis" and stated "wahrscheinlich gehört zu unserer Art Av. scabriuscula Reeve". Dunker's holotype is present in MfN112865. Comparing the BMNH and MfN holotype, then Dunker's view is confirmed and *scabriuscula* is considered conspecific. Dunker's type is, in shape, very close to Iredale, 1939 *calosoma* pl. 5 fig. 11. ***Pteria straminea*** (Dunker 1852) is the oldest valid name and its type locality is here clarified as Qld, Low Isles.

OA4: ***Magnavicula***: Dunker (1872) and Prashad (1932) demonstrated that the wing length and even the coppery or silvery interior are variable in large ***Pteria penguin***. The shape can even be elongate or almost quadrate. Thus, ***A. lotorium*** and ***macroptera*** of Lamarck, 1819 have been synonymized by most authors (e.g. Lamy, 1935; Shirai, 1994, pl. 21; Abbott & Dance, 1996, p. 301; Wang, 2001; Jiuan & Okutani, 2001). Crucial for the understandings of *P. penguin* are the juvenile forms (see Oliver, 1992, pl. 9 fig. 1; Jiuan & Okutani, 2001 fig. 16-17). Slightly larger is Reeve's preoccupied ***A. signata***. A medium sized form is Reeve's ***A. savignyi***. Following Lamy (1935) *A. morio* Leach, 1814 and *A. heteroptera* Sowerby I, 1826 non Lamarck, 1819 are the same as *penguin*.

The species depicted from the Red Sea by Oliver (1992 pl. 9 fig. 2) and from Arabia by Oliver (1995 sp. 966 "*macroptera*") is instead ***P. aegyptiaca***.

Lamarck, 1819 described ***falcata*** (now in MNHN) and *falcata* var. b (now in MHNG). Lamy (1935) identified the Paris specimen, as before Deshayes, as the MED *tarentina* (= *hirundo*) and var. b as undefined Australian species. Both types have been studied. These represent 2 distinct species. The Paris type of *falcata* is indeed indistinguishable from *hirundo*; the type locality Australia is erroneous. Lamarck's var. b. is distinct and the juvenile of a larger Australian species, resolved by Iredale. ***Austropteria maccullochi*** has been well characterized and clearly referenced by Iredale, 1939 to the Australian *falcata* var. of Lamarck and *atlantica* Reeve non Lamarck. Unfortunately, he depicted a juvenile shell. Lamprell & Healy (1998 sp. 225) depicted instead Lamarck's *falcata* var. b from Australia, recognizing it as separate species, but misinterpreted Iredale's *maccullochi*. Shirai (1994 pl. 21 left) depicted a large *maccullochi* from the Arafura Sea, but misinterpreted it as *bennettii* of Iredale, which is a synonym of *penguin*. *P. maccullochi* is among the largest *Pteria* growing larger than 150 mm. It is an uncommon species, variable in length and strength of the wing. The color is brown or greenish brown. As Iredale remarked, the surface is very densely and strongly irregularly, pale brown flaked throughout in adults. The broad golden-brown margin is wider on the right valve. However, the wide gaping, mentioned by Iredale, is found in adult *penguin* as well. Furthermore, Dunker, 1880 described ***Avicula fluctuosa*** from unknown locality. He compared it also with Lamarck's *atlantica*. The holotype is present MfN 112864 and shows a small, rather square 55 mm specimen. A later added label reads "Australia" and further "atlantica Lam. Reeve pl. 18, sp. 73". It is most likely that *flexuosa* is indeed a juvenile and the earlier name for *P. maccullochi*. However, as the available specimens differ markedly in shape, an extended growth series is necessary for a firm conclusion. Definitely, a synonymy of *fluctuosa* with *nigra* as proposed by Shirai (1994) does not match the MfN holotype.

The type ***Magnavicula***, OD is ***bennettii*** (= *penguin*). Shirai (1994) accepted this genus for *penguin*, *bennettii* Shirai (= *maccullochi*) and *atlantica* (= *colymbus*). If, however, *fluctuosa* is indeed the juvenile of *maccullochi*, then smaller *Magnavicula* are obviously indistinguishable from *Pteria*. Together with most modern authors *Magnavicula* is not recognized as sufficiently distinct and here synonymized.

OA5: The complex ***avicular*** – ***tortirostris*** – ***heteroptera*** is difficult. Kilburn (1975) sharply differentiated *avicular* (syn. *chinensis* Leach) against *tortirostris*. He further stated that *A. brevialata* Dunker may be conspecific with *tortirostris*. Unfortunately, Kilburn analysed neither the MfN holotype of Dunker's ***tortirostris***, nor the MfN type lot of Dunker's ***rufa***, or the MHNG type lot of ***Avicula heteroptera*** of Lamarck.

Pteria avicular Holten, 1802 is understood in the sense of Kilburn (1975), Winckworth (1943), and Lamy (1935) with *A. chinensis* Leach, 1814 and *A. crocea* Lamarck, 1819 as synonyms. These authors also concluded that Reeve's *iridescens* and *trochilus*, but not Reeve's *crocea* are the same. Lamprell & Healy (1998) added Iredale's *antelata*, which matches. Holten's ***avicular*** is based on Chemnitz 11 205 2025-6 *avicula crocea*. An excellent interpretation of the variability in *avicular* has been given by Dunker (1872 pl. 11 fig. 1-4 under "*crocea* Lam"). *Avicular* is variable in shape and color, but often radially striped and with a glossy, golden hue. It is a comparatively small and fragile species and widely distributed from East Africa (KIL75 fig. 21b), Red Sea to Japan (Okutani, 2000 pl. 437 fig. 3 "*tortirostris*"). Reeve's yellow "*iridescens*" (REV575 sp. 48 = DKR80 pl. 11 fig. 5) is a color form and Reeve's *producta*" (REV575 sp. 55 = Oliver, 1992 pl. 9 fig. 5) and *trochilus* (REV575 sp. 51) are shape forms.

There is a second species widely distributed from the Red Sea (Oliver, 1992 pl. 9 fig. 3 "*tortirostris*"), East Africa (Kilburn, 1975 fig. 20 "*tortirostris*") to Japan (Okutani, 2000 pl. 437 fig. 1 "*brevialata*"). This species grows larger, is generally more solid, broader and typically red brown. This is "*tortirostris*" of Kilburn and *brevialata* of Japanese authors. Having studied many lots throughout the Indo-Pacific and from Japan, it was impossible to develop clear criteria to differentiate "*tortirostris"* as understood by Kilburn (1975) and Oliver (1992) from ***brevialata*** Dunker, 1872 as understood by Japanese authors. Kilburn (1975) clearly differentiated against *avicular*, but did not exclude synonymy with *brevialata*. Dunker himself described *brevialata* from Indonesia Amboina, Maluku, and the Philippines as 75 mm species. In 1882, he identified also specimens from Japan as *brevialata*. Oliver's "*tortirostris"* from the Red Sea could have been collected in Japan, there termed *brevialata*. Within *brevialata* from Japan some forms have strongly twisted anterior wings as requested by Kilburn for „*tortirostris”*, others fitting in form perfectly Kilburn's Mozambique fig. 20a, but have straight anterior wings and the right valve is smaller. Without doubt *brevialata* is a correct, but not the oldest name for this species. Iredale's OD of ***Austropteria levitata*** does not contain any significant clues for differentiation and is synonymized. Furthermore, Reeve's BMNH type lot of ***A. inquinata*** from Singapore has been studied. The largest specimen is the depicted syntype fig. 61. The others are smaller and represent a fine growth series. I was unable to separate these elongate, narrow, oblique, brightly chestnut red specimens from *brevialata* as known from Japan or from *levitata* as depicted by Lamprell & Healy (1998 sp. 229). Without doubt *A. inquinata* Reeve, 1857 is an earlier name for the originally equally 75 mm *brevialata*. However, crucial for the understanding of this species are two far older names. First, Dunker's ***Avicula rufa*** described 1849 from Java. In MfN labelled 16353 (syntypes) and 112966 2 lots with 3 specimens represent ***Avicula rufa*** Dunker, 1849. Just the smallest "syntype" matches Dunker's original measurements. The other, larger "syntype" is conspecific and the even larger 3rd specimen from Java is very close to the depicted *rufa* Dunker (1879 pl. 19 fig. 8). It is obvious that Dunker received after the original, small holotype, further and larger specimens from Java and depicted the largest specimen available. The MfN label further reads "cf. *inquinata* Rv". The holotype and the other *rufa* specimens are in shape and brown-red color indeed indistinguishable from Reeve's BMNH *inquinata* type lot. Finally, the MHNG type lot of ***Avicula heteroptera*** Lamarck, 1819 could be studied. This is one of the most misrecognized *Pteria* starting with Sowerby I, 1826, continued by Lamy (1935) and ending in most recent literature and databases (e.g. CLEMAM as syn. of the Atlantic *hirundo*). MHNG 1087/93 encompasses 3 specimens and 1087/94 encompasses the var. b, a small oblique, dark, yellowish radial streaked specimen. These 4 specimens belong to 3 distinct species. The largest specimen, 1087/93/1 100.4 mm, still bears the ink number 4 and is here selected **lectotype**. The medium sized specimen 1087/93/2 63.5 mm is conspecific and here selected **paralectotype**. These two reddish, broad forms with sizes in excess of 100 mm represent *Avicula rufa* Dunker, 1849 and are earlier than *Avicula inquinata* Reeve, 1857, as well as *Avicula brevialata* Dunker, 1872 and *Austropteria levitata* Iredale, 1939. Lamarck gave no type locality for *heteroptera*; but the Geneva specimens are correctly labelled "Oc. Indien". Lamarck's lectotype is in shape and size close to *brevirostris* depicted by Japanese authors (e.g. Kira, 1972 pl. 47 fig. 5). Lamarck's smallest syntype 1087/93/3 60 mm represents an apparently unnamed species, which is otherwise known from the Andaman Sea. It shares some features with *broomei*, but too little material is known. Lamarck's dark *A. heteroptera* var. b. conforms well to *P. avicular* (Holten, 1802).

Very close in color and shape to *heteroptera* is Reeve's ***A. castanea***, originally described from the Philippines. The BMNH type lot is difficult, it is labelled ?Singapore and contains 3 specimens and at least 2 distinct species. Just the 90.3 mm specimen conforms precisely to Reeve's fig. 49. The most elongate is a typical *inquinata* form. The highest and darkest, with a blackish internal border is distinct. Tomlin in sched. considered the type material of *castanea* and *inquinata* identical. Reflecting the variability seen in *heteroptera*, it appears more cautious to follow Tomlin and to consider 2 of the 3 specimens in the *castanea* type lot conspecific and *castanea* a further synonym of Lamarck's *heteroptera*.

A. aquatilis Reeve, 1857 is a juvenile specimen. The two small reddish brown syntypes labelled Moluccas are perceived closer to juvenile *heteroptera* than to juvenile *avicular*.

Consequently ***P. avicular*** is here applied for the generally smaller more colorful, iridescent, as adults strongly oblique forms, and ***P. heteroptera*** for the brownish-red, duller, generally larger, as adults more quadrate forms, often with strongly twisted wings. Both species are widely distributed.

Together with *A. rufa* Dunker, 1849 described ***Avicula tortirostris***. The holotype is present MfN 112866 and is identical to the depicted specimen Dunker (1872 pl. 11 fig. 6). As well recognized by Dunker, *tortirostris* is marked distinct from *rufa* (= *heteroptera*). Instead it approaches Holten's *avicular* depicted on Dunker's same pl. fig. 1-5. Nonetheless, from consistent orange-brown color, narrower, more slender body and particularly acute winged shape it is perceived distinct and a valid species. *Tortirostris* is a comparatively heavy species. *Tortirostris* appears biogeographically restricted to Indonesian and Philippine waters and is uncommon. Specimens precisely fitting the holotype have been dived in 10-18 m on gorgonians offshore N. Borneo and are known from the Philippines, Mactan 10-25 m. The maximum size seen is 111 mm (Philippines, Olango). Nothing close to *tortirostris* was collected in Japan, in East Africa or in the Red Sea.

Close in shape to *tortirostris*, but blackish in color is ***P. peasei***. *Pteria peasei* is well depicted by Abbott & Dance (1986 as "*avicular”* (syn. *peasei*)), by Okutani (2000, pl. 437, sp. 5 as *peasei*) and by Kira (1972 pl. 47 fig. 6 as *cypsellus*). *Peasei* is a black species, sometimes greenish or yellowish around the umbones, growing large. Body and wings are strongly extended, almost acute, and not iridescent, inside it is bluish white. *Peasei* is known from Australia, the Philippines, through Micronesia to Japan. Compared to also black, juvenile *penguin*, the body is slender and more elongate and the anterior wing smaller and more pointed. It appears that Iredale described this species as ***Austropteria perscitula***. Although Iredale did not accept *peasei* from Qld waters, Lamprell & Healy (1998) recognized in addition to *peasei* also ***A. cypsellus*** (syn. *perscitula*) from Qld. Their arguments to divide *A. cypsellus* Dunker 1872 appear tenuous. In MfN a specimen is present labeled ZMB 112.900 *Avicula cypsellus* juv. from Samoa. This is not the holotype, but close. However, this specimen with its shorter anterior wing is difficult to separate from *peasei* as is Dunker's original *cypsellus*. Together with most Chinese and Japanese authors, *A. cypsellus* is considered synonymous to *peasei*. It is not excluded that ***Avicula largillierti*** Philippi, 1849 from Basilan Isl., Phil is the even earlier name for *peasei*. However, the type was never depicted and is not located as yet; Dunker (1880 p. 78) could not interpret it. Unless a type can be found in Chile *largillierti* is treated as nom. dub.

Similar in shape to *heteroptera* is ***A. spectrum*** from the Philippines. However, the inside of the 2 medium sized, rather solid BMNH syntypes is well preserved and cream white at the broad border, silvery nacreous inside. Dunker (1872) and Hidalgo (1903) considered it distinct, but did not have further specimens, but Lynge (1909) attributed a 22 mm specimen from the Gulf of Thailand after comparison with the BMNH type. It is not excluded that *spectrum* is a valid, quite rare species, and if Lynge is correct, from deeper water (30 fathoms).

OA6: ***Pinctada***: It appeared highly unlikely that Reeve, disposing of the unique Cumingian collection, should not have named ***P. maxima*** (Jameson 1901) almost 50 years earlier. *P. maxima* is neither rare, nor narrowly restricted, or deep living. Equally astonishing would be that Dunker, who worked more than 30 years on *Pinctada*, should not have recognized *maxima* among the 40 pteriids described as new between 1849 and 1880 and the additional approximately 60 species depicted in his monograph.

Going through their monographs and through modern literature 2 possible candidates popped up: *Avicula placunoides* Reeve, 1857 and *Avicula anomioides* Reeve, 1857.

- A. placunoides was originally described from Australia and then variously placed, also as synonym of *anomioides* (e.g. DKR80, JAM01, LA292, WAN01, MALAC). The approximately 50 mm type could not be located in BMNH 3/09. However, the OD does not closely resemble any *maxima* seen. Shirai (1994) and Lamprell & Healy (1998) placed *placunoides* synonymous to Reeve's earlier *sugillata*. This opinion is shared.

- A. anomioides was described from unknown locality. Reeve's holotype, approximately 60 mm, is unambiguously present in BMNH. This species has also been variously treated, most notably by Jameson (1901) who described *maxima*, but considered *anomioides* a juvenile *vulgaris* (= *imbricata*). However, *anomioides* has been recognized by various authors as a valid species, e.g. Melville & Standen (1895) in Melanesia, Loyalty Isl., Melville & Standen (1899) in Torres Strait, Prashad (1931) notably in W.-E. India, Sri Lanka, Andaman Sea and Indonesia or recently Hylleberg & Kilburn (2002) S. India, Gulf of Mannar. Prashad (1931) reported from a shell collected in the Andaman Islands "agrees almost exactly with Reeve's description and figure …". He also referred a 132 mm specimen from the same location and characterized *anomioides* in color and scars. He explicitly excluded Jameson's synonymy with *vulgaris* which rarely exceeds 90 mm and also excluded synonymy with *margaritifera* and *chemnitzii*, the 2 other large, in excess of 100 mm species found by Prashad in India. Significantly, all these authors did not report the large *Pinctada maxima*, but according to Shirai (1994)'s distribution map they should have, as all localities are within or at least at the border of the known distribution range of *maxima*. Furthermore, huge *maxima* are known from Sri Lanka. Shirai (1994) listed all globally known large, more than 100 mm *Pinctada* species, nowhere he did comment on *anomioides*, but Iredale (1939 p. 339) did. He stated that the *anomioides* records of Hedley and Melvill & Standen from Torres Strait may "be based upon the juvenile of *P. maxima* Jameson".

The holotype of *anomioides* has been carefully studied and compared to smaller *maxima* material. From flattish, rather fragile texture, quadrate-ovate shape, identical radial striations, sparse ventral lamellation, whitish internal border, hinge and wing configuration, and shape as well as position of the muscle scars there is no doubt, that *anomioides* is indeed a juvenile *maxima* and the earlier name for the largest *Pinctada* and one of the most famous bivalves known. ***Pinctada anomioides*** (Reeve, 1857) has been many times validly used after 1899 and the holotype is unambiguously available. Its **type locality** is here designated as Andaman Isl. and *Pinctada maxima* is formally synonymized.

OA7: Shirai (1994) demonstrated that the common Caribbean and the common Indo-Pacific *Pinctada* are morphologically and regarding size and habitat not discernible. The analysis of Tëmkin (2006) demonstrated, apart from a very high similarity, only a small difference in interfilamentar tissue junction (present in "*P. fucata*" absent in *P. imbricata*). Tëmkin (pers. com., 2/2007) added that neither morphological soft anatomy, nor shell characteristics, or geometric morphometric methods reveal significant differences. In addition, the same form occurs in the Canary Isl. and in the Mediterranean (e.g. Tunisia, Lebanon, Israel), which also biogeographically intermediates IND and CAR perfectly. Thus, these forms are here considered synonymous, representing one of the very few cosmopolitan bivalves. The oldest name ***Pinctada imbricata*** Röding, 1798 is applied. Röding himself did not mention any locality, but gave Chemnitz and Knorr as references. According to Chemnitz 8 p.134 Knorr's specimen came from the West Indies, whereas his depicted specimen came from India, Tranquebar. Thus, the original type locality of Röding can be understood as India **and** West Indies. This makes ***Avicula radiata*** Leach, 1814, ***Avicula fucata*** Gould, 1850 (Fiji), ***Avicula lurida*** Gould, 1850 (orig. loc. NZ err), ***Avicula martensii*** Dunker, 1872 (Japan) and as elaborated by Shirai (1994) about a dozen Dunkerian "species" synonymous. ***Perlamater vulgaris*** Schumacher, 1817 (no loc.) is based on Chemnitz 8 80 717. This is considered the same, following here Jameson (1901).

However, Oliver (1995) depicted in addition to sp. 971 *radiata* (= *imbricata*) sp. 972 ***Pinctada* cf. *nigra*** from the Gulf of Oman and the Persian Gulf. As main difference he stated hinge without teeth. There indeed, a species is commonly found which surpasses the variability of *imbricata*. Adults are much more inflated than *imbricata*, quite solid, the colors are mostly white with reddish radial streaks, and the hinge plate is quite thick, broader than in *imbricata*, without teeth. However, from shape, colors, dentition and scars *nigra* can be dismissed at once. ***A. concinna*** Dunker, 1872 described without locality shares some traits. Jameson (1901) and Shirai (1994) could not place it. However, the MfN syntypes proved to have clear teeth and otherwise match *imbricata* forms personally found in the Red Sea or in Arabia well, also described by Dunker earlier as *A. varia* from the Red Sea. *Concinna* is here synonymized with *imbricata*, most likely originating from the NW. Indian Ocean. On the other hand, Lamy, (1929 p. 115) well characterized a very old species, which perfectly matches Oliver's "*nigra*" in hinge configuration, namely ***Perlamater inflata*** Schumacher, 1817. Consequently, Lamy (1929) placed *inflata* closer to *margaritifera* than to *imbricata*. Schumacher depicted the hinge pl. 2 fig. a, b and considered his new species distinct from *margaritifera* which grows much larger, but shares a similar hinge configuration. Dunker (1880 pl. 25 figs. 6-7) depicted *inflata* from Sri Lanka and stated it there commonly found. In addition, specimens found in the Maldives fit *Pinctada inflata* well. Oliver gives 50 mm, Dunker's Sri Lanka specimens approached 80 mm; a lot in MHNG Sri Lanka, Aripo (= pearl beds of Arippu) demonstrated a size in excess of 93 mm. According to Sherborn *inflata* has been validly proposed, is not preoccupied and here recognized to represent this NW. Indian Ocean species without teeth. The **type locality** of *inflata* is herein clarified as Sri Lanka, Arippu. If a neotype needs to be selected, the MHNG lot labelled *Meleagrina inflata* Schum. from Sri Lanka, Arippu, with 4 specimens, offers possibilities.

Lamarck's ***albina*** is understood in the sense of Lamprell & Healy (1998) with ***A. carchariarum*** as synonym. This is a large species and grows to at least 130 mm. As such the original locality, Tasmania, is erroneous and *albina* appears distributed along the WA coast only.

A. sugillata, as stated by Jiuan & Okutani (2001) is a distinct, smaller and more colored species, much wider distributed. It has been described from E. Australia; specimens recently live taken in SA, Spencer Gulf are much closer to *sugillata* than to *albina*.

The NW. Australian ***P. reeveana*** was very early synonymized by Jameson (1901) with *sugillata*, an action followed by Lamprell & Healy (1998). However, Iredale (1939) and Allan (1962) objected and considered *reeveana* a valid species. Indeed, the oblique shape, the white nacreous interior, the massively "lappet structure", the lacking purple does not match *sugillata*. *Pinctada reeveana* is closer to *carchariarum*, but, as no intermediaries have been observed, *reeveana* is considered a valid species.

OA8: Whereas most modern authors synonymize, Shirai (1994) accepted the Polynesian ***Pinctada cumingii*** as subspecies of *margaritifera*. However, at least in the Marquesas both species occur side by side, which obviously excludes a subspecies concept. *Cumingii* occurs more commonly there, is more ovate, flatter and stronger imbricated; the byssus is denser and longer. Whereas Tuamotu specimens are mostly blackish, the Marquesas specimens are usually brownish. As such Shirai's pl. 13 is referable to *cumingii*. Together with Reeve, 1857 and Dunker (1872) ***P. cumingii*** is considered a valid Polynesian *Pinctada*.

Whereas most modern authors synonymize, Shirai (1994) depicted the type of the Hawaiian ***P. galtsoffi*** and accepted it, as before Dall, Bartsch & Rehder (1938), as valid species. No specimens were studied, but I have no reason to doubt their assessment.

Genetic comparisons could easily solve these issues.

OA9: **SAF**: ***P. imbricata*** extends to Natal from North and the endemic large ***capensis*** extends to Natal from South. Kilburn (1973) further accepted *P. nigra* from Natal. However, all evidence indicates that *nigra* is not found in SAF but another species, which may occasionally be dark as well.

Jameson, 1901 described it as ***natalensis*** from Durban similar to his *carchariarum* in shape and sculpture. Shirai's *nigra* pictures do not cover this species, nor are the *natalensis* studied close to *nigra*. *Natalensis* is not rounded but rather square in shape, it is more compressed, with a longer hinge line, typically rather flat and much more fragile than *nigra*, which is as adult a quite solid species. The base color is often white with darker radial streaks but greenish white, even orange, or dark brown specimens occur. *Natalensis* is closer to *imbricata* than to *nigra*, but still more compressed, with a quite distinct sculpture of short, broad low lamellae and with a distinct, rather ovate, comparatively broad pallial sinus. Turton (1932) found typical *P. natalensis* in Port Alfred; further specimens have been studied from Natal, Umdloti, from Thompson's Bay and from Tanzania. As mentioned, but not inquired by Kilburn (1975), Dunker, 1852 earlier described ***Avicula*** (***Meleagrina***) ***petersii*** from Mozambique, Querimba. This species was never depicted and even Dunker (1880 p. 79) only mentioned it as possible variety of a Hawaiian specimen. However, two syntypes are still present in MfN 16385 which conform well to the OD and to Natal specimens. Furthermore, the marvellous syntype of ***A***. (***Meleagrina***) ***badia*** Dunker, 1852 described from unknown locality is present in MfN 16383. The latter is well depicted in DKR80 pl. 2 fig. 7. *Badia* was variously interpreted as *vulgaris* (JAM01, LA272), or as *albina* (HIG99). However, the syntype is correctly stored in MfN under *petersii* which has page priority. There is no doubt that this decision by a former curator is correct and that *petersii* is the valid earlier name for Dunker's *badia*, but also for Jameson's *natalensis*. Finally, the syntypes of ***A***. (***Meleagrina***) ***bicolor*** Dunker, 1872 are present in MfN 108678. This is another Dunkerian species without type locality and subsequently variously placed, most often in *imbricata*. Even better than the depicted, the non depicted, smaller syntype matches *petersii* in sculpture, shape and scar and *bicolor* is perceived conspecific. As such ***Pinctada petersii*** (Dunker 1852) ranges from SAF, Port Alfred through Natal, its type locality Mozambique to at least Tanzania. It is a flat, rather fragile, variously colored, medium sized *Pinctada* measuring approximately 70 mm (coll. auth, TURT, JAM01, and DKR80).

The type of ***P. nigra*** from Singapore is depicted in Shirai (1994 pl. 35). Otherwise, *nigra* is widely distributed, extending to Japan and Eilat in the Red Sea. The Red Sea form was described by Dunker, 1872 as ***A. reentsi*** and was found in Eilat's shallow water, snorkeling in 5 m, also in the Gulf of Aden, Djibouti. In this respect Lamy (1929)'s records are here confirmed. However, as concluded by Shirai (1994), there is no justification to consider *reentsi* other than a juvenile *nigra*. Compared to equal sized *petersii*, small *nigra* are more solid, more inflated, the radial ribs are more pronounced, especially internally. Adult *nigra* are marked distinct from large *petersii* and reach more than 90 mm (Borneo).

Avicula (***Meleagrina***) ***scheepmakeri*** Dunker, 1872 has been described as 92 mm species from unknown locality. The unique holotype is now present in MfN, Berlin as ZMB112911 also visible on systax on www. This species has also been variously placed. Japanese and Chinese authors, e.g. Koyama et al. (1981), Wang (2001), but most notably Shirai (1994) considered it a large *P. nigra*. Dunker, 1872 did not give a location, but Dunker (1880 p. 79) stated the origin Solomon Isl. Material from there should be compared to verify this synonymy.

Also black, but much smaller, rather ovate, and acutely pointed is the quite uncommon ***Pinctada vidua***. It has been described from Fiji and was dived on gorgonians in 25-35 m in the Marquesas, Nuku Hiva. The 36 mm type is depicted in Shirai (1994 pl. 19). *P. vidua* appears as rather small, approximately 50 mm only. Philippine "*vidua*" specimens are instead referable to *nigra*.

6.19 VULSELLIDAE

OE1: The number of valid *Vulsella* has been disputed ever since. Fischer-Piette (1977) accepted 1 species, Smith (1911) accepted 4 species, Lamarck (1819) discerned 6 species, Reeve (1858) recognized 17 species, and De Gregorio found 21 valid species. Chemnitz named 2 species, but it appears that he depicted instead 3 under two names. *Vulsella* are only known form the IND and adjacent areas (SAF, JAP, and SA). Here 5 species are recognized.

As there are strong doubts regarding the Mediterranean localities of many of the named forms of De Gregorio (1884) and Lamarck's together with Reeve's names are more than sufficient to cover the few existing species, the types were not studied, and all of de Gregorio's names are here omitted. However, his two created genera *Abisa* (*Vulsella navicula*, type, SD Iredale, 1939) and *Madrela* (*Vulsella virginis*, type, SD Iredale, 1939) seem to be based on *Vulsella* sp. and are added as additional generic synonyms.

Recognizable is a large, radially streaked, widely distributed species (Red Sea through Australia to Japan), identified unanimously as ***Vulsella vulsella*** (Linnaeus 1758) with *V. lingulata* Lamarck, 1819 as synonym (Dodge, 1952), also well depicted by Chemnitz 6 2 11 from India. *V. mytilina* is a huge specimen depicted by Smith (1911 sp. 1) and considered by Dunker (1875) and Smith (1911) as synonym. *V. hians* Lamarck, 1819 proved to belong here as well. Also most of Reeve's species appear to be juvenile *vulsella*.

Restricted to the S. and SW. coast of Australia a smaller, elongate, coarsely ribbed form occurs. Undoubtedly this is ***V. ovata*** Lamarck, 1819 described from Australia (type EAS11 sp. 5). The SA specimens studied are quite variable, and even differ within the same lot in color and shape. I follow Smith's and Lamprell's view and consider only one species found in SA waters and Cotton's opinion based on extremes. The surface sculpture of *ovata* is finer, the chondrophore smaller and not deeply cut, and the anterodorsal margin is never as prominent as in *fornicata*.

An old species occurs in the Red Sea and its vicinity, named ***V. fornicata*** Forsskål in Niebuhr 1775. Oliver (1992 pl. 11) well depicted it. The type material is illustrated by Yaron et al. (1986 sp 24 and 25). It is likely that Chemnitz 6 2 10 from the Spengler collection is this species, also brought by Niebuhr from the Red Sea instead of a juvenile *vulsella* as assumed by Chemnitz himself and most subsequent authors (Chemnitz 8 71 667 *Ostrea rostrata* also from the Red Sea is not a *Vulsella*, but instead a pointed *Malleus* very probably the same as 657 (= *regula*)). *V. fornicata* is a comparatively small, rather broad, strongly auriculate form, with a deep triangular chondrophore, similarly streaked as *vulsella*. *V. isocardia* Reeve, 1858 is the same.

V. rugosa of Lamarck has been variously treated. In addition to the specimen depicted by Smith (1911 sp. 6-7), a second conspecific specimen is present in Geneva, MHNG 1089/57. Lamarck gave no locality. Smith (1911) recognized it as valid Indian Ocean species. The very pointed shape, together with a broad hinge plate and a medium size of approximately 50 mm remove it from *minor*, *vulsella* and *fornicata*. Thus, I follow Smith and consider it a valid species. Smith synonymized Reeve's *corollata* from Zanzibar, Reeve's *crenulata* from the Red Sea, further Reeve's *linguafelis* fig. 13a from unknown locality and specimens from Aden. Oliver (1992 pl. 11 fig. 5c-d) is closer to *rugosa* than to *vulsella*. Nonetheless, the exact distribution and habitat of *rugosa* are currently insufficiently known.

The last species is widely distributed throughout the IND and somewhat variable in shape. Habe (1981), following Prashad (1932) depicted it as *V. minor* from Kii Peninsula, Zhongyan (2000) as *V. minor* from S. China Sea, Japan and further localities, Wang (2001) as well as *V. minor* from Chinese waters, and Hidalgo (1904) also recognized another species beside *vulsella* from Philippines waters. The oldest name is ***V. minor*** Röding, 1798, based on Chemnitz 6 2 8-9. This species is uniform in color, without the radiating color-markings or the large size of *V. vulsella*, and elongate, without the anterodorsal margin of *fornicata*, reaching about 50 mm. Chemnitz' specimen came also from the Red Sea collected by Forsskål and Niebuhr. Oliver (1992 pl. 11 fig. 6) depicted this small species as *cf. mytilina* from Suez, but had erroneously earlier synonymized *minor* with *fornicata*. According to most authors *V. attenuata* Reeve, 1858 is a synonym. According to Prashad (1932) and Smith (1911) *V. pholadiformis* Reeve, 1858 is a further synonym. Smith (1911) depicted the type of Lamarck' *Vulsella spongiarum* (sp. 4) and stated it astonishingly S. Australian with *ovata* as variety. However, Lamarck described this specimen from the Indian Ocean. Lamy (1935 p. 70) stated that the specimen chosen by Smith is the largest, 42 mm, out of 5 specimens, identified *spongiarum* by Lamarck and originated from the Red Sea. All evidence indicates that Lamarck's *spongiarum* is the same as Röding's *minor* and Oliver's *mytilina*, but not a S. Australian species.

OE2: ***Crenatula*** are highly variable with a huge list of named forms. The number of species has been disputed ever since. Many authors agree on 1 species, others list many different species. Here *Crenatula* is considered monospecific. 4 color forms are often found, brown, blackish-purple, greenish and red-rose or even marbled reddish-yellow/white. Possibly, the sponge host influences colors. ***Ostrea picta*** Gmelin, 1791 is the oldest name.

Crenatula travisii Turton, 1834, a unique specimen, described from MED (Atl., GB) seems to represent an accidental find. No *Crenatula* has ever been reported living in these waters.

Crenatula nakayamai is perceived the same as *flammea* of Reeve (see also Higo et al., 1999; Lamprell et al., 1998), a beautiful color form.

OE3: Similar to *Crenatula picta* also ***Electroma alacorvi*** occurs in a variety of colors and forms. This might as well be connected with the specific host corals. In addition, *E. alacorvi* displays a remarkable variety in obliqueness of the valves and in forms, from elongate to quadrate. Typical specimens are elongate-black, but even in the Red Sea brownish or paler specimens occur in various forms. Further east also greenish (***smaragdina*** Reeve, 1857), orange (***electrina*** Reeve, 1857), yellowish, rose-brown, brown-whitish streaked forms (***ovata** Quoy & Gaimard, 1835*) are found, often dark puncticulate in the umbonal region.

Following Lamy (1929) I could not detect any clear criterion to separate ***A. malleoides*** Reeve, 1857. Sufficient arguments to separate ***Avicula spadicea*** Dunker, 1852 were not found either, as also stated by Fischer-Piette (1980). Modern Japanese authors (e.g. Okutani, 2000) could not detect a second species as described by Dunker, 1852 from Japan. The differentiation in Lamprell et al. (1998) between *ovata* and *alacorvi* is not convincing and the Qld "*ovata*" is barely discernible from Red Sea specimens, also not from Qld "*alacorvi*" on the same page. Furthermore, ***Meleagrina ovata*** was earlier synonymized by Habe (1981) and Fischer-Piette (1980). Thus, *E. alacorvi* is here considered as a highly variable species in color and form, ranging from the Red Sea, through the tropical part of Australia to Japan and at least to Samoa, with 20 synonyms. The oldest name for this species, ***Mytilus meleagridis*** Bruguière, 1792, is considered an nom. nud., following Sherborn and Prashad (1932). Dillwyn, 1817 located *alacorvi* in South Sea Islands.

It is possible that ***Ostrea semiaurita*** Linnaeus, 1758 was the earliest name for *alacorvi*. Undoubtedly, box 188 of the Linnean Society Collection, London contains an unmarked specimen of the punctuate *alacorvi* form. However, Linnaeus OD is very short, the London specimen unmarked and *aurita* has been variously interpreted in the last 250 years and even been placed in the Caribbean by US authors. It was not even recognized by Hanley and Dodge. As no Swedish specimen is present to add weight, *semiaurita* is best considered a nom. dub.

Tëmkin (2006) considered ***Pterelectroma*** Iredale, 1939 as of "doubtful taxonomic status". Indeed, ***E. fuscopurpurea*** and ***E. papilionacea*** are as thin as is the type OD ***A zebra*** (= ***E. physoides***), thus, weakening Iredale's first argument. The second, a definite posterior wing separated from the body, is similarly found in some *E. papilionacea* forms and weaker also in certain forms of *alacorvi*. Consequently, this subgenus is here synonymized.

OE4: From S. Australia 6 *Electroma* species have been described by Lamarck (2), Quoy & Gaimard, Dunker and Reeve (2). Both Cotton (1961) and Lamprell & Healy (1998) reduced this number and listed 2 respectively 3 species, though with partly divergent characteristics. From the various BMNH and MNHN types studied, Cotton's view is shared and 2 SAU species are recognized, both first described by Lamarck, 1819. It appears that Lamprell & Healy (1998) depicted *papilionacea* twice, and, additionally, sp. 244 from a dubious location. The more fragile, larger "butterfly" species, generally ovate elongate, greenish as juvenile, whitish-yellowish as adult conforms to Lamarck's small ***virens***. Quoy & Gaimard's ***georgiana*** is the same, as concluded by Lamy (1935), but was originally based on larger, 34 mm specimens. Reeve's BMNH ***punctulata*** series is perceived very close; also Dunker's ***hyalina*** fits here better.

The other species, rounded ovate, remains slightly smaller, somewhat more solid and slightly more inflated, often in darker, horny colors with white radials. This species conforms to Lamarck's ***papilionacea***. It is Cotton's "*punctulata*". Lamarck had two *papilionacea* series, the largest specimen measured slightly more than 31 mm. Unfortunately, Reeve's *scalpta* type was not studied, but from the OD it appears closer to *papilionacea*.

A. pulchella and ***A. flammata*** were both described from the Philippines and both by Reeve, 1857. Lamprell & Healy (1998) synonymized *pulchella* with *A. georgiana*. However, the BMNH types rather indicate that Reeve's location was correct and that both are better placed in *alacorvi* which is known from the Philippines.

E. fuscopurpurea and ***E. vexillum*** are two further valid Indian Ocean *Electroma*, both treated by Oliver.

6.20 MALLEIDAE

OD1: This is a small family. 8 true *Malleus* are here globally recognized.

Malleus anatinus with a moderate extension of one wing, as mentioned by Oliver (1992, *normalis*), intermediates the strongly winged and the sparsely or unwingend forms. As *anatinus* has been allocated by some authors to *Malleus* and by others to *Malvufundus* the value of a subgeneric distinction based on wing extensions is obviously questionable. In addition, the black, uncommon ***M. daemoniacus*** with a weak or even lacking internal ridge would even better qualify for subgeneric distinction. Finally, the low number of extant malleids does not cry for a subgeneric distinction, based on gradual characteristics.

Thus, ***Malvufundus***, ***Brevimalleus*** and ***Parimalleus***, all created for low or unwinged forms are here treated as mere synonyms.

OD2: ***M. candeanus*** has been listed from Ascension by Rosewater (1975). Two specimens found in 2005 in Ghana, Central West Africa, subtidal 5-10 m; nestling among sandstones, 16 and 35 mm enlarge the range to the West African mainland and add another species living amphiatlantic. Brazilian specimens grow larger, to approximately 63 mm, but are otherwise very close, especially regarding the strong umbonal lamellation. The color ranges from almost black to whitish purple.

Whereas Boss & Moore (1967) synonymized ***Malleus rufipunctatus*** Reeve, 1858 with *M. candeanus*, Skoglund (2000) synonymized it, based on Bernard (1983), with *M. regula*. I have seen too little Panamic material. Obviously, genetic methods could help to clarify its status and the validity of Boss & Moore's assessment.

Tëmkin (2006) stated *candeanus* distinct from *anatinus*. Unfortunately, he did not compare it with *regula*. For the time being, a larger, rather common panpacific *regulus* and a smaller, uncommon panatlantic *candeanus* are differentiated.

OD3: ***M. regulus*** has been described from the Red Sea. Oliver (1992) demonstrated the variability in shape and color. *M. regulus* seems widely distributed, extended to Japan (Okutani, 2000 pl. 440 sp. 4) and to Australia (Lamprell & Healy, 1998 sp. 272 "*decurtatus*"). Following Oliver (1992) Lamarck's *decurtata* is perceived as color form. According to Barnard (1964), Turton, 1932's *Pinna aenigmatica*, *saccata* and *s. similis* belong also here.

In addition, a similar second IND species is recognized by most authors, but this species has been variously named.

It grows larger and has a higher, more extended internal nacreous area. Color and shape may be very similar to *regulus*. This species is known from Japan as ***M. irregularis*** (Okutani, 2000 pl. 440 sp. 3; Kii, 112 mm) or from Australia (Lamprell & Healy, 1998, sp. 271 "*regula*"; 120 mm; Darwin, 99 mm). It may be that Iredale's *gregarius* is also this species. Fischer-Piette (1978) identified this second species as ***M. legumen*** Reeve, 1858, a view shared. *M. irregularis* is perceived as extreme, curbed form hereof (see holotype remarks in Fischer-Piette, 1978 p. 22, fig. 5-8.) In addition to curbed, almost straight *legumen* have been collected in Japan, Kii.

6.21 ISOGNOMONIDAE

OB1: ***Isognomon*** are highly variable, especially in shape, with a long list of synonyms in almost each species. A review with modern methods was not encountered.

The number of species has been disputed ever since. It ranges from 1 (Fischer-Piette, 1976), more than 23 (Reeve, 1858) to 31 (Clessin 1890). Approximately 80 names have been created in the last 250 years. Here 15 species are perceived distinguishable.

Most genera of Iredale, 1939 (e.g. *Melina*, *Malleoperna*) have been synonymized by subsequent workers and even ***Parviperna*** (size, shape, color) and ***Anisoperna*** (sculpture) are perceived as very weak subgenera only.

OB2: The BMNH type series of Reeve's ***australica*** from Australia has been compared to Reeve's type of ***anomioides*** from "California". The former is the type ***Anisoperna***, OD; the latter was early recognized as erroneously located. The BMNH-label of *anomioides* reads indeed Torres Straits, which is more likely. Furthermore, the type series of *australica* contains, in addition to brownish-yellow specimens, also whitish ones, virtually identical to the white type of *anomioides*. There is no doubt, that these two are conspecific. Iredale (1939) came to the same conclusion and selected against page priority the correctly located *australica* and synonymized *anomioides*.

Following Iredale, there is also no doubt that *australica* is a valid species, markedly distinct from the quite uniform *perna*; the latter is usually more solid, cream with reddish-brown radial streaks. *I. australica* is more fragile and displays a larger variety in colors from pure white to brown. Lamprell & Healy (1998)'s conclusions are not shared. Instead, Iredale's findings are here confirmed.

From the OD, Gould's ***eremita*** from Polynesia seems instead to represent *I. perna*.

OB3: The type species ***I. isognomum*** displays a stunning variability in shape and color as 3 named species by Lamarck, 1819 and 5 additionally named species by Reeve, 1858 witness. However, all intergrades occur. Unless clear genetic data could support separation, just one highly variable species is recognized. *Isognomum* grows larger than 200 mm. Some typical forms are illustrated.

OB4: Gmelin's ***Isognomon legumen*** is a smaller more fragile, elongate, usually creamish-white species, occasionally darker ventrally. It is highly variable in shape, less so in colors, found from the Red Sea to SAF, through Japan to Hawaii. ***Perna vulsella*** is a Lamarckian species placed globally by various authors. Lamarck himself was vague, stating "les mers de l'Inde et d'Amerique?" but admitted that Savigny found it in the "mer Rouge". MHNG 1087/85 represents a small 40 mm syntype ink marked 9. Analyzing Red Sea *legumen* (e.g. Oliver, 1992, pl. 10 fig. 4a-f), or specimens collected in Arabia to Japan, no doubt remained that *Perna vulsella* Lamarck, 1819 is a junior synonym of *I. legumen*. Thus, the **type locality** of ***P. vulsella*** Lamarck, 1819 is here restricted to the Red Sea. ***Perna maillardi*** Deshayes in Maillard, 1863 (Reunion) and ***Perna torva*** Gould, 1850 (Hawaii, holotype in DBR, 1938) seem not distinguishable from the whitish-cream *legumen*. Kay (1979) depicted *I. legumen* from Hawaii and specimens examined from there are indeed too close to IND forms to be separated.

The Caribbean ***radiatus*** is generally more fragile and stronger colored than *legumen*, but in shape these two may occasionally be quite close.

OB5: In the Caribbean by most modern authors 3 species are recognized – ***alatus***, ***bicolor*** and ***radiatus***.

Macsotay et al. (2001) found 4 species in Venezuela: *alatus*, *vulsella* (Lamarck), *oblicua* (sic, Lamarck) and described ***vulselloides*** as new.

Alatus does not pose problems.

According to Lamy, Lamarck's *obliqua* is the same as Gmelin's *alatus*, but Macsotay's "*oblicua"* appears from dentition as *radiatus*.

Lamarck's *vulsella* is an IND species. Macsotay's specimens appear instead as *bicolor*.

The new *vulselloides* is more difficult. However, from texture, dentition and byssal position a small, solid *bicolor*, grown in special conditions is most likely. *I. chemnitziana* (= *bicolor*, Chemnitz 7 59 580) was based on a comparable, small, lamellate, solid species and is considered synonymous by most modern authors.

6.22 OSTREIDAE

OY1: Many authors contributed to this important family, e.g. Küster (1868), Sowerby II (1870-71), Lamy (1929-30), Ranson (1967), Stenzel in Moore (1969), generically most notably Harry (1985) and last but not least Torigoe (2004).

Furthermore, in ostreids, many genetic analyses are available (e.g. OFO990, GIR, KIRK, MOR031, GONZ04, LAMK06, LAPE06).

Unless clear arguments to the contrary have been found, generically Harry (1985) is followed. Recent genetic analyses support many of Harry's views. Thus, I see no merit in mixing ***Nanostrea***, ***Teskeyostrea***, ***Booneostrea*** or ***Undulostrea*** into *Ostrea* as proposed by Torigoe (2004) or ***Planostrea***, as proposed by authors. As stated by Harry (1985) these are OSTREINAE, but not close to the Med type species *O. edulis*. All have unique traits, different genetics (e.g. *Teskeyostrea*) or characteristic habitats and most are easily recognized.

Furthermore, I see no merit in merging the clear group of the 4 extant ***Striostrea***, or the compact group around *cucullata*, ***Saccostrea*** with more than 10 extant species, into *Crassostrea* as proposed by Lawrence (1995). At least for the extant taxa, his analysis is based on inappropriate criteria. In addition, instead of fewer than 10, approximately 30 crassostreinids live. Matsumoto (2003), Kirkendale et al. (2004) and especially Lam & Morton (2006) demonstrated a genetic distance of the *Saccostrea* to the *Crassostrea* clade, represented by *rhizophorae* and *virginica* resp. *gigas* and *virginica*.

From the available data however, ***Myrakeena*** appears better placed in OSTREINAE than in LOPHINAE, as also concluded by Torigoe (2004). The best affinities of ***Anomiostrea*** are unknown; it is tentatively placed in OSTREINAE as well. Ranson (1967) recognized both type species as valid and placed them within *Ostrea*.

G. **Ranson** (1967) treated the extant ostreoids and considered 50 species valid, of which 8 new. He based these new species on their larval shells (prodissoconch). In this family of highly variable species, Ranson considered this early structure as decisive. His extensive work has been variously treated, from "inutilisable" (Boss, 1968), as n.n. (many authors) to at least partly valid (Torigoe, 2004). Judging from Ranson's results, his method is reasonable, but with weaknesses. At least in some cases, solely based on prodissoconchs, distinct species were obviously not discernible (e.g. only 4 gryphaeids, 1 global *Saccostrea*). However, in gryphaeids and *Saccostrea* many more species occur, considered valid by subsequent authors and/or by genetic analyses. Nevertheless, I see no reasons to classify Ranson's new species as invalidly proposed, but certainly as unusually characterized. Most species are without in-depth research in various museums not conventionally understandable, or, not all conventionally recognized species are as yet translated into prodissoconch structures. As far as is known, nobody depicted and translated Ranson's species into "conventional" terms. For the time being Ranson (1967)'s following 8 species are here considered valid, but as yet not identified.

Crassostrea guyanensis (CAR,Trinidad, Suriname, N. Brazil (MNHN, USNM, IRSNB, MCZ ...; to be compared to *paraibanensis*),

C. tridacnaeformis (IND, Red Sea, (MNHN), New Caledonia (IRSNB)) and

C. caparti (IND, Thailand (ZMUC), S. Timor (IRSNB))

as well as

Ostrea valettei (ARG, S. Brazil, Uruguay, Argentina (MNHN, USNM, BMNH...); is likely *puelchana* (SCAR),

O. bartschi (IND, Nicobars, Phil, E.Thailand, Borneo, Pratas Isl. (MNHN, ZMUC, USNM)),

O. rehderi (Phil (USNM); prob. valid (TORI04),

O. winckworthi (India, Sri Lanka, N.Austr., Hong Kong-Japan (MNHN, USNM, BMNH, IRSNB, ZMUC, ZSI), and

O. catalai (New Caledonia (MNHN))

Lamy (1929-30) mentioned more than 400 valid ostreoid names. If the additional names attributed in the 20th and 21st century are added, then approximately 500 names are available for extant oysters. Whereas Sowerby II (1871) depicted more than 80 species, Harry (1985) recognized only 36 species (30 ostreids, 6 gryphaeids). From the material studied, I am convinced, that Harry considerably underestimated the number of living ostreoids. Torigoe accepted 70 species. Here at least 75 species are recognized, some very recently described.

In synonymies and species recognized to a large extent Torigoe (2004) is followed. However, Lamarck had a large private collection of ostreids. Many of his types in MHNG, Geneva have been erroneously interpreted by Lamy and by Torigoe.

Ardovini & Cossignani (2004) listed 7 ostreoids from the difficult **WAF** province. Their view is shared. However, 4 have an earlier West African name and the amphiatlantic *rosea* is here placed in *Parahyotissa*.

OY2: ***Ostrea***: Quite unanimously ***O. edulis***, the morphological and genetical very close Australian ***angasi***, the IND-JAP ***denselamellosa***, the JAP ***futamiensis*** and the SAF ***atherstonei*** are placed in *Ostrea*.

Ostreola was created by Monterosato for the Italian ***stentina***. Harry (1985) applied it for three similar, smaller species with a plicate unattached valve and comparatively strong chomata; the East Pacific *conchaphila*, the W. Atlantic *equestris* and the E. Atlantic type species. Torigoe (2004) included further species and placed it incertae sedis. European authors often consider *Ostreola* distinct from *Ostrea*.

The available genetic data show identity between *chilensis* and *lutaria*, a comparatively low distance between *O. angasi*/*O. edulis* and *chilensis*, but also a low distance between *denselamellosa*, *puelchana* and *conchaphila*, a close affinity between *conchaphila*, *auporia* (= *virescens*) and *equestris* and finally a close relation between *stentina* (= *capsa*), *auporia* and *equestris*.

Coan et al. (2000) and Caribbean authors considered *conchaphila* and *equestris* as *Ostrea* and *Ostreola* synonymous. Beu (2006) concluded that *Tiostrea* is synonymous to *Ostrea*. Lapègue et al. (2006) concluded that their data on *stentina* (= *capsa*) "would favour incorporation of *Ostreola* in *Ostrea*".

Considering all available data, it appears hard to argue that ***Adontostrea***, ***Eostrea***, ***Tiostrea***, and ***Ostreola*** are other than synonymous to *Ostrea* and ***algoensis***, ***chilensis***, ***conchaphila***, ***equestris***, ***pulcheana***, ***virescens*** and ***capsa***, though all valid species, are none other than true *Ostrea*.

O. stentina has been originally described from Med, Corsica. Lamy (1929) separated Adanson's WAF Le Garin (= *capsa*) from the Med *stentina*. Torigoe (2004) considered *stentina* as Med *Ostreola*, did not accept *capsa* as valid, placed *lacerata* which he erroneously considered identical to Adanson's Le Garin in *Crassostrea*, differentiated hereof Gmelin's *stellata* and placed this species together with the doubtfully synonymized *guineensis* in *Saccostrea*.

Harry (1985) considered *stentina* East Atlantic from the Med southwards, possibly to South Africa. Ardovini & Cossignani (2004) also saw only one WAF *Ostreola*, namely *stentina*, and Nicklès (1950) synonymized Le Garin with *stentina* and considered Hanley's *lacerata* distinct. Harry's view is shared, but *stentina* is not the oldest name for this species.

From the material studied it is indeed very difficult to keep the MED and the WAF species apart. They share morphology, comparatively small size and are often found in similar estuarine habitats. The attachement is not with clasper spines as in *lacerata*, but as stated by Adanson mainly to stones, or rocks, often umbonally.

O. capsa Fischer von Waldheim, 1807 is definitely a valid name for this species, erected on Adansons's Le Garin from Senegal, accepted by Sherborn and Lamy (1929) and further used in the Adanson review by Fischer et al. (1942). There is little doubt that Dunker, 1853's *O. guineensis* from Luanda, as synonymized by Nicklès (1955), is the same. Shape is extremely variable in *capsa*, the small chomata usually extend along the umbonal area, as depicted by Nicklès (1950 sp. 335); but in other specimens analyzed from Ghana, the chomata occasionally extend along the whole border as nicely depicted in Sowerby II (1871 sp. 62) for *guineensis*. The internal color is whithish to purplish to greenish, outside *capsa* is usually whitish red-brown. Nicklès gave 50 mm, which fits the largest WAF specimens seen; Lapègue et al. (2006) stated 40-52 mm and Cossignani et al. (1992) reported exceptionally 70 mm for *stentina* from Italy, Adriatic Sea.

O. lacerans Hanley, 1856 was an error for the preoccupied ***O. lacerata*** Hanley, 1846, which is instead a *Dendostrea*.

The true identity of Gmelin's ***stellata*** from WAF is somewhat dubious. Hanley (1856) and Lamy (1929) placed it close to *cucullata*; Torigoe (2004) placed it as probable earlier name for *guineensis*, but in *Saccostrea*. However, *guineensis* is not a *Saccostrea* and tubular spines are not known from *capsa*. Thus, *S. cucullata* is more likely and *O. stellata* is treated as probable synonym of *cucullata*.

Usually, ***O. equestris*** is listed from Maryland to Argentina with ***O. spreta*** and ***O. "cristata"*** Dall & Simpson, 1901 as synonyms (e.g. TORI04). However, from the types, the OD's and the material at hand this does not match. Furthermore, Diaz et al. (1994) depicted an ovate, whitish, interior brillantly white species from Venezuela, not fitting *equestris* or *spreta*. In addition, Weisbord (1964) described two new species from Venezuela ***O. lixula*** and ***O. libella***, both accepted as valid and also found extant by MACS. Finally, the type of Anton, 1838's ***Ostrea imputata*** described without locality is still present in SMTD, Dresden, No 6788. This is a true *Ostrea*, but not an *edulis* variety as earlier curated. It is ovate, quite solid, whitish, inside brilliantly white, with a reniform scar. From the global ostreids analyzed so far, *imputata* most closely approaches South American ostreids. Together with K. Schniebs, the type will be discussed and figured in the Dresden Museum periodicals 2009. It can not be excluded that Diaz et Puyana's sp. 67 is conspecific with Anton's *imputata*. It is further possible, that Weisbord's *libella* is the same. On the other hand, Weisbord's *O. lixula* seems to be conspecific with the much more common *spreta*. However, these tentative conclusion need much more material than presently available from Columbia, Venezuela and N. Brazil.

True ***equestris*** is a rather small, whitish purplish species, generally elongate, the upper or right valve deeply sunk and comparatively thin and fragile. In general it is strongly, densely plicate. It appears to occur mainly in the Northern part, certainly US, Bahamas and Cuba and is generally shallow living.

The BMNH type series of ***O. spreta*** Orbigny, 1846 from Rio represents a distinct, also comparatively small species which occurs from Brazil southwards, e.g. Uruguay, Argentina. This is solid, ovate, inside typically greenish-yellow with a large reniform scar. In some of the type specimens purplish streaks occur. In general the plications are weaker than in *equestris*, in some almost absent.

The huge 90 mm *"Ostrea cristata"* Dall & Simpson, 1901 non Born, 1778, a solid, reddish-brownish species, clasping, is not conspecific, but instead what Harry later named *Parahyotissa mcginty* (= *rosea*); Born's true *cristata* is an IND *Dendostrea*.

Coan et al. (2000) synonymized ***lurida*** with ***conchaphila*** and gave the arguments.

Sowerby II, 1871's ***tubercularis*** from Timor was variously treated. Lamy (1929) considered it identical to *cristatella* and as valid species from Timor; Torigoe (2004) considered it the same as *denselamellosa*, accepting a Timor distribution of this originally Japanese species. Melvill & Standen (1899) reported *tubercularis* from Torres Strait, Albany Pass, 18 m. This complex merits additional work and material. At present all names are listed under *denselamellosa*, following here tentatively Torigoe.

Whether Oliver (1995's **sp. 998**) from Arabia, Masirah Isl. conforms to any of Ranson's unresolved *Ostrea* or represents a new species is open.

OY3: ***Planostrea***: Harry (1985) depicted the correct type species, OD ***pestigris*** and gave the main synonyms, as confirmed by Torigoe (2004). Hanley's *pestigris* was wrongly understood by Sowerby II in Reeve (1871 sp. 78), instead the WAF *lacerata* (= *senegalensis*) is depicted. Sowerby's *palmipes* sp. 56 equals Hanley's IND species. This caused many misunderstandings in modern literature (e.g. KARA, Chinese and Japanese authors).

P. pestrigris is usually a flat shell, often the upper valve is much smaller. Subtriangular to ovate is the typical shape. Mostly *pestigris* occurs in purplish-white, but yellow, brownish or purplish-red and almost white specimens occur. The generally umbonally attached lower valve may be strongly radially ridged, with up to about 15 stronger ridges. All specimen found came from shallower water, but Lamprell & Healy (1998) recorded it down to 100 m in Australia. *Pestigris* certainly grows larger than 70 mm, reported up to 100 mm from Australia.

OY4: ***Booneostrea***: Obviously, the types of Deshayes true ***cucullina*** from Reunion represent juvenile *cochlear* (TORI04). Thus, Harry's small, flaky "*cucullina*" is instead Iredale's ***sedea*** from Autralia, or Habe's ***setoensis*** from Japan. As concluded by Torigoe (2004), also Lamy's ***subucula***, well depicted in Oliver (1995 sp. 997), appears the same and is therefore the earliest name. Valves studied from the Gulf of Oman, Persian Gulf, Madagascar, N. Borneo and Honshu, Kamakura share a small size, a curbed lower and a much smaller, flaky and strongly lamellate upper valve, inside often with a chalky thickening dorsally (also well visible in the holotype of *setoensis*, TORI83 pl.1 fig. 5) and sparse dorsal chomata. Single dead valves are usually all chalky white, whereas live specimens are purplish brown, the strongly extended fragile borders easily break off. Specimens have been found attached to or in other shells or gregariously on mangrove roots. Lamprell & Healy (1998 sp. 334) characterized *subucula* well, but depicted erroneously Sowerby's sp. 4 the WAF "*parasitica*". The largest *subucula* seen measured more than 40 mm, Oliver (1992) recorded it from the Red Sea with 45.9 mm pl. 16 fig. 1 as "*cochlear*".

OY5: ***Cryptostrea***: ***O. semicylindrica*** Say, 1822 is by no means a nomen oblitum as stated by Torigoe (2004). It has been quite consistently mentioned in English and American literature (Hanley, 1856; Tryon, 1873; Dall, 1898) and was discussed by Lamy (1930, p. 272). Furthermore, it is listed in most modern catalogues, but usually erroneously as synonym of *virginica*. Sherborn stated it validly proposed and not preoccupied.

If therefore Say's species proves indeed the same as Sowerby's ***permollis***, then ***semicylindrica*** is the valid, earlier name. Biogeography, the unique, unattached habitat embedded in sponges of the OD, as well as the white, large muscular impression would fit, but a semicylindrical shape was not encountered as yet. Say's type should be traced and compared.

OY6: ***Pustulostrea***: *Ostrea tuberculata* Olivi, 1792 (= *Limaria*) is an earlier homonym for *Ostrea tuberculata* Lamarck, 1804 (= type species, OD of *Pustulostrea*). According to Lamy (1929) *Ostrea australis* Lamarck, 1819 is the same, but with an erroneous type locality, namely King George Sound; the 5 syntypes of *O. tuberculata* and the holotype of *O. australis* in MNHN have been studied in 2007 and Lamy's opinion is confirmed. Thus, ***Pustulostrea australis*** (Lamarck 1819) replaces the preoccupied type species *tuberculata*. The **type locality** of *australis* is here corrected to Timor Island from where *tuberculata* has been described.

O. pseudangulata as described and illustrated by Lamy, 1930 and recognized as valid by Torigoe is a unique, ovate species, sharing some traits with *Pustulostrea*, with a bownish-metallic internal sheen. It is currently only known from the Philippines and appears exceedingly rare. Torigoe (2004) placed it in *Saccostrea*. However, it does not match particularly well there and is tentatively placed here. Anatomy and exact habitat are unknown. To date just 2 specimens from the Philippines have been studied. Lamy's type could not be located in the MNHN type collection, but may still be found in the general collection.

OY7: ***Crassostrea*** are quite unanimously recognized as nonincubatory, without chomata.

Lucas (1982) carefully elaborated the high probability that ***C. angulata*** was a Portuguese species, established in Europe before Christ and ***C. gigas*** a distinct Japanese species. However, the many imports, shipping and various phases of cultivation during the last 150 years make them today morphologically and genetically indistinguishable. Thus, *gigas* is considered a cosmopolitan species; *G. angulata* has been synonymized by CLEMAM and Torigoe (2004). Lamarck's unique specimen is still present in the MNHN type collection; it is in shape similar to true fossil *Gryphaea*.

Definitely, the Brazilian *Crassostrea* need additional work. Whereas many authors only recognize one huge, variable *rhizophorae* growing 288 mm, Torigoe (2004) differentiated 3 species: the small mangal *rhizophorae*, a larger, more solid *brasiliana* and a huge *paraibanensis*; Ranson (1967) earlier differentiated *rhizophorae*, *brasiliana* and *guyanensis*. From the material available and from recent genetic studies, at least two native *Crassostrea* species occur in Brazil, in addition to the farmed *gigas*. Thus, Torigoe's view is followed.

The small ***rhizophorae*** has generally elongate, often purplish muscle scars and is widely distributed from S. Florida, through the West Indies to S. Brazil. From the OD it is likely that Chemnitz 8 74 681 ***arborea*** meant indeed this species. However, he gave no locality and inferring from the text and the references Chemnitz obviously considered it cosmopolitan. Dillwyn, 1817 who first latinized *arborea*, included additional authors, offered a global assemblage, listed Indonesia, Maluku and the Caribbean "Curaçoa" and saw erroneously the Indonesian non-marine mango fruit tree as main host. As no type or neotype designation was found *O. arborea* Dillwyn, 1817 must be considered indeterminate and is treated as **nom. dub**.

O. brasiliana is a larger species, reaching at least 140 mm, often more ovate, with reniform scars. It is likely that this species extends further South to Uruguay and Argentina, as identified by Ranson (1967).

The huge ***O. paraibanensis*** seems confined to N.-NE. Brazil. *Lopha gibsonsmithi* of Macsotay & Campos, 2001 is not a *Lopha*, but a *Crassostrea* and should be compared to *paraibanensis*.

From the genetic data presented by Lam & Morton (2003) *virginica*, *rhizophorae* and the WAF *gasar* (= *tulipa*) are related, but distinct from the Indo-Pacific/Japanese *Crassostrea* clade.

Specimens, exactly as depicted by Sowerby II (1871 sp. 53 ***bicolor***) are found in WAF, e.g. Ghana, in lagoons. However, these are in morphology, size and habitat that close to ***tulipa***, that distinction, as proposed by Dautzenberg, (1912), does not appear warranted. Without genetic data to the contrary, Ranson's and Torigoe's synonymization is followed. Furthermore, Torigoe (2004) considered ***O. parasitica*** Gmelin, 1791 the earlier name for the well known *tulipa*, whereas most authors considered *parasitica* Indo-Pacific or Caribbean. Gmelin, 1791 based his *parasitica* on the same Chemnitz fig. 8 74 681 as Dillwyn, 1817 his *arborea* and gave an indeterminate Atlantic and Pacific distribution. Without doubt Gmelin's *parasitica* var. b is *gasar* (= *tulipa*), true *parasitica* obviously meant something else; the CAR *C. rhizophorae* is possible, as well as the IND *C. bilineata*. As no neotype designation was found, *O. parasitica* Gmelin is treated analogue to *O. arborea* Dillwyn, namely indeterminate and **nom. dub**. In both cases further inquires are not deemed necessary, as well introduced names are locally available. Thus, *tulipa* stands as valid name for the common WAF *Crassostrea*, *C. rhizophorae* for the common Caribbean and *C. bilineata* for the common IND-species.

O. bilineata based on Chemnitz 660 is the cultured Indo-Pacific black scar oyster. This species is widely distributed and got many names throughout its range. *Ostrea orientalis* Dillwyn, 1817 has been erected on the same Chemnitz figure. *O. lugubris* with an erroneous type locality and *O. iredalei* from the Philippines are the same. Torigoe (2004) added *angulata* of the Adams brothers and of Sowerby II non Lamarck. In addition, there is very little doubt, that ***Ostrea lischkei*** from Sri Lanka represents also this species.

Lam & Morton (2003) excellently described and genetically compared their new ***C. hongkongensis*** from Deep Bay. They excluded it to be the genetically closest *nippona*, but also not *ariakensis*, *gigas*, *sikamea*, *belcheri*, and *iredalei* (= *bilineata*). They gave a maximum size of 160 mm, an elongate, cupped left and flat right valve with a brownish-yellow lamellate sculpture, and a purplish, reniform muscle scar. Morphologically *C. hongkongensis* is closest to *bilineata*, but lacks the internal, usually marginal blackish, purplish or brownish-yellowish colors, and is also distinct in typical shape. *C. hongkongensis* is known from the Hong Kong area, and might be endemic there.

A similar species living in the same area as *bilineata*, also cultured, is ***O. belcheri***. However, this grows considerably larger, is more robust and has a white scar and white inner margin. Considering shape, size, muscle scars and colors, then Bartsch's huge ***O. benefica*** from Borneo appears the same as *belcheri*, but not as *bilineata* as stated by Torigoe (2004). Ranson (1967) analyzed the types and came to the same conclusion.

On the other hand, Preston's ***O. madrasensis*** with the comparatively thin texture, blackish inner margins and deep purplish black muscle scar appears as *bilineata*, but not as *belcheri* as stated by Torigoe. Durve (1975) also considered *C. madrasensis* (= *bilineata*) and *C. gryphoides* (= *belcheri*) as the two true edible oysters in India.

Iredale's characteristic ***dactylena*** is a valid *Crassostrea*. Neither is it close to *Saccostrea*, as stated by Iredale (1939), nor is it synonymous to *bilineata*, as proposed by Torigoe. Specimens studied from near the Qld type locality fit Lamprell & Healy (1998 sp. 338) well and are considered to represent this small, elongate, rather fragile *Crassostrea*. All specimens seen so far, have been only umbonally attached, preserving the unique sculpture on the outer lower valve. Swennen et al. (2002 sp. 62 small cf. *gigas*) and Robba et al. (2002 *"rosacea"*) from the Gulf of Thailand should be compared.

The PAN ***C. corteziensis*** has been synonymized with the earlier ***columbiensis*** by Harry (1985) confirmed by Coan et al. (2000). They also demonstrated that Fujita, 1913's description of ***ariakensis*** is sufficient and valid.

Obviously, the ***O. lingua*** Lamarck, 1819 MNHN-type consists of two lots, the worn, juvenile types from unknown locality and the purple var. supposedly from Timor (LAM29). However, this species could not be satisfactorily attributed (DES36, HANL56). Lamy (1929) considered it related to *Saccostrea mytiloides*, Torigoe (2004) placed it questionably near *C. bilineata*, and Ranson (1967) considered it identical to *C. rhizophorae*. *O. lingua* is here considered a nom. dub.

OY8: ***Saccostrea***: This is perceived as homogenous grouping around *cucullata*. Lam & Morton (2006) genetically analysed the IND populations, and confirmed distinction to *Crassostrea*.

The extreme dorsal extenuation, the "*cornucopiae*" form, is found in various *Saccostrea* species, definitely in *cucullata* (WAF and W. Indian Ocean) and *scyphophilla* (India, Australia, Japan), but it was not seen as yet in *kegaki*, *echinata*, *circumsuta*, *spathulata*, *malabonensis* or in the Panamic *tubulifera* and *palmula*.

Torigoe (2004) followed Chemnitz and divided between the WAF ***cucullata*** and the Natal, Red Sea ***forskahlii***. However, specimens collected in SAF, Natal or in the Red Sea, Egypt are so close to Born's type (NHMW 14.118) and to specimens studied from WAF, Angola that these are for my eyes indiscernible. Unfortunately, no genetic analyses for the WAF, SAF and Red Sea populations are available. Thus, conclusions are tentative.

For the time being Hanley (1856), notably also the conclusions of Nicklès (1950), Harry (1985), Oliver (1992 and 1995) who all considered *cucullata* also living in the Red Sea and the W. Indian Ocean are followed.

In addition, Torigoe, gave 50 mm for the IND species; but specimens personally collected in the Red Sea, Hurgada measure more than 90 mm, and from there *forskahlii* has been described. Lamarck, 1819 large, more than 90 mm MHNG holotype of ***Ostrea turbinata*** from the Indian Ocean proved to represent a typical *Saccostrea cucullata* instead of *Hyotissa*. Such forms are found in the Red Sea. *S. cucullata* seems restricted to Central WAF, Natal, Red Sea to Arabia, but does not occur in India or Australia.

Specimens from India, Andaman Sea, Gulf of Thailand, Philippines, Australia, Japan identified as *cucullata* are either the solid, usually smaller rock oyster *scyphophilla*, which is well known from the S. Red Sea (as *sueli*), from Austr. (*amasa*) or Thailand, Japan-Fiji (*mordax*) or the mangrove and estuarine *circumsuta* or even cryptic, undescribed species. In India, certainly *mordax* (= *scyphophilla*) occurs, but no true *cucullata* was as yet seen from there. The famous *Ostrea "cucullata"* (Bombay oyster) treated by Awati & Rai (1921) is *scyphophylla* but not Born's *cucullata*. The size, the blackish border and the reniform black muscle scar near the ventral border are unmistakable. Following Chemnitz and Lamy (1929) the type locality of *cucullata* is restricted to WAF.

In addition, Lamarck, 1819 described another, even larger, widely misrecognized *Saccostrea*, namely ***O. spathulata***. This is with slightly in excess of 140 mm one of the largest *Saccostrea* specimens known. Lamarck, 1819 gave no locality for his unique holotype. Very close and perceived conspecific are Sowerby II's marvellous BMNH-types of ***barclayana*** and the conspecific ***vitrefacta*** from Mauritius. Odher (1919) and Dautzenberg (1929) reported *vitrefacta* from Madagascar, and Odhner (1917) from NW. Australia. Indeed, an identical specimen studied came from WA, Shark Bay. *Saccostrea spathulata* is obviously a lesser known species found in the Southern part of the Indian Ocean. It is superficially close to *cucullata* and quite similiar shapes occur. However, *S. spathulata* is in general flatter, larger and with stronger chomata than *cucullata*. Cornucopial extensions are unknown. Distinct is also the broader and generally whitish to oak-colored muscle scar.

Other than concluded by Harry (1985), recently Torigoe (2004) and genetically Lam & Morton (2006) recognized in addition to *cucullata* many additional *Saccostrea* species in the Indo-Pacific and adjacent areas. Especially the latter genetic analysis indicates, that even more *Saccostrea* species may occur, than are here differentiated.

S. mordax (syn. *amasa*, *sueli*, *cornucopiaeformis*) is a widely distributed species, genetically and also morphologically well recognizable. It is solid, generally with the typical strong radially crumbled sculpture, as well depicted by Iredale (1939 pl. 7 fig. 8 *amasa*) or Lamprell & Healy (1998 sp. 336 "*cucullata*"). *S. mordax* is internally glossier than *cucullata*, often with a raised, deep black scar and glossy black margins. It generally grows smaller and usually occurs gregariously, strongly cemented on high to intertidal rocks. As *cucullata* also *mordax* is prone to an extreme extension of the umbonal portion. However, Australian *mordax* specimens were earlier described by Péron & Lesueur, 1807 as ***O. scyphophilla***. This name has been validly proposed, accepted by Sherborn and applied by Iredale (1949) for Shark Bay specimens. Allan (1962 fig. 65 sp. 3) depicted a specimen, and stated a range from Shark Bay to Qld, Mackay. Cotton (1961 fig. 74) recognized it as extant from SWA, NWA and Qld. Specimens studied from W. Australia leave no doubt that this is the same as *amasa* and *mordax*, therefore, the earliest valid name for the common rock oyster. The same dorsal elongation has also been encountered in other localities, very typically in E. Malaysia.

S*. *glomerata is a valid, genetically isolated species, restricted to SE. Australian and NZ; but possibly farmed elsewhere. S. *commercialis* is morphologically and genetically not distinguishable (LAMK06).

The Melanesian ***S*. *circumsuta*** was considered the same as *glomerata* by Torigoe (2004), a view not shared by Beu (2006), and also not supported by genetic data. Torigoe included in *circumsuta* also Sowerby's fabulous *vitrefacta* and *barclayana* from Mauritius, as well as *attenuata*. However, only the *attenuata* synonymy is shared. *Vitrefacta* and *barclayana* are instead junior synonyms of the distinct Indian Ocean *spathulata*. As specimens have no spines, but a lamellate sculpture, *circumsuta* may be identical to *cucullata*-A of Lam & Morton. As originally described *S*. *circumsuta* is perceived as an oblong, purplish-yellow-white, strongly, stitch-like denticulated, solid, never spined species. *S*. c*ircumsuta* is found as bay, brackish water, mangrove species, widely distributed. It seems that Yoosukh & Duangdee (1999 *Saccostrea "forskalii*") from Thailand is instead *circumsuta*. Tröndlé & Cosel (2005) identified the common, small rock oyster from the Marquesas as "*cucullata"*. However, the specimens collected there do not fit true *cucullata*. Instead, they are perceived as representing *circumsuta*.

The large, more than 100 mm ***O*. *subtrigona***, described from Australia, does not fit *cucullata* in sculpture and white muscle scar either. The BMNH-type is neither close to *scyphophilla* nor to *circumsuta*. Torigoe (2004) synonymized it with *forskahlii*, Lamy (1929) considered it valid and added a specimen from Society Isl. Lamprell & Healy (1998) did not treat it. At present Lamy's view is shared and *subtrigona* is considered a valid species with an insufficiently known habitat and distribution.

Lam & Morton's *cucullata*-B seems to be ***echinata*** (syn. *spinosa* obj. and *nigromarginata*). This is typically a rather fragile, blackish margined species, often found strongly spined in juveniles. However, as depicted by Lamprell & Healy (1998 sp. 339) or Torigoe (2004) this may grow quite large. Harry (1985) depicted this mytiloid species, with dark purple lamellae as ***S*. (*Parastriostrea*) *mytiloides***. However, these lamellate forms show within the same population all intermediaries to strongly hollowed spined forms. Torigoe synonymized Lamarck preoccupied *mytiloides* with *echinata* and considered *Parastriostrea* synonymous to *Saccostrea*. This view is shared. Sowerby II (1871) depicted these forms well sp. 3 (*mytiloides*), sp. 79 (*spinosa*), and the typical internal view in fresh juvenile specimens sp. 83b (*arakanensis*). Iredale (1939 fig. 10a-b *gradiva*) represent the typical unspined form, his *spinosa* (fig. 7) is the same, but spined.

The usually strongly spinose, comparatively small and rather fragile ***S*. *kegaki***, though morphologically quite close to *echinata* has been genetically isolated by Lam & Morton. It is mainly known from Japan. Compared to *echinata* which occurs in mangrove areas or mud flats, *kegaki* has only been found intertidally attached to stones in rocky shores. Whether Zhongyan (2004 *echinata*) from China is instead *kegaki* is open; at least the habitat mentioned fits *kegaki* better.

Faustino described a small yellowish-brown, horse-hoofed ***S*. *malabonensis*** from the Philippines, accepted as valid by Torigoe (2004). All specimens seen so far came from Manila Bay, the largest slightly less than 45 mm. Japanese authors found it also in Okinawa Isl., Iriomote. *S*. *malabonensis* appears close to Lam & Morton's *cucullata*-E and D.

In the tropical East Pacific two species seem to occur. One, very close and possibly synonymous to *echinata* has been named ***tubulifera*** by Dall; the other species ***palmula*** is, as stated by Sowerby II for the synonymous *mexicana*, quite close to the type species *cucullata*, somewhat lighter and smaller. Other than concluded by Harry ***mexicana*** is the same as *palmula* (Keen, 1979; TORI04). The *Dendostrea* species named so by Harry seems to be *amara*.

Also Lamy's ***dalli*** with a black border represents ***palmula***, as concluded by Torigoe (2004). Alamo et al. (1997) reported *palmula* also from N. Peru. Specimens have been studied at least as far south as Ecuador, Guayaquil area.

OY9: ***Striostrea***: I see no merit in including this well defined small group of huge, heavy, thick, internally iridescent species, often with very strong nodulose chomata, but just along both sides of the hinge and comparatively large scars in *Saccostrea*. Very characteristic are also divaricate riblets on the lamellae, but these are usually worn off; then a regular commarginal sculpture is visible. Stenzel (1971) and Harry (1985) gave more details.

Other than concluded by Harry (1985) globally 4 instead of 3 species are known.

Born's large type of ***denticulata*** (NHMW 14.120) fits specimens personally collected in WAF, Ghana well. This is an old species described as *Le Vétan* by Adanson and synonymized with *denticulata* by Chemnitz and Lamy (1929). As a matter of fact, Lamarck correctly identified Born's *denticulata* from W. Africa, his No. 15 MHNG 1089/31 bears the ink marked 15 and witnesses. In addition, Lamarck had a second large *denticulata* in his private cabinet, namely No. 17 ***Ostrea ruscuriana***. The specimen present, 210 mm, heavy, thick, oblong ovate, with a thick lower valve pierced with boreholes conforms precisely to his OD and is, despite a missing ink number, understood as Lamarck's syntype. The other syntype from the Faujas collection seems lost. Most authors followed Lamy, who misidentified *ruscuriana* with *edulis*, but no *edulis* with 210 mm, and a lower valve as thick that medium sized lithophagids may grow therein is known. Instead muscle scars, colors, chomata in the upper valve and shape conform precisely to large *denticulata*. Such specimens are known from "les côtes d'Afrique", but not from Algeria. The **type locality** of *Ostrea ruscuriana* Lamarck, 1819 is herein corrected to WAF, Ghana, where similar specimens have been collected.

The really crucial species is No. 25 ***Ostrea rufa*** Lamarck, 1819. MHNG 1089/37 is the largest syntype, originally described from "les mers d'Amérique". As recognized by many authors *denticulata* is extremely close and easily confounded with the even larger PAN ***prismatica***. Indeed

Ranson (1967) considered *denticulata* distributed in PAN and WAF. Both species grow more than 200 mm and are heavy as adults. Shape and colors may be very close. However, the muscle scars are distinct, more elongate in the WAF species, broader and less high vs. more rounded-ovate in the Panamic species. Lamy (1930) followed by Torigoe (2004) placed Lamarck's *rufa* as synonym of *denticulata*. However, inferring from the facts that Lamarck had two *denticulata* with such elongated scars to compare, that *rufa* indeed has more ovate scars, that Lamarck further gave a marked distinct locality for *rufa*, namely "America" and that neither Lamy nor Torigoe saw Lamarck's Geneva specimens it appears much more likely that *Ostrea rufa* Lamarck, 1819 is indeed Panamic and the earliest name for ***prismatica***. However, an additional assessment is here deemed necessary to confirm this tentative view.

The Japanese ***circumpicta*** (type HIG01 B417) belongs here, as recognized by Harry (1985). *S. circumpicta* seems to attain only about half the size of the other two *Striostrea*; many specimens have been collected in Honshu; but the largest from Chiba Pref. is still less than 100 mm. *S. circumpicta* is a quite heavy, solid species, with the typical metallic-iridescent internal sheen, often in whitish-grey-green, often reddish around the borders. The noduled upper border denticulations are also typical. Juveniles have a particularly large scar. In well preserved specimens irregularly divergent ribs are found.

The fourth, the type species of *Striostrea* ***O. margaritacea*** is SAF and W. Indian Ocean. A fresh specimen with the characteristic sculpture is well depicted in Sowerby II (1871 sp. 74 *multistriata*), other examples are found in Stenzel (1971) or in Oliver (1995 sp. 995) from Arabia. In beached specimen this sculpture is usually abraded, and the surface silvery. Lamy (1930 p. 272) did not understand Lamarck's *margaritacea*; instead he described a new species, namely ***Ostrea procellosa***. Harry (1985) obviously confounded *margaritacea* and the WAF *denticulata*, but Lamy (1929 p. 71) located the type *Striostrea*, OD *O. procellosa* unambiguously in SAF and Mauritius and Stenzel demonstrated it to be the same as *margaritacea*. Lamarck's type lot, marked 26 is unambiguously available in MHNG 1089/38. However, the locality Amerique is erroneous and here corrected to **SAF**. Steyn & Lussy (1998 p. 208 sp. 847) characterized this species well, but placed it erroneously in *Crassostrea* and confounded the figures. Their fig. 846 is *S. margaritacea*; fig. 847 is instead the introduced *C. gigas*. Adult *margaritacea* are quite heavy and easily surpass 100 mm, but seem to grow smaller than *denticulata*. *Margaritacea* are internally iridescent as typical in *Striostrea*, white with purplish to pinkish blotches. The strong brownish-red colors of *denticulata* and *prismatica* are lacking. *Margaritacea* occurs quite widely in the W. Indian Ocean, however, the eastward extension is as yet unknown. Hidalgo (1905 "*denticulata*") from Phil, Samar might instead be a misidentified *denselamellosa*, which is known from there.

Both, worn *denticulata* and worn *margaritacea* share a strong commarginal pattern. As Born's outside worn holotype, also Chemnitz famous 8 73 672-3 shows exactly this pattern. However, in Chemnitz the color is "silberfarbicht" and IND has been mentioned as locality, Chemnitz' "*denticulata*" is instead a larger worn *margaritacea*, identical to the silvery MHNG syntype. Thus, Bory's preoccupied *concentrica* and Dufo's *dentifera* are this species. The true identity and locality of the types of Fischer von Waldheim's earlier ***O. concentrica***, recognized as validly proposed by Sherborn, are currently unknown. Obviously, an abraded *margaritacea* is not excluded. However, unless the *concentrica* types could be located, Fischer von Waldheim's species is treated as nom. dub.

Other than here understood, Torigoe (2004) placed *denticulata* in *Dendostrea*, *margaritacea* and *prismatica* in *Saccostrea*, and *circumpicta* in *Ostrea*. He further synonymized *Striostrea* with *Saccostrea*. Future workers will decide.

OY10: ***Lopha***: Macsotay & Campos (2001) described ***Lopha gibsonsmithi*** from Venezuela. However, this species does not belong here, it is a *Crassostrea*.

There is indeed an obviously **undescribed** *Lopha* rarely found in the Caribbean. It shares with *cristagalli* the dense chomata and the sharply plicate shape. Only one specimen has so far been found in Martinique, St. Anne, 40 mm, personally snorkeled in about 3 m. However, much more material is needed for a new species. In the same area *frons* has been collected as well, but there the plicae are much rounder and the chomata much sparser.

Torigoe (2004) included in *cristagalli* also Chemnitz 675 (= *O. theca* Röding) from the Red Sea. However, Chemnitz 9 116 998 well recognized *cristagalli* and clearly differentiated it from his Red Sea species. Comparing Red Sea specimens, it seems that ***Lopha theca*** fits instead *Dendostrea folium*, depicted as *D." frons"* by Oliver (1992 pl. 16 fig. 5) and also identified as ***cognata*** Chemn. by Jousseaume from the Red Sea. Lamy (1929) considered Lamarck's ***sinuata*** the same.

The true identity of ***Lopha hyotis notina*** Iredale, 1936 from Sydney Harbor is unknown. Iredale's OD gives no clear hint. Allan (1962), Jansen (1995) and Lamprell & Healy (1998) did not treat it; Torigoe (2004) placed it with reservation under *Dendostrea rosacea*; Beu (2004) with reservation under *Parahyotissa imbricata* (= *inermis*), but did not exclude a fossil. The AMS-curator did not exclude *hyotis* (BEU04). As far as is known, neither of above mentioned species occurs in Sydney waters. On the other hand, Woolacott (1957) reported *Pretostrea bresia* as addition to the NSW list, stating it occasionally found on Sydney's beaches. *Bresia* (= *folium*) would at least reliably occur in Sydney, but has no spongy structure. Obviously, Iredale's single abraded valve is unidentifiable and considered nom. dub.

Lopha plicatella Röding, 1798 was listed as "der dreyeckige grüne Hahnenkamm" without reference and locality. Without analysis of Bolten's type material at Gotha it must remain a nom. dub. However, from the context *sandvichensis* would not be completely excluded.

OY11: ***Dendostrea***: This is another difficult group. No genetic analysis is available.

According to Iredale (1939) the type *Dendostrea*, SD by monotypy Sowerby II, 1839 is *O. folium.* Sowerby II emendated the original *Dendostraea* to today's *Dendostrea*.

Dodge (1952) clarified, based on Linnaeus' type material, that despite its erroneous locality, ***folium*** is the Pacific and ***frons*** the Caribbean species. Dodge's view is here followed.

Biogeographically, it is more likely that the larger, more ovate IND type species *folium* immigrated through the Suez Channel and lives nowadays in the E. Med.

Torigoe (2004) excellently reviewed this group. However, from the ample material at hand, he synonymized one important species too much with *folium*.

Lamarck's ***O. glaucina*** (MNHN, type coll.) is perceived as distinct, with weaker more rounded ribs, as also recognized by Lamy (1929). It is much less solid and generally grows smaller. Internally it is iridescent whitish, often with purple; fresh valve are yellowish-green inside. The chomata are weak, a few near the hinge. *Glaucina* is an Indo-Pacific species. An enigmatic species was Born's ***O. cristata***. It was described without locality and subsequently placed globally, in CAR (Dall, 1902; Torigoe, 2004), WAF (auctt.) or MED (Poli, 1795; Lamarck, 1819; HANL56; CLEMAM). However, Born's unique type is still present in Vienna (NHMW, No. 3190) and is Indo-Pacific. Ranson (1949) saw Born's original and stated it identical to *O. plicatula* Gmelin, 1791, but nowadays, *plicatula* is accepted as type species of *Alectryonella*, characteristically distinct in shape, sculpture and internal fingerprint structure. Brauer (1878) considered Sowerby II (Reeve's Icon.) fig. 68 (*Ostrea plicata* non Gmelin, 1791) closest. However, following Torigoe, this is more likely a synonym of *rosacea*. From all specimens globally seen, only Lamarck's *glaucina* fits Born's *cristata*. Lamarck himself erroneously understood forms of the Atlantic *edulis* as *cristata*, as his MHNG identifications witness. Very close to *cristata* are specimens personally collected in the Gulf of Thailand. Thus, **Malaysia**, **Kuantan** is here clarified as **type locality** for ***Dendostrea cristata*** (Born 1778). Similar specimens from further north are depicted in Swennen et al. (2001 sp. 65 as *glaucina*). Also Yoosukh et al. (1999)'s thin ovate "*folium"* from the Gulf of Thailand seems to represent this species. *Dendostrea cristata* is widely distributed in the central Indo-Pacific, at least NW. Austr., Phil, E. Malaysia, E. Thailand and locally commonly found. ***O. radix*** is perceived the same; such forms are available from the S. China Sea; Ranson (1967) located *radix* also in China. As far as could be ascertained, Chemnitz 8 71 661 (= ***O. parasita*** "Chemnitz" Küster, 1868) from the Nicobars, has never been resolved. Küster recognized it as valid, but considered it the same as Lamarck's ***O. elliptica***. Lamarck's purplish-brown holotype, inside weak and outside clearly ink marked 29 is present in Geneva (MHNG 1089/40). This is the same as *cristata*; Torigoe's *edulis* synonymy does not match. Therefore, most probably Chemnitz's old species latinized by Küster as *parasita* belongs here. In addition to the typical, moderately inflated forms also very flat and weakly ribbed specimens (WA, Shark Bay) are here included; these approach 82 mm, given as maximum size by Swennen, and may demonstrate a high variability in shape in *cristata*.

Küster (1868's sp. 22) ***semiplicata*** from Hawaii fits instead *sandvichensis* as concluded by Lamy (1930).

Torigoe (2004) treated ***rosacea*** and synonymized Hanley's ***chemnitzii***. This view is shared. Chemnitz' famous *orbicularis* 8 74 680 (= ***corbiculus*** Küster, 1868) is usually approached or synonymized with *plicata* due to the partly plicate surface (HANL55, TORI04). However, Chemnitz' precise OD leads into a distinct species. Neither has *plicata* a very flat, calcareous white attachment area, nor are the plicae very irregular, alternating smaller and larger, nor is the internal color whitish, nor is *plicata* commonly found on ships, or very strongly attached, or that variable in shape as stated by Chemnitz. All this fits *rosacea* precisely. From the material at hand, there is very little doubt that Chemnitz species (= *corbiculus* Küster) is a quite strongly sculptured *rosacea*. Chemnitz assumed that Linnaeus' lost ***O. orbicularis*** was the same. Linnaeus, 1758 "type" in Sweden, UL516 represents instead a *Placuna placenta*, not conforming in size and hinge to the OD. The London "type" of *orbicularis* is not Linnaeus' species either, but was later added by Hanley and is referable to *D. sandvichensis*. Although it is not excluded that Chemnitz was correct, Linnaeus' missing type material leaves no alternative than to follow Dodge (1952). He treated *Ostrea orbicularis* Linnaeus, 1758 as nom. dub. Oliver (1995 sp. 993) a thin, but strong "*Alectryonella plicatula*" from Arabia is definitely not an *Alectryonella*, but seems instead to represent also *Dendostrea rosacea*. At present 70 mm (N. Borneo, coll. auth.) is the maximum size known for Deshayes' *rosacea*.

As Ranson (1967), also Torigoe (2004) treated ***sandvichensis*** and synonymized ***crenulifera***. This is another widely distributed, comparatively small species, also with sparse lophine chomata, but compared to *rosacea* more solid, sharply radially folded and usually higher, internally often greenish or yellowish, occasionally reddish. Small, rose, strongly plicate specimens, very close to Japanese ones, have been found in the Red Sea, Eilat. Whether, however, Oliver, (1992 "*Alectryonella crenulifera*" pl. 16 fig. 6) which is not an *Alectryonella* is conspecific, is open, as also doubted by Torigoe (2004). Furthermore, Jousseaume in Lamy (1925) described two Red Sea species ***O. avalitesensis*** and ***O. solaris*** which were doubtfully synonymized with *plicata*. Unfortunately, these could not be located as yet (not MNHN type coll.), but may still be hidden in the MNHN general collection.

In WAF a *Dendostrea* commonly occurs, usually referred to *folium* (e.g. Nicklès, 1950 sp. 336; also Ardovini et al., 2004). However, neither sculpture, nor colors fit the IND species; the Caribbean *frons* is even more distant and is generally smaller. On the other hand, Hanley, 1846 described a preoccupied (Goldfuss, 1833, SHE) ***lacerata*** from Senegal, further characterized as *lacerans* in 1856. The claw like projections and the colors, especially the unusual silvery white interior, also white scars, fit this WAF *Dendostrea* precisely. This is HIG01 B406 "*pestigris*" and equals ***O. pestigris*** Sowerby II, 1871 but not of Hanley, 1846. What misleads most authors was presumably Hanley's statement "no cardinal denticulations". Torigoe (2004) confused *lacerata* with Adanson's Le Garin, which is *capsa* and placed it in *Crassostrea*. However, *Crassostrea* is not affixed with clasper spines to wood, other shells or stones. In addition, there is a very old species, medium size, red brown outside and whitish inside described by Adanson from Senegal as Le Rojel, attached to glass. This was named ***O. senegalensis*** by Gmelin, 1791. Indeed, Lamy (1929) placed *senegalensis* close to *lacerata*. Specimens found in Ghana are occasionally affixed on smooth surfaces and then quite compressed, but usually they have the typical *Dendostrea* shape. As they otherwise fit Adanson's OD well and usually grow approximately

50 mm, ***Dendostrea senegalensis*** is here applied. The only other WAF species in similar colors and shape is le Bajet, but this has been well depicted and identified as *Parahyotissa rosea* (FIP42 pl. 12).

Torigoe (2004) did not accept a Panamic *Dendostrea*. However, Harry (1985) reported these, though erroneously as *mexicana*. Specimens dived in the Gulf of California, Guaymas in 10 m are solid, cream, internally greenish, strongly plicate, have weak lophine chomata and are not the same as the Caribbean *frons*, nor are they *Saccostrea palmula* or *Myrakeena angelica*. From the former Boone collection, a large specimen 40.6 mm, identified as ***mexicana*** by Harry from Bahia de los Angles proved to be the same. It appears that Carpenter's ***amara*** fits instead well. Carpenter in Winkle (1947) compared *amara* with *spreta*, stating "very like *amara*, finely plicate on margin, greenish". WInd *equestris* are indeed quite close, but have instead ostreid chomata.

Skoglund (2000) further listed *D. folium* from various Panamic shores. Its identity is currently unknown, but from the Gulf, Isla Danzante attached to *Hyotissa fisheri* from 26 m, a 30 mm reddish, strongly plicate specimen was found, which seems indiscernible from *D. sandvichensis* from Japan or the Red Sea.

OY12: ***Nicaisolopha***: ***Lopha poppei*** is an uncommon, but quite famous species; it was originally described as the second *Lopha*, all white, from sublittoral Qld. Torigoe (2004) recognized that *Lopha* does not fit and placed it in *Ostrea*. However, the type *edulis* is remote in texture, shape, chomata and habitat. Dekker (2006) recognized that ***tridacnaeformis*** is the earlier name, that this species is much wider distributed and that instead *Dendostrea* or *Nicaisolopha* may fit. Comparing all global *Dendostrea*, then *tridacnaeformis* is perceived unique and not close to this quite compact group of solid, chomatid dendostreids. Shape, lamellation and the absence of chomata fit ***Nicaisolopha*** well, which was originally described as section of *Lopha*. Whether however, apart from fitting shape, the placement of *tridacnaeformis* in LOPHINAE is indeed genetically justified is open.

6.23 GRYPHAEIDAE

OX1: All extant genera belong to the subfamily PYCNODONTEINAE Stenzel, 1959. GRYPHAEINAE Vyalov, 1936 is fossil only.

In ***Hyotissa*** many modern authors followed Harry (1985) who considered *Hyotissa* monospecific.

However, I am convinced that at least 3 distinct huge *Hyotissa* are present, one very common, two just occasionally or locally found, all originally Pacific.

H*. *hyotis and *H. sinensis* have been early recognized as distinct by Chemnitz, followed by Mörch (1853, Poly, Anaa), Küster (1868), Sowerby II (1870), and Lamy (1930). ***H*. *sinensis*** has been refound in the Andaman Sea, off Phuket, and also off NE. Borneo, from offshore coral reefs, attached to walls and rocks, 7-10 m. The Phuket find was discussed with S. Bussarawit, PMBC, who earlier found *sinensis* himself and considered it a valid species. Mörch (1853) and Lamy (1930) reported *sinensis* also from Polynesia, Tuamotu. Indeed, in the Marquesas, Nuku Hiva, *H. sinensis* has been very commonly dived in rock crevices and at the top of small caves, 10-15 m, whereas no true *hyotis* was found there. It appears that *sinensis* occurs quite rarely in the Andaman and South China Sea, but very commonly in Polynesia. *H. sinensis* is thick and solid, but not or only weakly plicate, with almost smooth, usually blackish-purple borders, generally flatter, more compressed, the muscle scar not elevated, typically deep purple, occasionally yellowish brown. Scott (1994)'s 52 mm "*sinensis*" from Hong Kong appears instead as *Parahyotissa inermis*. At present *sinensis* is only known from the westernmost part of the Andaman Sea and the S. China Sea, N. Borneo, but not reliably reported from China. The MHNG holotype of ***Ostrea fusca*** Lamarck, 1819 fits *sinensis* from *Polynesia* better than specimens found in Thailand or in Borneo. Its **type locality** is herein corrected to Polynesia. Should genetic data confirm 4 instead of 3 large *Hyotissa*, then a beautiful type species and a valid name would be available in MHNG 1089/50.

H*. *fisheri is the most fragile, moderately plicate, generally found in purplish-brown or deep red juveniles. *H. fisheri* is only known from Panamic water. It has been well depicted by Keen (1971). *H. fisheri* is marked distinct from *hyotis* and barely confoundable when both species are at hand.

Easiest for distinction in *Hyotissa* are the muscle scars in adults, not particularly colored, flat in *fisheri*, yellowish-brown, marked elevated in *hyotis* and generally smaller, dark purple-black and flat in *sinensis*.

Paulay (1996) confused these species. His "*hyotis*" record from Hawaii is specifically indeterminate.

OX2: ***Parahyotissa***: Unless an in-depth analysis of the 4 or 5 *Parahyotissa* and the 3 or 4 *Hyotissa* species is presented, Harry's view is followed. Kirkendale et al. (2004) came to certain conclusions in this respect. However, other than in their case of OSTREIDAE, the number of gryphaeid species and specimens analysed is not recognized as sufficient base for a substantial conclusion. Torigoe (2004) kept *Parahyotissa*, but synonymized *Numismoida* and *Pliohyotissa*; but this is perceived as even less convincing.

Overall, *numisma*, *quercina* and the undescribed Chinese/Japanese species are comparatively close, *inermis* somewhat less. The panatlantic type species *rosea* appears rather distinct and shares some traits with the much larger *Hyotissa*. However, this question requires solid and broad genetic analyses.

Harry (1985) selected as type species ***Parahyotissa*** the preoccupied ***O*. *thomasi*** (renamed as ***mcgintyi***) from Florida. This is a reddish, cream or brownish solid, medium to large, strongly plicate species with the typical spongy sculpture, vermicular chomata and a reniform-ovate scar usually commarginally, yellowish-oak lined, measuring occasionally 100 mm. Harry gave West and East Atlantic as range. Indeed, Ardovini & Cossignani (2004) listed this species as "*Hyotissa macgintyi*" from West Africa. Many specimens from W. Africa, Conakry or Ghana analysed are morphologically not distinguishable from Floridan, Mexican, Martinique, Dominican or Brazilian specimens. However, *mcgintyi* is an old species, well recognized by Adanson as **Le Bajet**. Adanson's type has been refound and depicted in FIP42 pl. 12 fig. 2. They also confirmed that Adanson's species was named *Mytilus roseus* by Gmelin, validly proposed according to Sherborn and not preoccupied. Gmelin's unusual generic position is analogue to Linnaeus' *Mytilus hyotis*. Indeed ***Parahyotissa rosea*** is often erroneously listed as *hyotis* by Caribbean (e.g. Diaz et al., 1994 sp. 69) or WAF authors (e.g. Nicklès, 1950 sp. 340). Earlier Caribbean authors (e.g. Dall & Simpson, 1901) or Brazilian authors (e.g. Rios, 1974; BRASIL) termed *rosea* even "*cristata*". However, true *cristata* is an IND *Dendostrea* and the IND *hyotis* grows almost triple this size.

As recognized by Higo et al. (1999), the well known ***O. imbricata*** Lamarck, 1819 is preoccupied by Gmelin's not less known *O. imbricata* (= *Caribachlamys pellucens*). ***O. inermis*** Sowerby II, 1871 described from unknown locality is accepted by modern authors as synonym and the next available valid name for this widely distributed *Parahyotissa*. The type is depicted in HIG01 B389. Such rough purple-brown forms as depicted by Sowerby II (1871 sp. 70) are typically found in Japan. Thus, **Honshu**, **Chiba Pref**., **Hota** is designated as type locality for ***Ostrea inermis***. Philippine and Australian specimens are often larger and thinner.

Most modern authors synonymized Sowerby II's ***O. nobilis*** from Mauritius sp. 81 with *hyotis*. However, recently a huge specimen, 100 mm has been studied from the Philippines, Mindanao which precisely fits Sowerby's OD, purple, white around the umbones, compressed, rayed with large, diverging ribs and, additionally, round white muscle scars. Instead, *nobilis* represents a huge *Parahyotissa inermis*.

P. inermis is the most commonly found gryphaeid in the IND and extremely variable in colors (white, yellow, brown, grey, golden, silvery, red, purple and in all shades in between). It is also extremely variable in shape, usually rather flat and ovate, but some small specimens even approach *Dendostrea sandvichensis*. It is always quite easily differentiated by its spongy shell structure, usually best seen on the inside borders in fresh specimens, and the round, whitish muscle scar. *Inermis* occurs much wider than listed by Torigoe. Additionally, specimens have been studied from N. Mozambique, N. Red Sea, Sinai, and from Hawaii, S. Oahu.

As stated by Japanese authors it appears, that a second ***Parahyotissa*** (***Pliohyotissa***) species is present, SChi Sea, Borneo to Honshu, Sagami Bay, often named *chemnitzii* auctt. This species has a more elongated muscle scar than *inermis*, but is similarly colored as *quercina*. Consequently, Torigoe (2004) extended the range of *quercina* to Japan and China. However, comparing a specimen from N. Borneo with the many *quercina* seen from Panamic waters, I doubt them conspecific. Instead, the IND species is understood as **undescribed**. At present, the very limited Asian material prevents progress; this species is therefore listed as *P.* (*Pliohyotissa*) *sp*.

OX3: ***Neopycnodonte***: Most authors consider *Neopycnodonte* monospecific. Whether this is also genetically correct is open. Especially ***cucullina*** and ***alveatula***, both considered as valid species by Ranson (1967), are candidates for a close analysis. The synonymy of *laysana*, established by Ranson, has been recently reconfirmed by Paulay (1996).

"Pycnodonte" taniguchii in huge specimens analyzed from Miyako Isl. shares more traits with *cochlear* than with the Cretaceous pycnodont fossils; especially, with the type ***Pycnodonte***, OD *P. radiata* (STENZ Fig. J80). However, molecular results (MATSU) show a closer relation of *taniguchii* with *imbricata* (= *inermis*) than with *cochlear*. A generic separation is therefore justified. Whether *Pycnodonte* is indeed the correct place is very doubtful. It rather seems that a new genus between *Parahyotissa* and *Neopycnodonte* is required to properly accommodate *taniguchii*. This would leave *Pycnodonte* fossil only.

OX4: ***Empressostrea***: This genus has been recently erected together with Felix Lorenz for a giant species from N. Borneo. A unique feeding mechanism for Bivalvia has been reported. Furthermore, in every specimen exactly one pearlfish ***Onuxodon*** has been encountered, in size adapted to the size of the valves.

In fish literature at least 3 *Onuxodon* species are known living between Natal and Panama. It may therefore be expected that more *Empressostrea* species may be found at the very edge of the diving range, possible also in sublittoral caves.

6.24 ANOMIIDAE

OR1: This is a neglected family. Gray (1850), Hanley (1856), Reeve (1859) and Küster and Koch (1843-68) are available, apart from dispersed papers and local treatments by various authors. The European species have been well treated by Winckworth (1922). He reduced Küster's 15 European "species" to 4 anomiids.

Yonge (1977) published a difficult paper. Important comparisons appear based on erroneous type species (e.g. *Pododesmus*, *Monia*), and some of the specific statements are hard to concile with the reality. Whether his transfer of *Placunanomia* to *Placuna* is justified, and whether PLACUNANOMIINAE Beu (1967) is indeed a synonym is open. Both issues should be verified by modern methods.

Many of Linnaeus' and Chemnitz' *Anomia* are instead brachiopods. Röding (1798) recognized this error, but his *Fenestella*, intended for true anomiids only, was suppressed by ICZN, Opinion 622. However, earlier Philipsson (1788) recognized this issue as well and characterized *Anomia* vs. *Crania*/*Terebratula* as it is used today.

Whereas Reeve (1859) depicted 40 species, though with much duplication, Boss (1982) estimated 15 global anomiids. Here, approximately 25 species are considered distinct, some as yet undescribed. As recent experiences in the Marquesas Isl. with 2 species found, but none reported before (TROEN), or as recent records from New Caledonia, Koumac witness, the number of IND anomiids may be higher.

Most authors accept 7 genera, of which 3 monospecific. Most species are placed either in ***Anomia*** with 3 scars in the upper valve or in ***Monia*** with 2 scars. However, *Monia* needs genetic analyses. It appears that various lineages are confounded under a simplified 2 scars assumption.

OR2: ***Anomia***: A question disputed for 250 years is the presence of 1 or 2 species in the Atlantic. Many authors synonymize ***simplex*** with ***ephippium***, many do not. The type locality of Linnaeus *ephippium* reads: "Mare Mediterraneo **et** America". As far as is known, genetic comparisons are not available. The 3 muscle scars, usually 2 smaller and a top larger one, the variability in colors, or habitats do not offer special features. The two lower, generally smaller scars may be positioned side by side or in a row. Orbigny in Sagra, 1853 gave no distinguishing mark for *simplex*. Yonge (1977)'s supposed differences in ligament position (fig. 18a vs. d), could not be verified in reality. However, 2 differences could be observed. First, *simplex* grows smaller; the largest W. Atlantic size found is 55.5 mm (Brazil) vs. 93 mm (Med). Thus, in reality the reverse than stated by Yonge (1977). The author's collection shows the same picture; on average the Caribbean species are smaller. Second, in the specimens studied the byssal opening has generally been larger in Med specimens. Nonetheless, modern methods should verify whether Linnaeus' type locality is correct, or whether two species are present. For the time being 2 species are assumed.

Whether small specimens from **Tristan da Cunha** and **Gough Isl**. are indeed referable to *ephippium* (EAS85, SOO60, DELL64) is unconfirmed.

Furthermore, Gray, 1850 described a yellowish ***Anomia acontes*** from Jamaica with 3 muscle scars in a row, the two lower smaller. Gray's small specimen is depicted in REV596 fig. 21. Three small, yellowish ovate syntypes are present in BMNH 1964529 with 3 scars in a row, the two lower smaller. There is no doubt that *acontes* is the same as *simplex*. It is now clear that *simplex* was described in Sagra, 1853, not as assumed by Abbott (1974) already in 1842. Gray's earlier OD is precise, unambiguous type material is present. Orbigny's well known ***A. simplex*** has to be understood as a junior synonym and not vice versa as stated by earlier US authors.

Philippi's ***A. polymorpha*** is a composite species, but Gray (1850) selected and synonymized *polymorpha* with *ephippium*. The validity of Philippi's ***aspera*** from Sicily was doubted by the author himself. Shape, solid texture and sculpture rule *patelliformis* out; *aspersa* is understood as *ephippium* form. Another extreme *ephippium* was described by Reeve from Tunis as ***A. ramosa***, a small but strongly scaled species. I further fail to perceive the BMNH types ***A. lucerna*** and ***A. humphreysiana***, both described from unknown locality, as other than *ephippium* forms typically found in European waters. In both species texture, colors and scars matched. Furthermore, ***A. tyria*** Reeve, 1859 was originally described from Hawaii. Dall, Bartsch & Rehder, 1838 only reported *Monia nobilis* from there but nothing with 3 anomiid scars. Kay (1979) reported *nobilis* and stated to *tyria* "specimens comparable with the type have not been found in recent years". However, such purplish metallic forms, 45.4 mm, with a top larger and beneath two smaller scars are commonly found in European waters. There is little doubt that the BMNH type of *tyria* bears an erroneous type locality and is a misplaced *ephippium*.

A large, fabulous species has been described by Reeve, 1859 as ***A. strigilis***. Reeve gave no locality and the species seems not to have been recognized since. However, the BMNH-syntypes conform exactly to specimens occasionally encountered in the French Mediterranean, Marseille area. The two smaller, attached lower and the large upper scar demonstrate that it is a true *Anomia*. It is treated as glossy, smooth, yellowish-white *ephippium* form. A specific recognition without a strong genetic signal is not adequate.

Gray's 7 *Anomia* from the **East Pacific** have been synonymized by Coan et al. (2000) with ***peruviana***. Reeve (1859) depicted Gray's species. Most of the named forms have been personally found in a very restricted area in the Guaymas area. Undoubtedly Gray (1850) inflated minor morphological traits into distinct Panamic species.

The only true *Anomia*, Iredale, 1936 and Iredale & McMichael (1962) accepted from NSW was the large ***A. descripta***. Whereas Lamprell & Healy (1998) followed Beu's synonymy of *descripta* with the earlier NZ ***trigonopsis***, Beesley et al. (1998) did not, but instead declared *descripta* an endemic Eastern Australian species. However, large -*trigonopsis* are identical to large *descripta*. The three scars are, as in the European type species, arranged either in a row or then the smaller ones side by side. Iredale, 1936's base for creation of his *descripta* does not concur with the observable reality in NZ material. Unless genetic data would strongly oppose, this synonymy is here reinstated. Furthermore, the huge, 71 mm ***A. metallica*** and a smaller syntype described from unknown locality are present in BMNH 1964520. The comparatively large lower scars and the very small foramen do together with the size exclude *acontes* and *ephippium*. Instead, *metallica* most closely approaches *trigonopsis*. However, here a further assessment by a local expert is necessary before adopting Reeve's earlier name. Definitely, it would be astonishing, should this common species not have been illustrated by Reeve.

According to Chinese (e.g. ZHO; WAN01) and Japanese authors (e.g. Kira, 1972; HIG99; Okutani, 2000) just 1 true *Anomia* is found in China and Japan. However, own collecting there procured 2 distinct species, one very common and one very rare. Philippi also had from China 2 distinct *Anomia*. The large, approximately 60 mm, silvery species he described himself as ***A. chinensis***, the smaller inflated reddish species he gave to Küster, who published and depicted it 1868 as ***A. rubella***. The latter is the common species or the *chinensis* auctt. but not of Philippi, 1849. From the OD Philippi's *chinensis* was a very flat, ovate, large, virtually smooth species, just with commarginal growth lines, silvery pearly, with a small and elongated byssal foramen. It approaches species as *squama* or *timida*, but grows larger and has 3 instead of 2 scars. The species depicted (PHIL3 *Anomia* pl.1 fig.1, KUKO68 pl. 6b fig. 1-2) does not fit in shape, color and especially not in sculpture to what is traditionally depicted as *chinensis* from Japan. However, a specimen well fitting has indeed been found in Japan, Sagami Bay, Chiba Pref., fresh dead in local fisherman's refuse. As Philippi's specimen it is flat, ovate but medially extended, of a unique metallic silvery color. The size is with 34 mm. smaller than Philippi's type. The scars are very weakly impressed in a small trigonal white area, with a larger scar on top and two small rounded beneath, closely placed side by side. It may have come from sublittoral depth. Unfortunately, just one specimen has been collected; all the many others found in Japan were easily identified with the common species.

Furthermore, from the Philippines, the uncommon, small, flat, whitish ***A. amabaeus*** is reliably reported (e.g. LYN09, HID). In general, this species occurs below 20 m and is usually found smaller than 40 mm. Lynge (1909) synonymized Gray's ***dryas*** from Singapore based on the type material and depicted it also from the Gulf of Thailand. Lynge demonstrated that in *amabaeus* a keel connects the ligament attachment with the dorsal margin, well visible in small specimens. The umbones and the foramen are remote from the dorsal edge. Otherwise, the specimens are silvery white, fragile, flat and dorsally smooth, with a radial sculpture towards the margins in juveniles. In carefully comparing the Japanese *chinensis* with the BMNH types of *amabaeus* and *dryas*, I concluded that only one uncommon species is present. Consequently, ***A. chinensis*** is the valid earlier name. At present *A. chinensis* is reliably known from Singapore, Gulf of Thailand, Philippines, Vietnam, China and Honshu, Sagami Bay. Apart from Philippi's huge type, the other specimens seen are all less than 40 mm. *A. chinensis* appears as uncommon sublittoral species in the range from about 20-60 m.

The larger, very common Chinese and Japanese species is, instead, Gray's ***A. cytaeum*** originally described from China and accepted identical to ***lischkei*** from Japan by Higo et al. (1999). This is the earliest name for this common Japanese-Chinese species as also applied by Yokoyama (1920). The type is depicted in HIG01 B553s This species may be whitish as well, but has a rougher, irregularly wrinkled sculpture. The upper valve is moderately inflated. This species occurs in a multitude of colors, deep red, rose, orange, brownish and cream to white. It is without doubt identical to Küster's *rubella*. ***A. n. var. obsoletocostata*** and ***A. cuticula*** described by Grabau & King, 1928 from the N. Yellow Sea were based on specimens close in shape and color to *A. rubella*. The BMNH-syntypes of Reeve's ***A. placentella*** described from unknown locality represent a fragile, whitish, true *Anomia*, with comparatively small scars. Specimens very close have been collected in Japan and *placentella* is perceived as a further synonym of *cytaeum*. The true identity of Grabau & King's ***A. plana*** is somewhat doubtful, but a whitish *cytaeum*, similar to *placentella* appears from the illustrated specimen more likely than true *chinensis*. At least no *chinensis* were seen from the Yellow Sea. Japanese authors synonymized Yokoyama's ***A. nipponensis*** which appears from sculpture as large *cytaeum*. *A. cytaeum* is not a small species. Gray's type is 44 mm, Lynge reported a maximum size of 57 mm and the largest personally collected in Japan measures more than 64.5 mm (Honshu, Chiba Pref.). Specimens found in the Gulf of Thailand are also *cytaeum*. Furthermore, also from New Caledonia moderately inflated yellowish specimens are known. I could not detect any marked differences to specimens collected in mainland Japan. Thus, it appears that *cytaeum* ranges far into the Pacific. However, this should be verified by modern methods.

The Indian Ocean species ***A. achaeus*** is as adult more solid, growing even larger, the sculpture is usually rougher, often broadly radial and the scars, especially the top one, are generally broader than in *chinensis*. Whereas *achaeus* was described as smooth form, ***A. belesis*** was described as radially striate form, but both share the same large top scar. In synonymy largely Prashad is followed. Furthermore, Reeve described from Mumbai ***A. scabra***. The BMNH-holotype is represented by a comparatively thin upper valve only, but the radial sculpture and the huge upper scar closely approach and *scabra* is perceived as further synonym of *achaeus*.

Whereas from Hawaii no true *Anomia* is reliably known, in Polynesia, Marquesas two *Anomia* have been recently dived. The quite uncommon one matches Reeve's characteristic ***A. costata*** with a regular radial sculpture of prominent ribs. The analysis of the 42.7 mm BMNH holotype from M. C. demonstrated further similarities as the trigonal shape, size and position of the scars, with a rounded slight larger upper and two rounded adjacent or confluent rounded lower scars in a comparatively small whitish area. Also the cream whitish outer and the shiny, silvery, rather iridescent internal sheen are the same. The characteristic radial costae with a commarginal interrib sculpture where identical in the best preserved specimen and slightly or strongly abraded in the others. *A. costata* was described without locality; a Marquesas origin for Reeve's species is not particularly likely, but Cuming collected from many Polynesian Islands and this species may be expected widely distributed in Polynesia. However, Reeve's name is preoccupied by a Brocchi fossil. Here, ***Anomia macostata*** is proposed as nom. nov. *A. costata* Reeve, 1859 non Brocchi, 1814 (= foss.). A few single valves have been found in 12-18 m, on muddy bottoms with sponges. The exact habitat is unknown. The name *macostata* means, a *costata* from Marquesas, which is here designated as type locality. The holotype is BMNH 1964521.

The other Marquesas species has been commonly found on and among rocks in 10-30 m. It is irregular ovate, comparatively small, less than 36 mm. The two lower scars are ovate, generally side by side, and smaller than the larger upper scar. The upper valve is roughly irregularly ridged. The colors are whitish with a metallic hue of rose or green internally. This species appears to be **undescribed**.

OR3: In ***Patro*** 3 scars are found as well. However, the lowest, most ventral is the largest. The valves have a very fine, quite regular radial ribbing. The byssal opening is remarkably small for such large valves. The calcareous attachment (byssal plug) is much stronger than in anomiids. In addition, anatomical differences seem to exist. *Patro* is currently only known from tropical Australia, the largest ***australis*** seen is 72.8 mm (NWA). Beu (2006) reported an even larger extinct species from NZ.

OR4: ***Enigmonia***: ***E. aenigmatica*** with a special habitat is extremely variable in color and shape. Koch, 1846 described and well depicted 4 species (KUKO68 pl. 7). Reeve (1859 pl. 7) depicted most of Koch's forms. However, Reeve just considered 1 species valid. Reeve's view has been shared by most subsequent authors. From the material seen, his view is likely, but a confirmation with modern methods is lacking. Typically *aenigmatica* is ovate and bronze-red.

The preoccupied ***Aenigma*** has to be credited to Bergrath Koch, 1846 not to Gray, 1850 (IRE39). Koch did not select a type; but Iredale (1918) based on Gray, and finally, Iredale (1939) based on Koch selected ***rosea***. Koch, 1846's species were also referenced by Hanley (1856 p. 313).

Anomia farquhari described by Turton, 1932 from SAF, Port Alfred from a single beached valve is scarcely reflected in modern SAF literature. It is perceived as worn *aenigmatica*, identical to Turton's *A. alfredensis*, *A. oblonga* and *A. curiosa*. This Asian to N. Australian species is not known to occur in the W. Indian Ocean, but ***A. alfredensis A. oblonga***, and ***A. curiosa***, described by Turton, 1932 as found in his "Lucky Log" seven-feet-driftwood provide the answer for this accidental find. Turton also identified ***aenigmatica*** out of this driftwood. As this driftwood appears to stem from an area, where *aenigmatica* is common (i.e. India, Australia), the SAF, Port Alfred location of all 13 newly described "Lucky Log"-species (p. 289) is understood as erroneous. Definitely, the Port Alfred type locality of all of Turton's *Anomia* is not confirmable.

Turton's ***A*. *perplexa*** and ***A*. *problematica***, also "Lucky Log"-species, but no *Enigmonia* appear to be juvenile *achaeus* with an erroneous type locality as well.

OR5: ***Heteranomia***: As carefully demonstrated by Winckworth (1922), confirmed by Merrill (1962) and Peñas et al. (2006) there are no arguments left to keep the amphiatlantic *squamula* and ***aculeata*** separate. The sculpture is variable; the 2 scars in both supposed species are the same. Linnaeus' ***H*. *squamula*** is a small species, usually less than 15 mm, exceptionally growing to 22 mm (Iceland). Winckworth (1922) also gave sufficient anatomical and morphological arguments to keep this genus distinct. In addition to the reduced gill condition without ascending lamellae, the two muscle scars are generally not embedded in a pearly layer. Usually the upper scar is large, the lower ovate and small.

The cf. *aculeata* and cf. *squamula* records from WAF, Angola (GAB) and Still Bay, Mossel Bay and, Knysna (BA64 p.443) are enigmatic and would need reassessment of the original material. At present *squamula* is not reliably known further south than the Gibraltar area.

OR6: ***Isomonia***: The type ***alberti*** was first diagnosed as *Monia* and then in the same year more extensively described as ***Isomonia***. From the available data, *Monia alberti* was first presented at the meeting of January, 12th, 1897.

The species and the genus are still somewhat enigmatic. Dautzenberg & Fischer described a 38 mm, pectiniform, fragile, yellowish white species with 2 confluent scars. Nonetheless, *alberti* seems to represent a valid, but uncommon deep water form, as various left valves have been found at three stations around the Azores between 1230-1557 m together with all the other European 2-scar-species. In their 1906 paper, Dautzenberg & Fischer reported a further specimen from 1098 m. Dautzenberg (1927) gives the aggregation. I am not aware that *alberti* has been refound since.

Very tentatively, another species is placed here, namely Gould's ***P*. *umbonata*** from Japan. Due to 2 scars it was confounded with *Pododesmus*. Juveniles may be ovate, but full adults become almost equilateral pectiniform. Except existence of these 2 scars, no similarities of this pectiniform, fragile, rather flat, deeper water species with the large and as adult massive, shallow water *rudis* and *foliatus* were found. Japanese authors separate *Monia* generically from *Pododesmus* and place *umbonata* there. Definitely, *Monia* is closer, but does neither fit the unique *umbonata* particularly well. From shape and habitat *Isomonia* fits better, but *umbonata* may represent an undescribed genus.

OR7: ***Pododesmus***: Following European, Japanese and Australian authors, ***Monia*** is here separated and ***Pododesmus*** is restricted to 2 American species only. Both *Pododesmus* are comparatively shallow living, heavy and huge as adults, both reach more than 80 mm. In case of large and of solid specimens, both species have the byssal foramen overgrown and completely closed, a condition not encountered in any other anomiid. This is exactly the condition stated for ***Tedinia***, which was synonymized by Coan et al. (2000). Whether Conrad, 1860's fossil American ***Paranomia*** is indeed distinct seems doubtful.

Unfortunately, **Yonge** (**1977**)'s conclusions regarding *Pododesmus* and *Monia* are misleading. Taking his text at face value, then Yonge (1977) did not compare the correct type species of *Pododesmus* and of *Monia*. According to p. 495 he compared instead two congeneric species, namely "*Pododesmus cepio*" (= *Monia macrochisma*) with *Monia patelliformis*, but not *rudis*/*foliatus* with *zelandica*/*macrochisma*. It is therefore not surprising, that Yonge, as all authors before considered two true *Monia* as close. Also his further conclusions that *squama* and *patelliformis* are dubiously distinct, or that *A*. *ephippium* and *P*. *australis* are virtually identical in shell features are strange and did not conform to the perceived reality of subsequent authors.

The type species MT, ***Pododesmus*** is the Caribbean *decipiens* (= ***rudis***). Carcelles, 1941 described a second species ***P*. *leloiri*** from Golfo San Matias as more regularly ovate, more compressed, smaller 54 vs. 64 mm, with more fragile valves, rose-white instead of whitish and with a slightly distinct chondrophore. He stated both species occurring overlapping, in the same habitats, and usually not perforated, with a closed foramen. Abbott (1974) doubted distinctness of *leloiri* from *rudis*. Rios (1994) upheld it and characterized *rudis* as thicker, larger, with a strong chondrophoric apophysis, and ***leloiri*** as smaller, thinner, with a weaker apophysis. He depicted the former as deep brown and the latter as whitish internal centrally brown. Both his specimens show a closed foramen.

From Argentina specimens have been studied, some close to *leloiri*, others close to *rudis* as originally differentiated by Carcelles. However, the largest specimen was an ovate, flat, fragile *leloiri* with a still open foramen. Furthermore, the *leloiri* forms closely approach finer ridged specimens described from the West Indies as *harfordi*. Very similar specimens are also found in Florida, but *harfordi* and the similar *echinata* were synonymized with *rudis* long ago, confirmed by subsequent workers. Thus, Abbot's view is shared. Unless genetic data proves otherwise, the only conclusion from the material seen is that *rudis* is a highly variable species in thickness, color, sculpture and strength of apophyses. Very likely the exact configuration correlates with the microhabitat. In thick *rudis* the byssal foramen is generally overgrown, in juvenile or in fragile specimens it is often open, respectively the strong plug is not firmly grown into the thinner valve.

Inferring from the high variability on the Atlantic side, there does not seem much justification to separate ***pernoides*** Gray (= type *Tedinia*, OD) from the earlier ***foliatus*** on the Pacific side. At least specimens from Northern and Southern locations did not offer substantial differences. The largest specimen studied from the Gulf of California, Bahia de los Angeles is slightly more than 88 mm.

The holotype of the small ***P*. *gouldi*** is present in BMNH. It was described from unknown locality, but the conjoint label reads "from the shell of the large Liberia oyster". "Liberia oyster" points into *Striostrea prismatica* (Gray 1825), into a Panamic origin and a *foliatus* synonymy.

OR8: ***Monia***: Most authors include here various lineages with two scars. It seems that at least 3 groups are present, two as yet unnamed.

The type ***Monia*** is the NZ *zelandica*; in addition, the Northern Pacific ***macrochisma*** fits well in *Monia*. The European ***patelliformis*** has two rounded, separate scars as well. It is unmistakably with its imbricate sculpture most clearly at the boarder. Though smaller and more fragile than the Pacific species, *patelliformis* seems comparatively close to *Monia*, and has been placed here by virtually all authors.

A special group consists of rounded, subcircular generally small, less than 40 mm, very fragile, whitish species with 2 close, often confluent scars in the upper valve. The sculpture is very weak, generally with radials, giving the upper valve an almost smooth impression. The lower valve is extremely thin and bears a pear shaped foramen, which is generally somewhat removed from the dorsal border. A typical representative is the European ***squama***. Here belong also Iredale's ***timida*** and ***deliciosa***. This group of uncommon, deeper living species is without name and is here termed ***Tenuimonia***. The European *Anomia squama* Gmelin, 1791 is selected as type species. Winckworth (1922) also noted differences in the gill structure compared to *Monia*. The exact condition in the Australian species is as yet unknown.

M. squama, based on Chemnitz 8 77 697 *Squama magna*, originally described from Norwegian waters, is well known from the NE. Atlantic (e.g. Küster, 1868 as *striata*; Winckworth, 1922; Tebble, 1976). From Italy, but also from Greece and Turkey, this species is usually depicted as Monterosato's ***Monia glauca*** (e.g. REP, COSS). This is typically a smooth, fragile, small, deeper water species, with brownish radial streaks. However, specimens analysed from the Eastern Mediterranean (Greece, Limnos Isl., 110 m; Turkey, Bozcaada, 85 m) did neither sufficiently differ from *squama* in confluent or at least adjacent scars, in ovate shape, in whitish or brownish-white streaks, nor in fragile, almost smooth valves with weak irregular radials. Med specimens are somewhat smaller, rarely more than 25 mm and generally deeper living than in British waters. Winckworth (1922) synonymized Monterosato's *glauca* with a widely distributed European *squama* and this view is here confirmed. Dautzenberg & Fischer (1897)'s record of *Monia glauca* from the Azores is therefore also referable to *squama*. Whether the indicated depths, all below 1000 m refer to living or dead material was not indicated.

Winckworth's large ***Monia squama var. crassa*** does not fit well in *squama* and appears enigmatic. Whether it is indeed an extreme morph of *squama* as assumed by the original author or rather a hybrid is open. Whereas no WAF records are known, from SAF a *Monia/Pododesmus squama* was reported (BA64 p.442; Steyn & Lussi, 1998 sp. 867). However, these specimens with a rough surface and projecting scales, and obviously comparatively large foramens do not match *squama*. As also *squamula* and *patelliformis* do not match ***squama* SAF auctt**. appears to represent an **undescribed** species, possibly close to the next group.

The 3rd group is best represented by the Hawaiian ***A. nobilis***. It was described as *Anomia*, looks like an *Anomia* and was classified as *Anomia* by Dall, Bartsch & Rehder (1938) and by Kay (1979). Kay even depicted the larger of the BMNH syntypes. However, Dall, Bartsch & Rehder (1938) stated in the left valve 2 byssal scars. The BMNH-syntypes have been reanalyzed. Indeed there is only one round large scar beneath and a second on top, therefore, a condition similarly found in *Monia*, but not in *Anomia*. Kay reported *nobilis* widely distributed in the West Pacific, a statement which could not be verified. At least in the Marquesas, which otherwise shares more than 40% of the species with Hawaii, nothing similar was found. In addition, Kay (1995) in her Pacific Island overview listed only 1 anomiid, and only from Hawaii. It appears that *nobilis* is endemic Hawaiian.

Lamy (1938) identified a species from the Red Sea as *nobilis*. Oliver (1992 pl. 17) depicted a 20 mm specimen and identified this instead as ***caelata*** Reeve. This small, rare Red Sea species shows a rather square shape, higher than broad, an irregular radial sculpture and a yellow white background, flecked with reddish-brown. A quite similar specimen 33.9 mm has been found in the Andaman Sea off W. Thailand and is perceived conspecific. The BMNH-holotype of *A. caelata* has been studied. Reeve described it without locality. This is medium sized species, almost 40 mm, ovate, yellow and inside white. Numerous weak radial riblets are visible, on a rather glossy surface. Neither coloration, nor sculpture, or shape is close to the Red Sea species. Instead *caelata* is perceived very similar to the Hawaiian *nobilis* and may be a smoother form of the latter. None of the other species described by Reeve appears close to the Red Sea species. On the other hand, Gray, 1850 described ***Placunanomia colon*** from unknown locality. Iredale (1939) briefly mentioned it, obviously accepting it as *Monia*. The irregular radiating ribs and the spotted color of Gray's species point into the *nobilis* group. As the OD fits reasonably well, *colon* is adopted for this uncommon NW. Indian Ocean species. The condition of the scars "upper one oblong, longitudinal, the lower much smaller, circular" fits the condition in the Andaman specimen precisely.

This group of *nobilis*, *colon*, and possibly the unnamed SAF "*squama*" is very poorly known. These species are currently placed as ***Monia*** (***s.l.***).

6.25 PLACUNIDAE

OS1: Matsukuma (1987) recently treated *Placuna*. Unfortunately, he confounded *quadrangula* and *lincolnii* and did not treat the latter, as subsequently also Lamprell & Whitehead (1992). Philipsson based his *quadrangula* on Gualteri t. 104 f B. Dillwyn (1817) gave a good overview on the synonymy of the older names.

As concluded by Gray (1849), together with Sowerby's later described *lobata*, 5 species are recognized. Whether a subgeneric distinction adds value in this small group is arbitrary and here not applied.

The two best known species are the fragile white ***Placuna placenta*** and the rather solid, purplish, much larger ***Placuna ephippium*** (syn. *sella*). Both are quite common and widely distributed.

In addition, 3 further species are known from the central IND.

Sowerby's rather quadrate, characteristically lobed ***lobata*** with reddish radial streaks is easily differentiated and well depicted in Lamprell & Whitehead (1992 sp. 90). It is also the smallest species. It has been described from Australia, but ranges much further and is occasionally found in the Philippines and in Micronesia.

Philipsson's ***quadrangula*** is often confounded with *ephippium*. However, it grows in general smaller, is thinner, more papery. Gmelin's later name *sella minor* and Bruguière's *papyracea* fit well. *Quadrangula* has a radial color pattern emanating from the umbones. The sculpture is quite dense, irregularly radial. *P. quadrangula* is widely distributed, also found in the Philippines and in Australia. Lamprell & Whitehead (1992 sp. 89 "*lincolnii*") is instead *quadrangula*.

The 5th species, Gray's ***lincolnii*** is obviously the most difficult, but seems also the most uncommon. The unique BMNH holotype shows a huge, almost round species from "Australia", whitish outside, greenish white inside. Significant is a very strong, white, rounded almost central muscle scar. This proved the easiest way to differentiate from similar sized *ephippium*; where the muscle scar is smaller and generally purplish. In addition, in all *lincolnii* seen, the base color is opaque white, sprinkled or blotched with dark purplish red, whereas the predominant color in *ephippium* is purple. The widely divergent teeth in *lincolnii* are indeed somewhat longer. *P. lincolnii* has no radial color pattern, which is instead typical for *quadrangula*. The special greenish ventral color of the mature *lincolnii* type has been encountered in a gerontic Philippine specimen as well, but seems due to parasitic reaction. In general *lincolnii* is whitish with red blotches. *Lincolnii* was originally described from Australia. However, all specimens seen so far came from the Philippines; whereas all "*lincolnii*" seen from Australia are instead *quadrangula*. Lamprell & Whitehead (1992) did not depict true *lincolnii* and Iredale (1939) saw it close to *placenta* with adjacent teeth, which fits instead large *quadrangula*. All evidence indicates that Gray's original type locality is erroneous and that *lincolnii* is instead a Philippine species.

OS2: ***Placunanomia***: Whether this genus is correctly placed here, as proposed by Yonge (1977) should be reanalyzed with modern methods. All experts previously placed it in ANOMIIDAE.

6.26 PLICATULIDAE

OL1: In-depth, just two authors worked on this family in the last 250 years: Sowerby II (1847 and 1873, Reeve's Icon.) and Lamy (1919-39); Hanley (1856 pp. 288-9) treated also some plicatulids. No modern global review and very few data are available. Sowerby II (1873) recognized 14 species, of which 6 are here considered synonyms. Lamy (1939) recognized at least 14 species and varieties. Here almost 20 species are recognized, of which 3 are undescribed.

Lamarck, 1801 mentioned the IND *Spondylus plicatus* as example for his CAR *Plicatula gibbosa*, therefore the selection of the former as type species by Schmidt, 1818 stands against the opinions of Iredale, 1939 (*gibbosa*, MT) or Lamy, 1939 (*gibbosa*, = type).

Almost 100 years before Watson, 1930, Gray, 1854 p. 27 separated **PLICATULIDAE** sharply from SPONDYLIDAE and moved them closer to ostreids.

OL2: From **WAF** Cosel recently described ***angolensis*** from Angola to Cameroon. This species has been found in Ghana, Ampenyi, 5-8 m, attached to stones as well.

Said to have come from the Canary Islands, trawled in Isl. de Lobos a comparatively large, conjoint 33.5 mm specimen is available, which is perceived conspecific to whitish ***gibbosa*** from the Caribbean. If this locality is confirmed, then a further species lives amphiatlantic.

Lamy (1939) attributed a Congo, Pointe Noire valve to *gibbosa*, but this was more likely *angolensis*.

OL3: Many attempts by various authors have been undertaken to define more than one **Caribbean** species. Lamarck, 1819 started with 4 Caribbean species, from white to reddish. However, Lamy did not accept them as distinct, followed by modern authors. Even the extreme shapes of Weisbord's ***venezuelana*** and ***caribbeana*** have been synonymized by later authors.

In Venezuela and Uruguay occasionally *gibbosa* with spines have been found, and some have more ribs than usual. However, these are otherwise too close to Floridan specimens. A distinction as proposed by Macsotay & Campos (2001) is not warranted. It appears that spines correlate with microhabitats. As such ***gibbosa*** is highly variable in colors, from all white to all red with various intermediaries, in number of ribs, in trigonal to ovate shapes and in absence or presence of spines.

On the other hand, Petuch, 1998's ***P. miskito*** from Nicaragua seems valid. Petuch highlighted the small size and the lacking rough plicae. At least all similar sized *gibbosa* studied had plicae; virtually smooth specimens with only fine beaded radial riblets umbonally were not encountered as yet.

OL4: Keen (1971) depicted 4 species from the **Panamic** region. Here 3 are perceived distinct.

Her ***anomioides*** is quite easily recognizable.

The MNHN syntypes of ***spondylopsis*** have been analysed. This is typically a densely, regularly plicate, purple-brown species with a strongly colored margin in a narrow, dark purple band, especially so centrally in the upper valve. It reaches 51 mm. A further specimen, 50.4 mm (coll. auth.) virtually identical to the larger syntype, came from the Gulf of California attached to *Placunanomia* in 45 m. However, ***P. inezana***, originally described as fossil, has the same maximum size (52 mm), the same brownish colored crurae, the same reddish brown color and is also plicate. The border is vertically brownish striate, but these striae may develop in some specimens into brownish bands as exactly found in *spondylopsis*. Furthermore, the plication ranges from virtually smooth to strongly plicate. From the material analysed, *spondylopsis* is only a densely plicate, ovate extreme, but otherwise identical to the more common, typically rougher plicate, trigonal *inezana* forms. The latter is considered a junior synonym.

P. penicillata is internally an all white species with brown points or streaks on a white valve. It is perceived as cognate to the Caribbean *gibbosa*. It occurs in similar colors as *gibbosa*, some specimens have smooth, others roughly spined ribs. The specimens analysed are quite strongly plicate and have white crural ridges, whereas *spondylopsis* has brown colored crurae, and colored margins. Other than stated by Keen (1971) *penicillata* easily attains more than 30 mm, but none seen has been larger than 36 mm. Following Lamy (1939) Rochebrune's 29.6 mm MNHN type of *ostreivaga* appears closer to *penicillata* than to *spondylopsis*.

OL5 As usual most species occur in the **Indo-Pacific**. ***Plicatula depressa*** was first used by Lamarck 1801, but this name was declared n.n. by Sherborn. In 1819 Lamarck described this species validly, as oblong-trigonal, depressed, white, brownish-black maculated, 29 mm, with reservation from "les mers d'Amerique". Deshayes (1832) stated America as correct locality and Lamy (1939) cited it, without having analyzed Lamarck's Geneva type. The holotype is present in MHNG 1088/84. Instead, the Lamarckian *depressa* proved, as well curated, to be a quite typical *P. australis* as depicted by Sowerby (1847 fig. 22), confirmed by Lamy (1939) based on the Paris *australis* type. Obviously, Lamarck had two specimens in distinct sizes and intensity of colors. Against page priority, and against quality and larger size, here the better known ***Plicatula australis*** Lamarck, 1819 No. 6 is selected to represent this species and *P. depressa* Lamarck, 1819 No. 2 is declared a synonym.

Lamarck's ***australis*** is a characteristic and comparatively common species. Irregularly ovate, rather flat, many ribbed, with small brown to blackish spots on a white valve. It is widely distributed, at least from S. East Africa to Australia and Japan, but not known from the Red Sea or the NW. Indian Ocean as yet. However, in large specimens these dark spots may turn into radial lines (i.e. specimens from Borneo). Récluz, 1851 described a huge 49 mm ***P. lineata*** from unknown locality, but probably of Pacific origin. This is an ovate species with dark radial lines on a white background. The syntypes, a paired and a single lower valve are present in MNHN. *P. lineata* was not refound, nor reported since. Lamy (1939) who studied these types considered *lineata* as possibly valid. However, *australis* is known to reach 50 mm, and more likely *lineata* is only a large, uniquely colored, flat *australis*. Based on type material Lamy (1919 and 1939) synonymized Deshayes' small ***P. multiplicata*** from Reunion with *australis*.

Lamy further considered Sowerby II, 1873's ***P. aculeata*** (= SOW472 fig. 12) from unknown locality as variety of *australis*. However, here the type is lost and *aculeata* is best treated as nom. dub.

The interpretation of *depressa* by Sowerby II (1847 fig. 7 and 1873 fig. 7a, b) refers to another species. Lamy, considered it as distinct from Lamarck's presumed American species, located Sowerby's specimens in Djibouti and renamed it *P. plicata var.* ***concava*** Jousseaume in Lamy, 1922. Lamy's 3 MNHN-syntypes have been studied. Oliver (1992) mentioned that most Red Sea specimens are attributable to *plicata*; however, "some specimens with many ribs are present in collections and may represent a second species". He then considered these close to *australis* and in (1995 sp. 1001) depicted such specimens from Arabian waters as "*australis"*. However, *australis* is marked distinct and Oliver's second species conforms instead to Lamy's syntypes of *concava*. Even earlier, Deshayes in Maillard, 1863 described ***P. complanata*** from Reunion. Jousseaume in Lamy (1939) reported *complanata* from Aden as well. The MNHN holotype is represented by a small upper valve. It is a juvenile, but with a very characteristic shape. This holotype of *complanata* is virtually identical to the smallest valve of Oliver (1995 sp. 1001 "*australis*" bottom right). From the material seen, there is no doubt that indeed, a second *Plicatula* occurs quite commonly in the Indian Ocean, certainly in the Mascarenes, extending along EAfr to Djibouti, the Persian Gulf and into the S. Red Sea, at least to Yemen. This species is distinct from *australis* and from *plicata* in sculpture and colors. The earliest name is ***P. complanata*** Deshayes in Maillard, 1863. In general *complanata* is irregular in shape, ovate to irregular trigonal, many ribbed, but with rather weak ribs, whitish with brown or reddish lines and blotches. The crurae in adults are orange-white to orange-brown, whereas in *plicata* these are white. The scars are generally more ovate.

Comparable in size, shape and colors to the Chinese/Japanese *simplex* (= *regularis*) is ***P. pernula*** Melvill, 1898 from the Persian Gulf. Two out of 8 syntypes are present in BMNH. They share a ham-like rather compressed shape, but instead of ribs as in *regularis* a quite regular low spined almost knobby sculpture with irregular commarginal ridges is found. *Pernula* is perceived as valid, likely deeper water species; no other specimens except the type material were seen as yet.

A huge species, at least 48.3 mm is known from S. India, Trivandrum. It has about 2 dozens very fine radial ribs, a broad cream-brown margin in both valves and white, strong crurae. It seems **undescribed**, but limited material hinders progress.

Kilburn (1973) stated Smith's ***squamosissima*** from Natal distinct from *P. australis*. The BMNH types clearly confirm this view. *Squamosissima* is also distinct from *complanata*. The unique sculpture of dense, imbricate squamae without spines was not encountered in any Arabian or East African specimens and distinguishes at once. The small species is outside whitish, internally yellowish, with an ovate, central scar.

From Reunion a rather deeper water, comparatively large, 37 mm species is known, white with about 7 main, reddish ribs with hollowed, rather upright red spines. A conspecific specimen has been dived off N. Borneo. It does not fit any known species and appears also **undescribed**.

OL6: From the OD's, the ample material at hand, and the BMNH type material studied the ***plicata-ceylonica-imbricata-chinensis-essingtonensis-philippinarum*** complex from the Red Sea to Australia and Japan could not be broken up into clear cut species. Consequently all these forms are currently treated as synonyms of Linnaeus' comparatively large, solid, highly variable IND type species *P. plicata*.

Strongly plicate specimens with about 5 ribs are known from the Red Sea, Arabia, Sri Lanka, the Andaman Sea, and Australia to Japan (Kira pl. 49 fig. 4). Weakly plicate specimens with about 20 ribs occur from the Indian Ocean to Australia to at least China, but all intermediary forms occur there as well. Furthermore, in the same populations specimens with about 10 and with about 20 ribs may be found. Very low ribbed forms as Sowerby II (1873 fig. 11b "*philippinarum*") are found in WA, Shark Bay; but from there *imbricata* and *essingtonensis* were described. Many ribbed, strongly imbricate, almost spined forms occur in the N. Gulf of Thailand, as well as in Australia. Consequently, Lamy (1939) is followed in considering *plicata* a highly variable species and *chinensis*, the preoccupied *imbricata* and some more as synonyms. Lynge (1909) came to similar conclusions, but included here also valid species (e.g. *australis*).

Linnaeus' ***plicata*** is a strongly plicate species, originally from Java. It had about 10 ribs (DOD52), thus, exactly in the middle of low and high ribbed forms. Hanley (1855) stated as representing best Sowerby, II (1847 fig. 15 and 16 "*imbricata*") and Dodge (1952) stated Sowerby, II (1873 fig. 4a-d "*imbricata*"). REV734, fig. 4c (= SOW472 fig. 18) is from Honduras Bay and represents a white *gibbosa*. On the other hand, figs. 4a-b, d refer to Indo-Pacific species. Fig. 4b equals typical *plicata* in number of ribs, but this is the least imbricate specimen, fig. 4a has about a dozen ribs and fig. 4d has more than 20 ribs. Mörch's *P. chinensis* is based on Sowerby's Chinese "*imbricata*" fig. 15-16, which were identified by Hanley as typical *plicata*. The OD of Menke's preoccupied *imbricata* from W. Australia as well as Hanley (1858)'s comments on a syntype points into an imbricate, colored form, found in Australian and in China. There is no doubt, that many of Sowerby's depicted further species are also referable to *plicata* (e.g. 1847 fig. 1-4 "***ramosa***" non Lamarck" from Polynesia; 1873 sp. 14, fig. 13 ***ceylonica*** from Sri Lanka). The 3 syntypes of the latter, described from Sri Lanka, are present in BMNH and represent rather narrow, stronger ribbed forms. ***P. philippinarum*** has first been mentioned by Sowerby II, 1847 as of "Hanley, Recent shells". However, there is no earlier species described so and Hanley (1856 p. 289) himself referenced this species as Hanley in Sowerby. Sowerby's "species" consisted of 7 specimens, which are largely present in BMNH. His fig. 5 "*philippinarum*" is virtually identical to fig. 17 "*imbricata*", his fig. 13 and 14 "*philippinarum*" are except darker color very close to fig. 16 "*imbricata*". His figs. 10 and 11 represent smooth forms and were named *foliacea* by Jousseaume in Lamy, 1922. As recognized by Sowerby and Hanley and depicted by Lamprell & Healy (1998 fig. 276, right specimen) these are mere morphs grown on smooth surfaces. I see little reason to differentiate these from the specimens depicted as *imbricata* (= *plicata*). As stated by Lamy (1939), Dunker's large *P.* ***deltoidea*** from East Africa is closer to *plicata* than to *complanata*. A size of 47-48 mm is the maximum reported for *plicata* in various records. Sowerby II's ***essingtonensis*** BMNH-syntypes from Australia contain specimens with about 10 and specimens with about 20 ribs. These are too close to *plicata* (e.g. *philippinarum* forms) to be separated.

As such, ***plicata*** is understood as species with a marked rib sculpture. It is highly variable in number of ribs, 5 to more than 20, and in extent of imbrications of these ribs, in some almost devoid in others almost spiny. In color *plicata* is often white with reddish streaks, but whitish, cream, brownish, orange forms occur. However, all specimens analysed are white inside and the hinge teeth white. The margin is typically bordered with vertical reddish striae, sometimes forming a dense reddish band.

P. novaezelandiae Sowerby II, 1873 was described from New Zealand, but no *Plicatula* occurs there. It is an all white species with between 12-20 radial, rather rounded ribs, somewhat ovate with pointed central umbones. 3 syntypic specimens are present in BMNH. Lamy (1939) had no opinion, whereas Lynge (1909) approached it to *imbricata* (= *plicata*). However, it is not particularly close to the many *plicata* forms seen and may turn out to be a valid species of unknown, but most likely IND origin. It is here tentatively listed as valid species.

OL7: ***P. muricata*** Sowerby II, 1873 is a clear cut, smaller, compressed, finely ribbed species, with between 15 to 25 brownish-red ribs on a white background. No trace of an earlier description by A. Adams was found. Habe created ***Spiniplicatula*** for this species, a partition not recognized by most subsequent authors and not shared here either. Earlier, Dunker, 1871 described ***P. echinata*** from China. Lamy (1939) briefly mentioned it, but did not recognize it. From the OD, it is not excluded that Dunker earlier described *muricata*, but the type in the Museum Godeffroy, Hamburg was destroyed in WWII (Hausdorf pers. com. 9/07). Worse, Dunker (1882 pl. 11 fig. 4) depicted *muricata* from Japan without even mentioning his own *echinata*. It appears best to consider *P. echinata* as nom. dub., the type material lost.

P. simplex Gould, 1861 is also clear cut, also trigonal and small, but more inflated with much less, broader ribs. It appears that Okutani (2000 pl. 458 fig. 1 and 2) twice depicted the same species from Japan. This species was later described by Dunker, 1877 as ***cuneata*** from Japan, but synonymized by Japanese authors. However, Philippi, 1849 sp.15 described earlier ***Plicatula regularis*** from Taiwan. This is a valid name, so recognized by H. & A. Adams (1858, p. 562), by Sherborn and mentioned by Lamy (1939). The OD, especially the triangular, equivalve shape, but also the "apice modo adnata", the 7-8 regular ribs and the small size of 19 mm, together with the type locality, leave no doubt that this is the earlier name for *P. simplex*. ***Plicatula regularis*** Philippi, 1849 is well known to occur from Japan along the China coast to the Gulf of Thailand. Also small specimens personally collected in the Andaman Sea, offshore Phuket have been identified so.

Some comparatively solid small specimens from approximately 70 m off N. Borneo could not be accommodated. These are ovate with a very broad red white border in the upper valve.

Sowerby II, 1847 described ***P. dubia***. There is no earlier species named so by Hanley and the Island of Cana is, as Lamy (1939) demonstrated, near Panay in the **Philippines**, not in Ecuador or "West Columbia" as erroneously labelled. *Dubia* was at first a composite species, but restricted by Hanley (1856) to fig. 19. The species fig. 12 was later by Sowerby II, 1873 renamed *aculeata*, but this type is lost. *P. dubia* is without doubt a valid IND species. The depicted syntype fig. 19 together with two smaller specimens is present in BMNH 1992048. This is a fragile, flat, ovate species, very irregularly plicate, with upturned vaulted ends. *P. dubia* is known from the Philippines, Panay and Bohol, N. Borneo, Sabah and off PNG, New Ireland. Most specimens came from 60-110 m, the Philippine lot has been found shallower. These are brownish to ocre, occasionally spotted with darker dots. The crurae are orange brown and the inner border irregularly maculated in brown red as is well visible in the smallest syntype. *P. dubia* is a comparatively small species, usually found less than 30 mm. The depicted syntype is with 38 mm by far the largest specimen currently known.

6.27 PECTINIDAE

OG1: Comparing two recent works –Dijkstra (Internet 10 OCT 2006 "Modern classification of the Recent Pectinoidea"), and Raines & Goto (2006 "The Family PECTINIDAE") - then the suprageneric classification in pectinids is not stable as yet. In the last 15 years opinions about this family have changed very rapidly. Even the familial distinction to PROPEAMUSSIIDAE is not shared by all experts (e.g. Schein, 2006).

Unique in BIVALVIA, an additional layer of "tribes" is used by some authors. In even much larger and more diverse bivalve families this is not necessary. Furthermore, the attribution of "tribes" and genera to subfamilies is not unanimously shared (e.g. *Adamussium*, *"Aequipectinini"*, *Flexopecten*, *Hemipecten*, *Palliolum*). Obviously, CHLAMYDINAE and PECTININAE are not properly definable and are too large. It appears that pectinids suffer under the same "PECTININAE vs. CHLAMYDINAE" paradigm, as tellinids with "TELLININAE vs. MACOMINAE".

Here, a conservative approach with smaller units is applied. As in all other bivalve families, the tribes are omitted and, where widely shared, replaced by subfamilies. Unique genera with special habitats/mode of living which have been shifted hence and forth are separated, until their final position is genetically clarified.

PECTININAE,**CHLAMYDINAE**, **CAMPTONECTINAE**, **PALLIOLINAE** are groupings recognized by many modern authors.

AEQUIPECTININAE is also a recognizable group. However, some attribute it to PECTININAE, others to CHLAMYDINAE. This clearly indicates separation (see also WAL06). The RNA results of Barucca et al. (2003) do not show a close relation to true chlamydinids, but support segregation. Matsumoto (2003) only placed *Volachlamys* closer to *Chlamys* than to *Pecten*. *Flexopecten* is, following Sacco's original intention, placed near *Aequipecten*. This is also supported by Barucca et al. (2003). **DECATOPECTININAE** is well recognizable. Its main contents are shared by most modern authors. In addition, the RNA results of Barucca et al. (2003) support this separation from PECTININAE. The results of Matsumoto require a positioning close to PECTININAE. *Annachlamys* is by most authors considered as closely related to true pectinids.

The ***Mimachlamys***- and ***Crassodoma***-groupings are not stable as yet. Both are variously assembled and differently attributed (e.g. Mediterranean species *varia*, *pusio*, *multistriata* (see CLEMAM, Dijkstra, Barucca, Matsumoto)). This also applies to *Veprichlamys* and *Spathochlamys*. The cemented species *Pascahinnites*, *Hinnites*, *Crassodoma* and some *Talochlamys* are not uniformly understood. Some chlamydinids have a shagreen structure, others not. All these genera are included within CHLAMYDINAE; the two somewhat shaky tribes are omitted. The findings of Barucca et al. (2003) and Matsumoto (2003) point in the same direction and recommend also inclusion of *Mizuhopecten*, *Patinopecten*. Thus, FORTIPECTININAE Masuda, 1963 is here considered a synonym of CHLAMYDINAE instead of a valid grouping.

The unique species, which usually also have special habitats **PEDUMINAE** (*Pedum*), **HEMIPECTINAE** (*Hemipecten*), **ADAMUSSIINAE** (*Adamussium*), and **AUSTROCHLAMYDINAE** (*Austrochlamys*) are separated, following here mainly Habe. The special position of ADAMUSSIINAE has been supported by Barucca et al. (2003). Cattaneo et al. (1999) gave details to *A. colbecki*.

This leaves PECTINIDAE without tribes, but with 10 subfamilies. The analysis of Barucca also indicates a clear break between at least **PECTININAE**, **AEQUIPECTININAE**, **DECATOPECTININAE**, **ADAMUSSIINAE** and **CHLAMYDINAE** versus **CAMPTONECTINAE**. Unfortunately, members of the remaining four subfamilies were not included.

The results of Matsumoto (2003) strongly support a marked break between PECTINIDAE and PROPEAMUSSIIDAE. He shows a closer relation of spondylids to pectinids than of propeamussiids to pectinids. Thus, Schein's view is not supported.

Considered here are mainly Coan et al. (2000), the rDNA analysis of Hammer (2001), the RNA analysis of Barucca et al. (2003), the mtDNA analysis of Matsumoto (2003), Dijkstra (Internet, 11 OCT 2006) and his many OD's and papers 1984-2006, further Raines & Goto (2006) and most OD's and some type material.

Fortunately, at the genus and species level, the opinions are today to a large extent convergent. This is mainly due to the extensive and outstanding work of Henk Dijkstra in the last 25 years who intensely treated this family. His views are to a large extent followed. The shell microstructure is important for identification.

CLEMAM listed the virtually hundreds of additional synonyms of French late 19th century authors for the few common European species. Most are here not repeated.

OG2: **Pecten**: Virtually all Japanese and Chinese authors differentiate 2 or 3 related species; most Western authors accept only one. I am convinced that 3 distinct species occur, one very common and 2 rather rare. One species is ***P. sinensis*** (syntype: HIG01 B491; Scott, 1994 pl. 6 sp. A; REV49 sp. 33). This species has been described from China and occurs reliably in SE. Hong Kong waters, Tolo Channel (SCO94) and Daya Bay, Guangdong (Zhongyan, 2004 pl. 135A as "*excavatus"*). It seems to extend to the Kyushu border of Japan (Kira, pl. 48 sp. 2 "*excavatus"* and Okutani, 2000 sp. 57 "*excavatus"*). This species is rather smooth, elongate-discoid, only slightly concave, large in size, up to 95 mm. This form and size are unknown from mainland Japan. There, a closely related, common form occurs, which is smaller, rounder and stronger convex. This species was described as ***P. puncticulatus*** Dunker, 1877 from Japan (Taki, 1951; Okutani, 2000 sp. 55 *sinensis puncticulatus*; Kira, 1972 pl. 48, fig. 1 *sinensis*, "formerly known as *puncticulatus*"; Raines & Poppe, 2006 pl. 92 fig. 1-6, pl. 93 fig.1-4 "*excavatus*"). As originally described, this is the puncticulate, marmorate species, glossy, and colorful, which occurs most commonly in Honshu. Although it is mentioned from Indonesia, Philippines and even Australia, all specimens seen so far came from mainland Japan. A third, the rarest species has originally been described from China, ***P. excavatus***, but also occurs in Okinawa (Okutani, 2000, sp. 56 "*sinensis*") and Honshu, Aichi Pref. (coll. auth.). Anton's type is present in Dresden. He remarked the strong radial ribbing, also in the interstices of the right valve. This is neither found in *P. sinensis*, nor in *P. puncticulatus*. In addition, *P. excavatus* has a stronger radiate grooved structure, flatter squarish ribs on the left valve, is much more excavated than the other two, with a larger umbo, and is only known in dark reddish-white with a brown border inside. It has a similar size as *puncticulatus* with about 60 mm.

As stated by Philippi himself "*Pecten excavatus"* in Philippi, 1844 is different from the OD of Anton; Philippi's *excavatus* is the common *puncticulatus* of Dunker and caused much confusion.

OG3: Iredale, 1939 in his OD of ***Minnivola isomeres*** did not accept ***pyxidata*** in Queensland. He considered it an exclusively Chinese species. Iredale described *isomeres* as Queensland species and mentioned many localities within Qld. He did not restrict *isomeres* to NSW and S. Qld. His maximum size mentioned is 32 mm, but not 25 mm. However, Iredale's OD did not offer clear clues to differentiate *isomeres* from *pyxidata*. As main reason for separating his new "species" he stated "The description and figure of the latter (e.g. *pyxidata*) are not much like those of the Queensland shell, especially as regards the depth". However, this special depth of the larger valve is a generic and not a specific criterion. It is hard to argue, that *isomeres* should be outside the normal variability of *pyxidata*. The latter, according to all modern authors, occurs in Qld. Finally, Dijkstra (1998) mentioned many intermediate variations observed. Thus, *M. isomeres* is here synonymized.

OG4: Within ***Euvola*** Coan et al. (2000) mentioned ***Leopecten*** as useful subgenus. The differences between the type species OD *Euvola*, *E. ziczac* and a typical *Leopecten E. diegensis* appear quite significant. Following Dijkstra, in addition to *diegensis* also *stillmani* and *sericeus* are attributed to *Leopecten*. Furthermore, *chazaliei* is considered closer to *Leopecten*.

On the other hand, it is hard to accept, that *marensis* and *laurentii* should be mere ***Euvola***. Further work and especially phylogenetic analysis appear necessary. *Marensis* occurs from Florida to N. Brazil, *laurentii* from Florida to Venezuela. Raines & Poppe (2006) well treated these two species. *Marensis* from Honduras and Alabama are indeed the same. It appears that Macsotay & Campos, 2001 misinterpreted *marensis* and redescribed true *laurentii* again as ***Pecten*** (***Euvola***) ***amusoides*** from Venezuela.

Considering the high variability displayed in Caribbean ***ziczac***, excellently demonstrated by Raines & Goto (pl. 118, 119), also in shape and size of auricles, I do not see any strong arguments to separate a Northern and a Southern species as recently proposed by Venezuelan authors.

Pecten micans Chenu, 1843 has been validly proposed and is not preoccupied (SHE). Chenu, 1843 briefly described it on p. 3 (1843) and depicted it on pl. 9 figs. 4-5 (1844). The two depicted syntypes from the former Delessert collection are unambiguously present in MHNG 989.128/1 and /2. These 2 small, approximately 20 mm ***Euvola*** bear no locality. Obviously, T. R. Waller, 28.8.79 studied them and identified them in sched. as juvenile *Pecten raveneli* Dall, 1898 Western Atlantic. A successive publication has not, as yet, been seen.

OG5: According to Okutani (2000) in mainland Japan just 1 ***Serratovola*** occurs, namely the more uniformly colored *gardineri*. The reddish mottled *rubicunda* (syn. *asper* and *tricarinatus*) is found in Okinawa and westwards only. Habe, and subsequent Japanese authors, considered *asper* as distinct from *tricarinatus* (as did Abbott & Dance, 1986). Nowadays, *tricarinatus* is considered a synonym of *asper* (DIJ981 pl. 4 figs. 7-8, syntype *tricarinatus*).

Habe, 1951 designated "*tricarinatus"* as type species of *Serratovola*. However, all evidence points that Habe's *tricarinata* meant instead *gardineri* and not Anton's true *tricarinata* (= *rubicunda*). Consequently, the type species of *Serratovola* is *P. tricarinatus* Habe, 1951 non Anton, 1839 (= *gardineri*).

OG6: Japanese authors usually differentiate a narrow, heavy, thick and strongly convex form as ***Decatopecten striatus*** (Schumacher 1817). However, neither Schumacher's rather generic OD, nor any specific locality mentioned make *Pallium striatum* particularly applicable to this Japanese form. In hinge, dentition, internal color and the usually 5 ribs Japanese specimens are considered within the variability of *plica*. Dijkstra's synonymization is followed.

Pecten zeteki Hertlein's nom. nov. for Hinds preoccupied *P. digitatus* was synonymized by most modern authors with *vexillum*. However, neither narrow, compressed shape, nor 9 ribs, or internal white color matches *vexillum* particularly well. Hinds' type should be restudied and compared to *D. amiculum* as well.

OG7: ***Comptopallium*** is sometimes synonymized with *Decatopecten*. However, the large size, the more numerous and stronger ribbing and the medium to strong commarginal lamellae on and between the ribs are not found in *Decatopecten*. Following Iredale, 1939 *Comptopallium* is understood as valid and monospecific with a highly variable species in form and surface sculpture with all intermediaries from smooth to heavily lamellate.

OG8: ***Mirapecten mirificus*** is an extremely variable species; the left valve may be strongly concave, almost straight, or even convex. The sculpture may be slightly spined to knobby, the texture very fragile to quite robust. ***M. tuberosus*** is perceived as extreme form of *mirificus*, as also depicted from the Philippines by Springsteen & Leobrera (1986, pl. 93 fig. 17 *mirifica* compared to fig. 21 *thaanumi*). *M. thaanumi* is nowadays considered a synonym (see also Raines & Poppe, 2006 pl. 78, fig. 1, pl. 79 fig. 6; Drivas & Jay, 1988 pl. 53 fig. 6 as *M. mirificus*, Reunion; Martens, 1880, Mauritius).

Dijkstra, 1991 erected ***Glorichlamys***, based on Deshayes *elegantissima* and synonymized Smith's *cooperi* from the Maldives. The Indonesian specimen depicted however, closer resembles Lischke's stronger and more regularly ribbed *quadrilirata* from Kyushu than the weaker, more irregularly ribbed *elegantissima/cooperi* from the Indian Ocean. Furthermore, certain specimens studied from Madagascar, Tulear or Reunion are very close to typical *lischkei*, whereas certain specimens from the SChi Sea, N. Borneo or from Japan are very close to typical *elegantissima*. Both, Lischke, 1870 and Deshayes in Maillard, 1863 characterized their specimens as quadrilirate or quadripartitis.

The specimens characterized and depicted by Raines & Goto (2006 p. 116-117 and pl. 68) do also not procure clear marks for a distinction of 2 species. Furthermore, Dunker's *pertenuis* from unknown locality depicts a form with even more numerous, weaker ribs and approaches Lamprell & Healy (1998 sp. 710) from the Great Barrier Reef.

All evidence indicates that only one widely distributed *Glorichlamys* is present, highly variable in rib sculpture.

OG9: All older experts synonymized Conrad's ***N. fragosus*** with Linnaeus' *nodosus*. Almost all modern experts differentiate. However, the main difference, 8 or 9 ribs, is tenuous, and some Floridan forms even have also 9 ribs. Both "species" may or may not have nodules, both attain a comparable size, no marked differences in sculpture were detected. The traverse laminae are also seen in Brazilian specimens. In addition, Conrad, 1849 obviously described his species from the West Indies, where, according to modern experts, it should not occur. Unless genetic data would strongly support a distinction, *P. fragosus* is resynonymized with the variable ***nodosus***.

OG10: ***Aequipecten***: *Lindapecten* is perceived as weak, but useful subgenus for species with a stronger sculpture.

A. lineolaris and ***A. phrygius*** do not match here particularly well, but their closest genetic relations are unknown.

According to Ardovini et al. (2004, Guinea-Bissau), Nicklès (1955, Congo), Gofas (1986, Angola, as aff. *solidulus*) ***A. commutatus*** seems to extend much further south than just Senegal. It appears that *peripheralis* and *atlanticus* are end of range forms of the widely distributed and variable *commutatus*.

The types of ***Pecten schrammi*** Fischer, 1860 from Guadeloupe and ***Pecten*** (***Chlamys***) ***tamsi*** Bavay, 1906 from Venezuela could not be located at MNHN 6/09. It may be that both were forms of the variable *exasperatus*, which itself was originally erroneously located in the Med.

I fail to recognize more than one highly variable ***Aequipecten*** from S. Brazil to S. Argentina, Tierra del Fuego. *A. tehuelchus* is quite variable in number of ribs, strength of sculpture on the main ribs and in colors. The number of ribs is usually higher in larger specimens. The small form with fewer ribs is often called *madrynensis*, but Bernardi, 1852 described this low ribbed, small form 50 years earlier from the same type locality as *P. vanvincqii*; the type is still present in MNHN. *A. tehuelchus* Orbigny is as of 1842 n. & f.

OG11: ***Flexopecten***: ***Ostrea coarctata*** Born, 1778 has been described from unknown locality, but not depicted. However, the syntypes are available ever since in Vienna, NHMW, 14108, 2 single valves. As early as 1878, Brauer stated in his review of the Born collection identity with "*Pecten flexuosus* Poli". However, this important paper published in the Sitzungsberichte has been neglected by virtually all subsequent authors. Born's name is here reinstated. *O. coarctata* is listed as valid name in Sherborn and the syntypes are unambiguously available. Born's syntypes closely resemble specimens found in Italy, the **type locality** of *coarctata* is here clarified accordingly.

OG12; ***Argopecten***: In the many lots studied of ***Argopecten nucleus/gibbus*** from Florida throughout the West Indies, E. Panama, and Venezuela to Brazil, I was unable to establish clear criteria to separate *nucleus* from *gibbus*. Of course, there are large, yellow *gibbus* extremes with 19 ribs from Florida and small, well inflated *nucleus* extremes with 21 ribs; and chestnut speckled specimens also from Brazil. Redfern's criteria smaller, more inflated with widely spaced commarginal interrib threads for *nucleus* compared to *gibbus* worked only in some specimens in many others not. As typical *gibbus* a Venezuelan specimen is depicted in Raines & Goto (2006 p. 305) where it should not occur according to their biogeographic map on the preceding page. This same Venezuelan form with 20-21 ribs was described as ***Argopecten imitatoides*** Macsotay et al., 2001, but specimens very close are also known from the Bahamas. Neither rib number, nor convexity, neither color, nor size, neither costae on the posterior ear, nor interrib space, or biogeography was reliable. Interestingly, Abbott (1974) stated for *nucleus* 1 or 2 ribs more than for *gibbus*, whereas Raines & Goto see up to 23 ribs in *gibbus* and obviously less in *nucleus*. Finally, the OD of Linnaeus and Born describe virtually the same species with 20 ribs and do not give any hint to separate. Unless solid genetic data would separate, only one highly variable species is recognized.

The form *portusregii* characterizes very flat specimens, typically found on the US SE. coast.

On the other hand, Smith's ***noronhensis*** is a small widely distributed distinct *Argopecten*, known from Brazil to Panama. Also Reeve's ***sugillatus***, described without locality, may be a valid Caribbean *Argopecten*. At least a specimen from Honduras, dived in 12 m among algae seems close to the small, 20 mm, rather fragile and waxy BMNH-holotype. However, much more material is needed for firm conclusions.

The ***irradians*** complex is morphologically difficult and should be analyzed with modern methods. At least typical New York specimens are marked distinct from typical specimens from Texas. Furthermore, Diaz & Puyana (1994) depicted a specimen from Colombia as "*amplicostatus*". However, this specimen with at least 23 ribs neither fits their text (12-18 ribs) nor typical specimens from Texas. Instead, the Columbian specimens are very close to specimens from Cuba. These, however, appear closer to Petuch's comparatively small, many ribbed, rather compressed ***taylorae*** than to any other described form.

The introduced, quite colorful *irradians*, farmed in the Yellow Sea, appears closest to Northern US forms.

OG13: ***Volachlamys hirasei*** was described by Bavay in 1904 as ribbed form. As smooth form he described forma *b ecostata*, clearly indicating a close relation. These forms are considered synonymous by most modern authors (e.g. Okutani, 2000, "inseparable, because they seem to constitute the same interbreeding populations"). One year later Pilsbry, 1905 described *Pecten awajiensis*. This has the same ribbed form as *hirasei* and is considered by most modern authors synonymous as well. Grabau & King, 1926 depicted the ribbed form as *Pecten solaris* and named the smooth form *Pecten teilhardi*, both from the northern Yellow Sea, Beidaihe.

However, in the same article Bavay also described and depicted ***Chlamys ambiguus*** which originated form the Yellow Sea (mare sinense boreale), and which he considered clearly distinct. As the name was preoccupied by the fossil *Chlamys ambiguus* Münster, 1833, Hertlein, 1936 renamed it *Chlamys sinomarina*. This appears as valid species found in the Yellow Sea (Zhongyan, 2004 pl. 135 fig. f). The broader shape, the smaller number (12-13) and thicker ribs differentiates this from *hirasei*. Until intermediary forms are found, ***Volachlamys sinomarina*** is recognized as valid and separated from *hirasei*.

Ostrea undata Born, 1778 was described from unknown locality, but not depicted. In addition, Born's originals are now lost (BRAUER). Possibly, his single valves were later replaced by complete and better quality specimens, but this is not provable. The two paired specimens available NHMW 14112, 2 are without doubt the same as *Ostrea tranquebaria* Gmelin, 1791 as stated by Mörch (1853) and Brauer (1878). However, as Born's original material is no longer available *Ostrea undata* is best treated as nom. dub.

OG14: ***Cryptopecten***: The genetic results of Matsumoto (2003) show a close relation of *vesiculosus* to *Pecten*. It may well be, that this group is wrongly placed here.

Whereas Wagner (1989) basing on type material recognized 5 IND species, Raines & Poppe (2006) only recognized 4 IND species and changed Wagner's synonymy. From the material at hand I am neither convinced that *nux* is the same as *guendolenae*, nor that *hastingsii* is the same as *vesiculosus* (HIG99) or the same as *nux* (DIJ06). Instead, Wagner's view and his synonymy are shared.

The quite common reddish, large ***C. vesiculosus*** from EChi and Japan and the flat type species ***C. bullatus*** from Natal to Hawaii do not pose problems.

The type of ***C. bernardi*** is depicted in HIG01 B473, the type of ***C. hastingsii*** Melvill, 1888 as well B472s. Following Wagner, these are considered identical. However, the type locality of *hastingsii*, Japan is erroneous. *Bernardi* is not known from mainland Japan, where the much larger, less inflated *vesiculosus* (syn. *hysginoides* Melvill, 1888) occurs. *C. hastingsii* has the characteristic shape, color and auricles of *bernardi*. This species has been quite commonly found in the Marquesas, at below 20 m and has recently also been found in the Philippines, Aliguay, 100 m. It is the most inflated *Cryptopecten*, often deep red inside.

Wagner separated ***nux*** from ***guendolenae***. *C. guendolenae* is a rather common species found in the Red Sea to Natal and also well known from the Philippines. This is usually multicolored, moderately inflated, and smaller than *bullatus*. It is depicted as *nux* in Raines & Goto (2006 p. 315) or in Dijkstra & Kilburn (2001 fig. 50-51).

True ***C. nux*** is also a rare species. The type is depicted in Wagner (1989 fig. 6-7). It is more inflated than *guendolenae*, more solid and both auricles slightly larger, internally it is glossy, deep violet, deep yellow or deep orange, generally as the rather uniform outside colors. It usually has less than 20 ribs, whereas *guendolenae* has typically 22 ribs. It was originally described from Marquesas, but the type locality was restricted by Wagner to the Philippines. None was encountered diving in the Marquesas, although Tröndlé and Cosel reported it from there at a depth from 60-120 m. Specimens have been seen from the Philippines and from New Guinea. It is further reported from tropical Australia.

OG15: The difficult and highly variable ***Chlamys*** of the NW. Pacific have been treated by Coan et al. (2000). They accepted 3 large species and gave the synonymy. The type of ***C. chosenica*** is depicted in HIG01 B433, the synonymous ***C. rosealba*** in Scarlato, 1981 fig. 181-184. This Asian species remains slightly smaller, is quite colorful with a comparatively regular ribbing. Adults are often strongly inflated.

Pecten rubidus Menke, 1843 from West Australia has been validly introduced based on Martyn's figure, not in synonymy. In all probability Menke saw the red colored form of *Mimachlamys asperrima* (Lamarck 1819). However, the type appears lost (not MfN) and the name has never been used in the Australian or pectinid literature as valid species (e.g. Dijkstra Internet, 10. 10. 2006; Lamprell & Healy, 1998; Jansen, 1995; Lamprell & Whitehead, 1992; Cotton, 1961; Allan, 1962; May, 1958; Iredale, 1925 and 1939; Thiele, 1930; Odhner, 1917; Melvill & Standen, 1899). In two cases *rubida* Menke was mentioned: Rombouts (1991 p. 27) lists "*C. rubida* (Menke, 1843)" under "other taxa in the *C. asperrima* complex", nonetheless, Rombouts (1991 p. 18) considered *Chlamys rubida* (Hinds, 1845) as valid. Raines & Poppe (2006 p. 30) considered *rubida* Menke, 1843 (*non* Hinds, 1845) as a synonym of *Mimachlamys sanguinea*, but *rubida* Hinds, 1845 as valid as well.

On the other hand, the well known NE. Pacific *Pecten rubidus* Hinds, 1845 has consistently been applied (see Dijkstra Internet, 10 OCT 2006; Raines & Poppe, 2006 p. 186 and included pectinid records from 1903-2000; Coan et al., 2000 p. 234 and included American and pectinid records from 1931-91; Foster, 1991 p. 46; Abbott, 1974 p. 444). This name has invariably been applied to the well known Aleutian/Californian *Chlamys*.

Based on ICZN Art. 23.9.2. ***Pecten rubidus*** Hinds, 1845 is here declared valid and considered **nomen protectum** and the older *Pecten rubidus* Menke, 1845 is considered a nomen oblitum.

Chlamys rubida is a highly variable and widely distributed species. Coan et al. (2000) gave the synonymy.

OG16: Dijkstra (2006) considered ***Psychrochlamys*** a synonym of ***Zygochlamys***. This view is shared, *patagonica* the type *Psychrochlamys*, OD is perceived too close to *geminata* to be separated.

Z. delicatula barely fits into *Talochlamys* as proposed by authors, but seems well placed here.

OG17: ***Semipallium*** may be over-named. The difference between *S. barnetti* and *S. dringi* is not particularly clear. In the text of Raines & Goto *dringi* is not known from the Philippines, whereas 8 specimens from the Philippines are depicted. These are barely distinguishable from *barnetti*, depicted some plates earlier. Also the differentiation between *S. dianae* and *S. fulvicostatum* is extremely difficult.

These species appear erected on slight differences in form and color. Consequently, the confusion in literature is tremendous and virtually nobody seems able to distinguish them properly.

S. flavicans is a widely distributed and variable species. *S. marybellae* does not seem to differ significantly. Specimens found in the Andaman Sea and off Mozambique are hardly distinguishable from Guam specimens. Most distinct appear the Japanese forms, which are often larger, blackish and finer sculptured. *Marybellae* is here not recognized as valid species.

OG18: ***Scaeochlamys***: Usually ***superficialis*** is considered to live in the Red Sea and *ruschenbergerii* in Arabian waters. However, Raines & Goto (2006) remarked under ***ruschenbergerii***: "This is a difficult species to identify and it may currently be a variation of L. *superficialis*". Indeed, specimens off Eilat, Israel connect these extremes well.

The differences mentioned by Dijkstra, et al. (1984) seem quite variable. Red Sea specimens may reach almost the size of Arabian specimens, they may be as convex, and the fineness of the sculpture is variable. Typical *superficialis* seems just to represent an uncommon extreme, flat light form of the more common rounded, heavier typical *ruschenbergerii* form. *Superficialis* is well depicted in Chemnitz 7 66 630 (*arausicanus*), likely stemming from Niebuhr's material as well. Locally, in pristine habitats, this is a very common species. Usually it occurs in reddish-brown color, but orange and white are also found.

Superficialis/*ruschenbergerii* have been generically shifted hence and forth and been placed in *Scaeochlamys*, *Laevichlamys*, *Azumapecten*, sometimes even in different genera. Comparing the type species, then *superficialis* is perceived closer to *livida* than to *multisquamata*.

Gmelin's ***Ostrea sauciata*** is based on Chemnitz 7 69 H from the Red Sea, in all probability from Forsskål and Niebuhr's original material. Raines & Goto (2006 p. 398) placed it as synonym of *ruschenbergerii*. However, the OD of Chemnitz clearly points into *P. rubromaculatus* of Sowerby II, which is well known from the Red Sea. *Laevichlamys sauciata* (Gmelin, 1791) is therefore understood as the valid, earlier name for *Pecten rubromaculatus*. Lamy (1936) came to a similar conclusion.

OG19: ***Pascahinnites***. Specimens dived at the type locality of Hinds' ***coruscans*** at Marquesas, Nuku Hiva have been compared to ***hawaiensi*s** from the type locality Hawaii, Oahu. However, I could not detect any features justifying a separation. In general the Marquesas fauna is in bivalves close to the Hawaiian fauna and approximately 40% of the bivalves are shared.

It seems that *coruscans* from other locations, especially Australia, differ somewhat from above synonymous pair.

Thus, if a separation is deemed necessary, then Australian or Indian Ocean *coruscans* have to be renamed.

OG20: Light (1988) analyzed ***M*. *nivea*** and ***M*. *varia*** and classified *nivea* as subspecies. As outlined in the introduction, the "concept" of subspecies is here not shared. Facing the question synonymous or valid, without a doubt the latter option is chosen.

Nivea is easily recognizable. Light could clearly attribute 99.1% of the 900 species analyzed. This quota is not nearly achieved in many other pectinid "species". *Nivea* has a higher rib count of 40-46 (*varia* 26-32), has mostly a white color (*varia* is highly variable, but often purple or brown). *Nivea* occupies a restricted geographic niche within the wide distributional area of *varia*, and occurs there within a special habitat.

OG21: A suppression of *Lissochlamis* Sacco, 1897 in favour of ***Lissochlamys*** Sacco, 1897 is ICZN-pending. Chemnitz' ***exotica***, erroneously from the Red Sea, has been earliest latinized by Holten, 1802 (WIN43).

OG22: ***Karnekampia*** as described by Wagner, 1988 is applied to a closely related "species-complex", found in the E. Atlantic from Iceland, into the Med to S. Africa. The number of species considered valid ranges from 1 to 4 according to the author consulted. Obviously, intermediary forms occur. All species are uncommon and live mainly bathyal. Here, three species are perceived recognizable.

6.28 SPONDYLIDAE

OM1: Lamprell's second ***Spondylus*** book (2006) is used as base; many types are depicted and many of Lamprell late views are shared. His first book on spondylids is not recommended. In addition, the types of Higo et al. (2001) have been taken into account. A few Chemnitz' types are illustrated in Martynov (2002). For the Hawaiian species Dall, Bartsch & Rehder (1938) has been used. Additionally, many types have been studied in MNHN and especially BMNH. Base literature included Chemnitz vols. 7, 9, and 11, Schreibers (1793), Lamarck (1819), Chenu (1845), Sowerby and Reeve. However, the following still reflects a somewhat superficial view. The necessary, extended genetic analysis is lacking and seems for this group indispensable.

Gaideropa Deshayes, 1832 obj.; but also *Eleutherospondylos* Dunker, 1882; *Lanilda* et *Sponvola* et *Eltopera* Iredale, 1939 and *Corallospondylus* Monterosato, 1917 are commonly regarded as synonyms, as the shell features are perceived by most authors not significant enough to warrant splitting. However, Waller (2006) insists that ***Corallospondylus*** becomes cemented immediately after metamorphosis and no byssal notch ever develops, whereas other members have a byssal notch in early stages. *S. gussonii* is not the only small spondylid found bathyal. The same or at least quite similar forms are known or were described from Caribbean, Panamic and New Caledonian waters. Furthermore, the genetic results of Matsumoto (2003) show a distance of ***Eltopera*** *sanguinea* (= *S. anacanthus*) to other members, which may indicate a further separable group. *S. fauroti* is also close to *anacanthus*. Generically, much more work is necessary and further groups may come to light. For the time being, the conventional view is followed and just one genus is applied.

The family itself is considered monophyletic by most modern authors.

The following species are considered lost or dubious:

- *Spondylus antiquatus* Linnaeus, 1771 (LINN71, no loc., no ref., no type = nom. dub., HANL55, DOD52)

- *Spondylus citreus* Gmelin, 1791 (no loc, no type, description ambiguous, ref. Argenv. Conch t 20, f. K unclear, possibly even chamid, = nom. dub)

- *Spondylus aurisiacus*, *cancellatus*, *coccineus*, *costatus*, *maximus*, *muricatus*, *oblongus*, *plicatulus*, *punctatus*, *purpureus*, *rubellus*, *striatus* and *virescens* Schreibers, 1793 (no types, no loc., no sizes, references dubious or ambiguous, = nom. dub., COX29, LAM38, own investigations).

- *Spondylus pesasinus* Schreibers, 1793 references Chemnitz Vign. 9 a, b from IND. The picture of Martynov (2002 fig. 3 D-F) does not fit Chemnitz particularly well. Cox (1929) considered this species as enigmatic; Lamy (1938) and Lamprell (2006) did not mention it. It is considered a nom. dub.

- *Spondylus princeps* Schreibers, 1793 was invalidated by ICZN 3014. Though unnecessarily, as *princeps* Broderip also falls into synonymy of *crassisquama*.

- *Spondylus marmoratus* Schreibers, 1793 is considered by authors synonymous to *S. foliaceus*. However, no locality was given, the reference is dubious and the description would fit *S. variegatus* even better. It is considered nom. dub.

- *Spondylus rufus* et *labrum* et *cruentatus* et *macis et cristatus* Röding, 1798 (no loc, no type, no ref. = nom. dub.)

- *Spondylus imbricatus* Perry, 1811 (= nom. dub., PET03)

- *Spondylus microlepos* Lamarck, 1819 (type lost, locality and reference dubious, LAK06)

- *Spondylus coccineus* Lamarck, 1819 non Schreibers, 1793 (type lost, no loc., LAM38, LAK06). Consequently the nom. nov. *Spondylus punicus* Bernard, Cai & Morton, 1993 is without base, no type was designated.

- *Spondylus longitudinalis* Lamarck, 1819 (type Dufresne coll. lost, locality and reference dubious, see also FUL15; Chenu's specimen pl. 9 fig. 1 is a worn *versicolor*)

- *Spondylus unicolor* Sowerby II, 1847 (type lost, no locality, variously interpreted, nom. dub.).

At present above 65 spondylids are recognized, all except 8 species (MED, WAF, CAR, PAN) are IND or living in adjacent areas.

OM2: The number of valid CAR species varies significantly. Weisbord (1964) accepted 1 valid species only: *S. americanus*. Above 25 names are available. Here 3 species, ***americanus***, ***tenuis*** and the small, deep water panatlantic ***gussonii*** are considered valid. A separation of *ictericus* from *gilvus* as proposed by Lamprell (2006) is not supported in the material studied. Both are here considered junior synonyms of *tenuis*.

The name ***S. ictericus*** Reeve, 1856 is no longer defendable. At least 3 names, validly proposed and used after 1899, are older. Typical *S. ictericus* is a sparsely spined form, with an almost flat upper valve and is typically spotted or yellowish around the umbo. It has been described from the Bahamas. However, very similar specimens are found throughout the Caribbean.

A quite similar species has been depicted by Chemnitz 9 115 987 from West Indies, St. Croix. It has been properly referenced and latinized as ***S. tenuis*** by Schreibers, 1793. As Schreibers' types are lost, Chemnitz 9 115 987 is here selected as plesiotype (see also Cox, 1929; Lamy, 1938; Lamprell, 2006). *S. tenuis* is the earliest valid name for the larger CAR non-*americanus* forms, the umbonal part may turn left or right.

Also ***S. ambiguus*** Chenu, 1845 (CHENU pl.28 fig. 1; holotype in LAK06 pl. 41 f I-J; MHNG seen 5/09) is older than *ictericus*. The type locality is correct. This is an even flatter form, speckled over the whole valves, with more ribs. Typical specimens are mainly found in the West Indies, e.g. Guadeloupe and Martinique.

S. monachus Chenu, 1845 (CHENU pl. 26 fig. 5; MHNG, seen 5/09) has a characteristic shape. It was described from Indian Seas and desperately synonymized as probably (FUL15) or variety (LAM38), or even as synonym of *croceus* (Lamprell, 1986). However, nothing similar is found in the Indo-Pacific. Specimens virtually identical to *monachus* are known from the S. Caribbean and N. Brazil. Close are also Reeve's fig. 38 and 40. *S. monachus* Chenu, 1845 is a further synonym of *tenuis* with an erroneous type loc.

S. gilvus and ***S. erinaceus*** Reeve, 1856 are inflated forms found in the same areas as *S. ambiguus*.

S. sowerbyi *Fulton*, *1915* (= *S. digitatus* Sowerby II, 1847 non Perry 1811) is accepted by most authors as juvenile, strongly spathulate form.

S. vexillum and ***S. ustulatus*** Reeve, 1856 are less inflated, also spathulate forms, described from the Bermudas, but also found in Brazil.

S. electrum Reeve, 1856 and ***S. ramosus*** Reeve, 1856 non Schreibers, 1793 are bright orange-yellowish forms, with more or less spines, mainly known from the West Indies, approaching Chemnitz' type species.

The BMNH holotype of ***S. electus*** Fulton, 1915 (FUL15; LAK06 pl. 23 sp. J) described without locality has been studied. It bears typical traits of the Caribbean *tenuis* and was correctly synonymized by Lamprell (2006).

All these forms have intermediaries and are neither morphologically, nor biogeographically, or from habitats separable. The extent of spines and the convexity of the upper valve is a variable element, and various degrees are found in the same populations.

S. tenuis is even more variable than *S. americanus*. Compared to *S. americanus* it is generally smaller, often more robust, usually less or then spathulate spined and often speckled around the umbones.

The high variability of ***S. americanus*** is well documented. In addition, off Guarapari, Espirito Santo, Brazil a large, white, profusely spined form is found. This form (see also BRASIL, sp. 4) is here understood as large and relatively deep living end of range *S. americanus*. Very recently, it has even been described as *S. aurispinae*.

OM3: ***S. asiaticus*** has been described from India. The type is depicted LAK06 pl. 40 figs. C-D. Both MNHN syntypes are brownish and sparsely spined with brown margins. The later named BMNH ***S. setiger*** Reeve though stronger spined is perceived conspecific. The marginal colors and dentition in both species are very close. Such specimens are known from W. Thailand and N. Mozambique. Whether Reeve's locality Philippines is correct is open. At least similar specimens were not encountered in Philippine or in Chinese water as yet. The specimen identified from Qld in Lamprell & Healy (1998 sp. 279b) is instead close to *asperrimus*. The specimen from the Philippines identified by Lamprell (1986 pl. 10 fig. 2a) is instead close to *affinis* (= *multisetosus*).

Asiaticus is currently understood as Indian Ocean species. All three type specimens are strongly attached with the lower valve and therefore uncommonly shaped, but upright shapes are known. *Asiaticus* is uncommon and in addition to the involved BMNH and MNHN types just a few specimens have been seen.

OM4: The NW. Indian Ocean species are extremely difficult, with a multitude of names available. In addition to the ones described and treated by Lamprell (2006), earlier, Jousseaume (1888) and Jousseaume in Lamy (1927) described Red Sea species. Many of these antedate Lamprell's later names. Most of these types are present in the MNHN type collection. However, ***S. echinus*** Jousseaume in Lamy, 1927 from Djibouti and ***S. vaillanti*** Jousseaume in Lamy, 1927 also from Djibouti were not found in 6/09, likely still resting in the MNHN general collection. The former should be compared to Lamprell's colored *darwini*-form *pickeringae*, the latter with Oliver (1992 pl. 15 fig. 4).

Following Dekker (pers. comm. 2004) and Lamy (1927) the earlier name for ***S. smythae*** Lamprell, 1998 is ***S. fauroti***

Jousseaume, 1888. An upper and a lower syntypic valve are present in MNHN and represent this characteristic Red Sea form. As mentioned by Lamy (1927 and 1938) this species is very close to *S. anacanthus*. *S. anacanthus* is not reported from the Red Sea proper, but occurs elsewhere in the Indian Ocean.

The juvenile MNHN holotype of ***S. unicus*** from Djibouti has been studied. It is definitely not a *S. gaederopus*, as stated by Lamprell (2006). In addition, *gaederopus* is not known to occur in the Indian Ocean. The purplish spines remove it from *roseus*; also juvenile *candidus* are distinct, but *unicus* shows affinities to small ***layardi*** from Sri Lanka and is perceived the same. *Layardi* itself seems confined to the NW. Indian Ocean. Lamprell (2006) synonymized ***lemayi*** from Aden.

The unique ***S. exilis*** Sowerby III, 1895 was described trawled off Karachi, but not recognized since. The BMNH holotype reveals that is was taken dead, as marked incrustations on the somewhat bleached inner side of the valves are still visible. The hinge was originally brown. Rough spined sculpture, hinge, muscle impression and rough marginal crenulation together with material at hand and biogeography do not rule out that *exilis* is only a large *layardi*.

S. gloriandus from the Persian Gulf is rare as well, but has been refound and is denser and more regularly spined.

In MNHN 4 complete syntypes of the small ***S. roseus*** are present, measuring 23-30 mm. This species was never treated by Lamprell. The MNHN syntypes from Djibouti do not fit juvenile *pratii* or *groschi* and are also distinct from *unicus*. However, spines, color and biogeography do not rule out that *roseus* is the juvenile form of *gloriandus*, but more material and growth series are needed to confirm this possibility.

The unique type of ***S. darwini*** is depicted in Lamprell (2006 pl. 27 fig. a) and also in Lamprell (1986 pl. 2 fig. 6a). This species is represented by a single, but complete MNHN holotype. As stated by Lamy (1938) the color is white and orange around the umbones and also weakly streaked in these colors on the upper valve. *S. darwini* has been described from unknown locality. However, as Jousseaume collected largely in the Red Sea and in Djibouti it is quite likely that this shell stems from this area. On the other hand, ***S. pickeringae*** has been described from Eilat and is well known from the Gulf of Aqaba. Although the shells are usually brightly orange streaked, almost all white specimens occur. The depicted specimen is from Eilat. As neither the white spining, nor the surface sculpture, or the strong and enlarged internal ribbings of *darwini* are distinct, *S. pickeringae* is here treated as junior synonym. The specimen depicted in Oliver (1992 pl. 15 fig. 1 *S.* "*crassisquamatus*") appears to be the same. The specimen depicted as *darwini* from Qld in Lamprell & Healy (1998 sp. 281) is distinct and close to BMNH *asperrimus*. It is the same as Lamprell (2006 12 J-L) from Qld and occurs in the Northern part of Australia, at least from NWA, Dampier and Broome to Qld, Great Barrier Reef. The specimen depicted in Lamprell (1986 pl. 2 fig. 6b), presumably from the Philippines, is distinct from both. It seems that *S. darwini* is confined to the northern part of the Red Sea only.

S. groschi itself appears as quite solid, valid Indian Ocean species, also known from the Med and Zululand. It has strongest affinities to *foliaceus*.

Spondylus concavus has been described by Deshayes in Maillard, 1863 from Reunion. It has been rarely treated and as far as is known, not refound since. Viader (1937) listed it in the Mauritius catalogue; however, it is not clear, whether he collected it or just copied Deshayes' Reunion list. Deshayes had only two lower juvenile valves, which, however, presented marked features: deeply concave, weakly attached, fragile and transparent, whitish with a marked pale orange-yellow border, the border simple, and a special lined sculpture with 5 or 6 granulated interribs. Obviously, this spondylid is exceedingly rare. Recently, from nearby Pemba Isl., off Tanzania, dived 30-40 m, dead but articulated, a 77.1 mm specimen has been studied. It fits all characteristics well. The (microscopic) granular interrib structure is present, but it was only visible at the border and the umbonal portion. It seems that this trait is better expressed in juveniles. The upper valve is very flat and much smaller. It is orange-yellowish white, with some irregular reddish spots in the broad white umbonal area. The sculpture consists of numerous fine ribs, very sparsely spined ventrally. The interstical sculpture is irregularly granular. Inferring from the scarce information, an offshore, insular, sublittoral habitat is most likely. None, of the known Indian Ocean spondylids is close.

OM5: It has been published in the Festivus in 2009, that ***S. crassisquama*** Lamarck, 1819 is instead of E. Pacific origin and the valid earlier name for the well known *S. princeps* Broderip, 1833. The holotype is MHNG 1089/5. Furthermore, in the same article Fulton (1915)'s conclusion that the BMNH-syntypes of Reeve's ***S. basilicus*** represent the same species, as does the huge BMNH-holotype of ***S. dubius*** Broderip, as concluded by Lamprell (2006), have been confirmed.

In addition, ***S. limbatus*** (*syn. calcifer*) and ***S. gloriosus*** (syn. *linguafelis* auctt.) occur in Panamic waters.

S. leucacanthus is the only surviving name of Skoglund and Mulliner (1996)'s Panamic review. However, their distribution data and characteristics of the 3 PAN species discussed hold.

OM6: In above mentioned Festivus article I also illustrated that ***S. linguafelis*** Sowerby II, 1847 is neither a Polynesian, nor a Hawaiian species, but instead a quite rare, large, solid, brownish and heavy Philippine species. A BMNH neotype has been selected.

OM7: It was not possible to draw a line between ***S. castus***, ***S. albibarbatus***, and ***S. spectrum***, all Philippines of Reeve, 1856. The brownish color characteristic for *albibarbatus* is a variable feature; the sparse ribbing of *spectrum* or the dense spines of *castus* as well. There are too many intermediaries to connect these three extremes. Moreover, Reeve was not aware of ***S. echinatus*** while describing his three Philippine species. Schreibers' oldest name is here reinstated for this complex of large, robust elongate-ovate, white species; usually black speckled around the umbones, with more or less brown umbonally, and sparse to strong spathulate, always white spines. Reeve's *castus* is closest to specimens from India and Sri Lanka, the possible type locality for *echinatus*. The specimens depicted by Lamprell (2006 pl. 7 fig. G-K) from Australia are closest to the *spectrum* form. His *castus* pl. 11 is closer to the typical forms from the Indian Ocean.

OM8: The Hawaiian spondylids are difficult, at least 4 species occur.

The species, usually referred to ***linguafelis*** does not fit Sowerby's OD. Hawaiian specimens are much more fragile and usually grow smaller. Instead of a cat tongue sculpture with thick prickles as in *linguafelis*, a multitude of slender spines is present. A uniform dark brown color is not reported for the Hawaiian species, but orange, white, purple and red are known. The strongly marked brown border is lacking as well. Consequently Dall, Bartsch & Rehder, 1938 considered the Hawaiian species as new and described it correctly as ***S. gloriosus***. This is the valid name for this famous and expensive species, mainly known from Hawaii, but also reported from offshore Panamic Isl. Longer spined Philippine specimens named "*linguafelis*" are instead ***swinneni***.

S. hawaiensis was originally described by Dall, Bartsch & Rehder, 1938 from Hawaii, and consequently variously synonymized. However, the specimen depicted by DBR as *hawaiensis* and by Kay (1979 as *tenebrosus* syn. *hawaiensis*) are indistinguishable from Lamarck's *candidus*. Reeve's *tenebrosus* (= *violacescens*) is instead an Australian species. Specimens studied from Honolulu and Oahu share the same colors, the same radial sculpture. Internally the same radial marginal sculpture occurs as in *candidus* from Tahiti, Marquesas or the Philippines. Obviously, Lamprell (2006) came to the same conclusion. DBR's ***sparsispinosus*** is instead a juvenile *nicobaricus*. *Candidus* is widely distributed and known to reach 150 mm.

The true identity of the bright red ***parvispinus*** was not satisfyingly resolved. However, the USNM type proved that the reddish *parvispinus* is a juvenile *candidus*, the same as *hawaiensis*.

S. mimus appears as rare, valid Hawaiian species, distinct from *gloriosus*. The species depicted in Severns (2000 p. 236, and here copied) as *S. nicobaricus* is not Schreibers' species, but seems instead to represent *mimus*.

Furthermore, there is a huge orange-red species known from Hawaii. This is one of the largest and heaviest spondylids globally, attaining at least 175 mm. The upper valve is inflated, a radial sculpture is lacking. The thick deep purple-brown marginal border, the almost silky, uniform surface and the stronger hinge with larger teeth does not allow synonymization with *candidus*. Subsequent study of the USNM *mimus*-type and discussions with Mike Severns led to the conclusion that this represents a large *mimus*.

Finally, true ***nicobaricus*** (syn. *S. serratissimus* Dall, Bartsch & Rehder, 1938 and *S. sparsispinosus* Dall, Bartsch & Rehder, 1938) is well known from Hawaii.

OM9: ***S. lamarckii*** is considered as a recognizable form, mainly found in Philippine waters. It has been depicted 1843 in CHENU pl. 9 sp. 4 as *ducalis* and renamed *lamarckii* in 1845. It has been considered as form of *S. ducalis* (= *sinensis*) by Fulton (1915) and Lamy (1938) or as distinct species by Reeve (1856), Hidalgo (1905) and Lamprell & Healy (2001). Lamprell, 2006 stated its differences to *S. sinensis*, but synonymized it with *spinosus*. However, it clearly surpasses the variability of *S. spinosus*, which is restricted to the Red Sea and adjacent Med waters.

The almost smooth microsculpture is different from the prickly sculptured *sinensis*. When present, the white spines are non spathulate; the margin is dark purple, as well depicted in Sowerby II (1847 sp. 21). The size is generally larger than *sinensis*. *S. lamarckii* is considered a valid species. Chenu's pl. 9 fig. 3 might be true *sinensis*.

OM10: Both, ***S. multimuricatus*** Reeve and ***S. lamyi*** Fulton are not well known and *multimuricatus* is often confounded. However, from Philippine material at hand it appears that these two are at least very closely related, possibly conspecific. Both types are depicted in LAK06 and have been studied in BMNH.

Multimuricatus is ovate in shape and has comparatively dense, fine hollowed spines, very short umbonally, becoming longer ventrally. In color it ranges from orange, brownish to purplish.

OM11: Lamprell (2006) synonymized ***S. affinis*** and ***S. fragrum*** with *S. violaceus* Reeve, 1856, selected *violaceus* as valid and a lectotype. The earlier use of *violaceus* "Lam." by Sowerby II, 1847 is erroneous for *violacescens* Lamarck, 1819 and, thus, negligible.

However, having studied all types involved and many dozens specimens, I am convinced that *S. multisetosus* Reeve, 1856 is not separable from *affinis* and *fragrum*, but that ***violaceus*** is a distinct larger and more solid species.

Reeve described *multisetosus* (type in LAK06 pl. 19 G) as ovate and rather thin and the BMNH syntype conforms. Reeve's ***multisetosus*** is here selected to represent this complex. All three *S. multisetosus*, *S. fragrum* and *S. affinis* were described from the Philippines. This complex encompasses small, fragile and usually thin, depressed to slightly inflated, pecten-shaped spondylids, generally with sparsely colored margins. These are very common in shallow water in the Philippines and the S. China Sea (N. Borneo, Gulf of Thailand). Although they often have 5 or 6 principal ribs with often spathulate spines, and often red stained whitish umbones, they display enormous variability in color and ribbing. It also appears that the type locality of the misinterpreted ***S. camurus***, Philippines, is correct and *camurus* belongs also into this group. At least many of the Thailand and Philippine *multisetosus* studied show too strong resemblances to consider *camurus* a distinct species.

It is unlikely that the heavy, densely ribbed Mediterranean specimens consistently identified so by Lamprell & al. (2001) and Lamprell (2006) as *multisetosus* (or as *limbatus* by Repetto et al., 2005) from the Mediterranean represent this Philippine species. Instead as stated by CIESM, it is probable that the Med specimens are only densely and shortly spined *spinosus* immigrated from the Red Sea. These are quite variable in color (all red, brown with yellow spines, brown red with white spines), as depicted, usually denser spined than the Red Sea forms.

The type series of Reeve's ***violaceus*** itself described from unknown locality appears instead indistinguishable from Reeve's earlier ***virgineus*** from the Philippines. *S. virgineus* is considered a valid species and *violaceus* without locality is here synonymized. Reeve, 1856 depicted a young specimen with weak colors (type in LAK06). Such and larger specimens are uncommonly found in Bohol, Masbate, and Cebu. Adult specimens are usually stronger colored, occasionally all purple, but still with almost smooth, somewhat waxy surfaces and generally with whitish umbones often dark sprinkled. From the Philippine material at hand, it is also not possible to keep Fulton's *reevei*, also from the Philippines, as distinct species. ***S. reevei*** Fulton, 1915 is a nom. nov. for Reeve's preoccupied *hystrix*. Reeve's depicted BMNH syntype of *hystrix* is profusely spined; the non figured syntype approaches *violaceus*. *S. virgineus* is currently only known from the Philippines.

OM13: It appears that some of the Australian forms described by Iredale, 1939 were too hastily synonymized by Lamprell with ***nicobaricus***. *S. percea* appears indeed the same as *ciliatus*, i.e. the white, strongly spined *nicobaricus* form. However, another specimen studied from GBR conforms quite well to Iredale's ***lindea*** and seems to surpass even the high variability of *nicobaricus*. It has longer and denser spines with an expressed triangular area in the lower valve and also a stronger crenulated margin. *S. lindea* is currently understood as strong *nicobaricus* form, but it may turn out to represent a valid species.

Other WA and Qld specimens appear to fit *S. parocellatus* well and the differences between ***eastae*** and *parocellatus* are currently unclear. It can not be excluded that *eastae* is a junior synonym of ***parocellatus*** and the latter widely distributed in tropical Australia. However, Iredale's types were as far as is known never depicted and firm conclusions are without type material and larger series not possible.

S. rostratus Chenu, 1845 pl. 26 f 4 is perceived as further variety of ***S. nicobaricus***, found in the SW. Indian Ocean, e.g. E. Africa (also LAM38; the type is depicted in LAK06 pl. 41).

The specimen precisely conforming to Chenu's type figure of ***S. lima*** is present in MNHN in the Lamarck collection. Additionally, it is labelled *Sp. coccineus* var. b. Lamarck, 1819 on the back and *S. radians* on the front. Lamprell (2006)'s statement that the *lima* type could not be located is here corrected. Lamprell (2006 pl. 13 figs. A-D from Japan) does not match true *lima*, but seems instead to represent a weakly spined *occidens*. Lamy (1938 p. 268) studied *lima* and considered it a *nicobaricus* variety. Indeed closest to *lima* are densely, short spined, dark reddish *nicobaricus* as found in the SW. Indian Ocean (e.g. Steyn & Lussy, 1998 sp. 864). Consequently, Lamy's view is here confirmed.

OM14: ***S. mireilleae*** Lamprell & Healy, 2001 is perceived the same as ***S. occidens***. The type is in MNHN and fresh material from New Caledonia was studied. It fits well into the widely distributed color- and shape-variable *occidens*. Usually large and/or deeper water specimens, also from the Philippines, are paler, whereas smaller and/or shallower specimens, also from New Caledonia, display brighter colors. The depicted, pale WRS specimen is from 120 fathoms, Philippines. Neither depth, nor special habitat, nor sizes offer any distinct features to separate *S. mireilleae*. The morphological "differences" mentioned "narrower ribs, less inflated top valve, regular spining" are variable and found in Indian Ocean and Philippine specimens as well. Unless genetic data would render a clear signal, *S. mireilleae* is not recognized as valid species but here synonymized with *occidens*.

OM15: ***S. senegalensis*** is variable in strength and number of ribs as in convexity of the upper valve. It occurs in various shades of red-purple-orange. The holotype of ***S. excavatus*** (Chenu, MHNG 30638) is well within the variability of *senegalensis* and agrees with specimens found off Ghana. It is by no means a "nude" species as assumed by Fulton (1915) and Lamy (1938), but the type is rather worn, though the short spines are still present. *Spondylus* sp. Lamprell, Stanisic & Clarkson (2001 p. 617) from CapV also appears as flatter, denser spined form of *senegalensis*. *Senegalensis* is currently the only larger *Spondylu*s described from the West African coast.

OM16: Other than stated by Lamprell (2006), Lamarck's type of ***S. violacescens*** is present where it should be, namely in MNHN. Chenu's "*violacescens*" pl. 27 figs. 3, 3a does not match and was not recognized by Lamy (1938). The old MNHN label reads: "Fourni pour Chenu Illustr. Conchyl. pl. 24 fig. 1-1a". Indeed Chenu's first "*asiaticus*" figure matches Lamarck's type quite well. True *asiaticus* with a type in MHNG is represented by the distinct figure 2 on the same plate. Chenu's view that these two are conspecific is not shared. The MNHN lot contains a further smaller, whitish specimen, not recorded by Lamarck and as concluded by Lamy (1938 p. 202) erroneously placed there. *S. violacescens* was described from SWA, King George Sound. However, from this area only the significantly distinct *S. tenellus* is known. Consequently, Lamarck's type locality is false. Lamy (1938) and Lamprell (2006) accepted Reeve's *tenebrosus* as identical. Lamprell placed *violacescens* in tropical Australia. I have seen too little material, but Lamprell's conclusion seems plausible.

6.30 LIMIDAE

OU1: A limid is generically easily recognized, and specifically more easily confounded.

Globally, Boss (1982) estimated 125 species. Here, more than 250 species are considered valid, mainly based on the outstanding global review of Stuardo (1968). In addition, Sowerby II (1843 and 1871), Thiele (1918-20) and Lamy, (1930-31) and modern authors, notably Kilburn (1990 and 1998, SAF), Mikkelsen & Bieler (2003, CAR), and Allen, (2004, Atlantic) contributed to this huge and difficult family.

Based on phylogenetic trends Stuardo (1968) proposed a separation into two subfamilies LIMINAE for *Lima*, *Acesta*, *Ctenoides* and *Divarilima* and LIMATULINAE for *Limatula*, *Limaria*, *Limea* and *Escalima*. He further stated presence or absence of posterior retractor muscles as distinctive. Most authors treat LIMIDAE without subfamilies. However, whether Stuardo's hypothesis makes sense, should be verified by modern methods.

OU2: ***Lima***: Stuardo, 1968 characterized ***Allolima***, type OD ***Lima tomlini*** as subgenus of *Lima*. He stated *Allolima* as group of small species, very inequilateral, with a unique inclination of the hinge axis and a rotation of the mantle-shell. He further stated adductor and posterior retractor muscles smaller and posterodorsal placed, compared to strong and anterior placed in *Lima* s.s. Additionally, he stated the tentacles scarcer compared to *Lima* s.s. *Allolima* contains rather fragile, often glassy species, with a marked lunule-like concavity anterodorsally. *Allolima* are generally sublittoral to bathyal, compared to the subtidal-sublittoral *Lima* s.s. This group was perceived as special by F. R. Bernard (1988) as well; but he obviously placed members, e.g. *nasca*, *marioni* or *tomlini* close to or identical to *Plicacesta*. Kilburn, 1998 placed *Allolima* members in his new *Fukuma*, and even considered it generically distinct from *Lima*.

A group of closely related species is present from SAF to Japan. The best known is ***L. tomlini***, type *Allolima*, OD deep water, rather ovate, with about 35 ribs, originally from Indonesia. The next East ***L. ewabensis*** is somewhat related in shape to *nakayasui* but with more ribs, markedly larger and markedly deeper living. Habe, 1987 described ***Lima nakayasui*** from the Philippines, less ovate, higher than *tomlini*, with about 28 ribs. A further species smaller, more convex with more ribs 28-35 is ***L. fujitai***, ranging from the Philippines to Japan. Yokoyama, 1922 described ***L. vulgatula*** with 22 broad, flattish ribs as Honshu fossil, Okutani (2000 pl. 443 fig. 5) depicted it living from Honshu. The synonymy of *vulgatula* with *fujitai* as proposed by Koyama et al. (1981) and Higo et al. (1999) appears from size and ribbing unlikely. Finally, as easternmost species, Stuardo listed ***L. quantoensis*** Yokoyama, 1920. The originally fossil *L. quantoensis* grows larger and has more ribs than *fujitai*. It was described in 1920 as 22 mm species with 37 ribs. In 1922, Yokoyama reported it living in Central Japan, a view accepted by Higo et al. (1999 B348). On the other hand, precisely from Central Japan, with the same shape and exactly the same number of 37 ribs ***L. profunda*** Masahito, Kuroda & Habe in Kuroda et al., 1971 was described. The type is depicted in HIG01 B345. I fail to recognize *profunda* other than a large *quantoensis*.

Going from *tomlini* West a closely related species is ***Fukuma messura*** Kilburn, 1998 from SAF. It has even more ribs than *tomlini*, but is in sculpture and shape very similar to *nakayasui*. As *messura* is the type OD, ***Fukuma*** is considered a junior synonym of *Allolima*. Following Stuardo (1968) there are few arguments to place *Allolima* outside of *Lima* as proposed by Kilburn. Mikkelsen & Bieler (2003) kept the related *marioni* also in *Lima*.

From the species analysed, *Allolima* seems only to encompass Stuardo's *tomlini*- and *marioni*-groups. His unrelated species, especially *tahitensis* (and *ogasawaraensis*) but also *zealandica* seem to represent distinct lineages, requiring further distinction. These 3 latter species are consequently placed as ***Lima* s.l**. Just very tentatively included in *Allolima* are *pseudocaribea* and *nasca*. These two share some traits, but do not fit all characteristics well. Here, genetic data would be helpful. Overall, it appears that more than 2 subgenera are needed to accommodate the almost 30 global *Lima* species.

Whether true ***L. mestayerae*** still lives in NZ, as stated by Stuardo (1968), could not be confirmed. All NZ-material seen has been referable to *zealandica* and Otago lists only one *Lima* from NZ. However, *mestayerae* is barely a synonym of *zealandica* as proposed by Powell (1979). Neither shape nor number of ribs match and same-sized *zealandica* are distinct from the Pliocene fossil type of *mestayerae*. *L. zealandica* itself does not fit into *Lima* s.s. Neither does it fit well into *Allolima*. The robust valves, the large size, the few broad ribs, a commarginal-oblique interrib structure and a somewhat oily sheen are distinctive.

Lima ogasawaraensis Habe, 1993 and ***Lima tahitensis*** Smith, 1885 appear closely related. Both are small, have few and profusely spined ribs and are reported sublittoral from about 50 m. Both are rare and only known from a few specimens. It is even not completely excluded that they might be conspecific. Stuardo (1968) considered the latter unrelated to the *tomlini*/*marioni* group, and both are placed here s.l.

Another pair seems composed of ***Plicacesta nasca*** Bernard, 1988 and ***Lima pseudocaribea*** Stuardo, 1986. Both are extremely rare and only known from 2 respectively 1 bathyal specimens. The former is not close to *Plicacesta*, but has been compared to the more related *tomlini* and *lata*. *Nasca* seems to belong to *Lima*. *L. pseudocaribea* was synonymized with *marioni* by Mikkelsen & Bieler (2003). However, their action appears premature, as the shape does not fit *marioni* particularly well, as no true *marioni* record is known biogeographically close, and as Stuardo (1968) considered *pseudocaribea* an unrelated species, not close to the *marioni* group. *L. pseudocaribea* is considered a rare bathyal species from the Gulf of Mexico in need of further finds. Both species are just very tentatively placed in *Allolima*.

Lima vulgaris is a shallow, but large true *Lima* growing up to 156 mm in Philippine waters. The largest studied measures more than 146 mm. Huge Philippine specimens are often pink-purplish inside. *L. vulgaris* is widely distributed and extends to S. Natal, Park Rynie. Kilburn (1998) designated Tranquebar, SE. India as type locality. As neither the large sizes, nor the colors of the IND specimens were ever seen in European material, Stuardo is followed and *vulgaris* (syn. *sowerbyi* Deshayes) is considered a distinct, valid species. Stuardo (1968) further stated more acute umbones in the European type species *lima*. ***Lima persquamifer*** was erected, as Iredale, 1939 considered *vulgaris* a Med species. Stuardo (1968 p. 81) did not find any distinguishing marks and *persquamifer* is considered synonymous.

Lima vulgaris also occurs in the Red Sea, and, additionally, ***L. paucicostata***, depicted by Oliver (1992 fig. 6a-b as "*lima*"). Dekker & Orlin (2000) corrected Oliver's views and confirmed the earlier statements of Stuardo (1968) and Thiele (1920 pl. 2 fig. 14). At present, *L. paucicostata* is reliably known from the Red Sea only.

Stuardo proposed ***L. meridionalis*** for the other SAF *Lima*, characterized as *L. lima* by Barnard (1964). This opinion was obviously not shared by Kilburn & Rippey (1982), Kilburn (1998) and Steyn & Lussi (1998). Instead, they equaled the SAF species with Iredale's NSW ***L. nimbifer***. The SAF and the SA species are morphologically indeed related. Furthermore, from the material studied, *nimbifer* is quite variable in shape (well exemplified in IRE24 pl.34 figs. 1-4). However, 3 reasons hinder acceptance of Kilburn's proposal. Biogeographically, both species are restricted and no intermediary records are known. Australian specimens (Iredale, NSW: 60-70 mm) reach generally a larger size than the SAF (BA64: 25 mm, Steyn & Lussi: 40 m; seen: 47.5 mm, which is the maximum size known). Third, the S. Australian species lives mainly subtidal (2-27 m), whereas the SAF-species is found sublittoral (45-200 m). In shape, *meridionalis* is usually narrower and more inflated. Thus, unless genetic data would prove otherwise, *L.* (*L.*) *meridionalis* is considered a good species and Stuardo's view is followed.

In Australian limids Stuardo (1968) and the older literature (especially Iredale, 1924/25/29/39 but also Cotton, May, and Allan) have to be consulted. Unfortunately, Lamprell & Whitehead (1992) misunderstood many species, especially so in *Lima*.

Stuardo (1968) could not find marked differences among ***nimbifer*** and ***gemina***. From the material seen, this view is shared. From Perth virtually identical shapes are known as from NSW. Thus, *nimbifer* is perceived as larger, shallow, widely distributed SW-SE. Australian true *Lima*, and *gemina* synonymous. *Nimbifer* is markedly distinct from *vulgaris* as also recognized by Jansen (1995, NSW).

Two distinct, rare, smaller, deep water species are represented by ***L. benthonimbifer*** and ***L. spectata***. The former seems confined to SE. Australia, having fewer ribs and the latter to SW. Australia, having more ribs. As stated by Stuardo (1968), Cotton's material should be reanalyzed, as he might have confounded two species. Stuardo placed these two in *Allolima*. Thiele (1920 pl. 3 fig. 9) depicted Hedley's "bassi" (= *benthonimbifer*).

L. tropicalis has been studied from Lord Howe Isl., dived in 18-25 m. It is a small white species with 25-26 angular-rounded, very sparsely scaled ribs, uncommonly found. It has been well described by Iredale and recognized by Stuardo (1968) as *Lima* (*L.*). It is considered distinct from *vulgaris*, smaller, with more and sparsely spined ribs, confined to SE. Australia only.

L. bullifera Smith, 1913 from Polynesia, Henderson Isl. is markedly distinct from Deshayes *bullifera* in biogeography, size, rib number and color. It is also distinct from ***L. disalvoi*** from Easter Isl. and perceived as **undescribed**.

OU3: ***Ctenoides***: Stuardo (1968) considered 4 groups discernible: *Scabra*-group, *bernardi*-group, *planulata*-group and *cebuensis*-group.

However, from the specimens studied, the *scabra*- and *planulata*-groups intergrade and specimens may be very close; e.g. *annulata* shares traits of both groups and *C. vokesi* is perceived in between as well. *C. vizagapatnamensis* is not particularly close to *ales*, somewhat more to *planulata*. On the other hand, the *cebuensis*-group seems to encompass quite distinct lineages; *C. concentrica* (syn. *oshimensis*) has a unique periostracum and shape, and is not close to *cebuensis* (syn. *philippinarum*). The latter, together with *symmetrica* and *sanctipauli* shares traits with *Divarilima* and might even be separated from *Ctenoides*.

Only the *barnardi*-group is perceived homogenous. All 4 species included, ***barnardi*** (syn. *suavis*), ***atlantica*** (syn. *obliquus*), ***dispar*** and ***samanensis*** (syn. *miamiensis*), are small, oblique, fragile, whitish, translucent and deeper water. Overall, Stuardo's proposed grouping is not perceived convincing. As a better proposal needs more material, for the time being all species are placed in *Ctenoides*.

Stuardo analyzed 20 *Ctenoides*. Of these 2 species *corallicola* and *ferescabra* are considered synonyms, as already indicated by him. In the last 40 years the CAR *vokesi* and the WAF *catherinae* have been added. *Parajaponica* from Phuket appears somewhat shaky, but likely a further, undescribed species is present in the Philippines. This brings *Ctenoides* to approximately 20 species.

Barnard's preoccupied SAF *Lima divaricata* has been named ***Ctenoides barnardi*** by Stuardo, 1968. He designated a holotype out of SAMC-material from "off Cape Natal, 85 fms, 15x13 mm", distinct than earlier designated by Barnard for his *divaricata*. *C. barnardi* is therefore a new species with own type material. Kilburn, 1998 also renamed *divaricata* as *barnardi* and applied Barnard's type locality "off O'Neil Peak (Zululand), 90 fathoms, 2 valves". This is then a nom. nov. and a junior synonym. More importantly, Stuardo mentioned three additional *barnardi* samples from the Philippines and off Pratas Island (= Dongsha Islands) in the South China Sea, between Taiwan and Hong Kong. Indeed from Bohol, 80-200 m, 20-22 mm specimens are known very close to the OD and also to Kilburn (1998)'s excellent pictures of *barnardi*. A specimen from similar depth (186-187 m) from nearby Lubang has been identified ***Ctenoides suavis*** by Poutiers (1981). *C. suavis* was originally described in 1971 from Sagami Bay. The type is depicted in HIG01 B360. Comparing the Philippine, the Japanese and the SAF specimens I fail to recognize significant differences. Unless genetic data would reveal distinct features, *suavis* is synonymized. As such *C. barnardi* is a sublittoral species, 50-200 m, usually approximately 20 mm, very widely distributed from SAF, Transkei to JAP, Honshu. It is a typical group II-species, small, oblique, fragile, whitish, deeper water. The related ***C. dispar*** is currently known from Phuket only. The number of ribs in *dispar* is similar, approximately 60, but the shape distinct, anterior straight and then strongly protruding instead of evenly rounded as in *barnardi*. Stuardo also stated the ribs markedly divaricating posteriorly in *dispar*, whereas in *barnardi* a normal condition occurs.

Higo et al. (2001) depicted the holotypes of *oshimensis* and ***concentrica*** and synonymized these, as earlier Koyama et al. (1981). *Oshimensis* is based on the adult form. Oliver & Zuschin (2000)'s worn valve from Red Sea, Safaga appears to be this species. However, confirmation is needed that *concentrica* lives there. Otherwise, the westernmost locality, where specimens have been dived on ledges in less than 45 m is Indonesia, Alor Strait. Off N. Borneo, *concentrica* has been found in 70 m and Stuardo gives 120 m. Okutani (2005) reported 4 specimens 12-14 mm found in 288-311 m in Okinawa, Nansei Isl. No pictures were given and the depth contrasts with the otherwise sublittoral distribution of *concentrica*.

From the Red Sea, Gulf of Aqaba, a single *Ctenoides* specimen similar to *ales* is known from 25-30 m; 33.3 mm; all white, ovate, moderate divergent sculpture close, though slightly finer than *ales*. ***C. reticulata*** from Indonesia is excluded by its more inequilateral shape and the reticulated sculpture. ***C. tominensis*** also from Indonesia appears close; however, weak tubular scales are not present in the Red Sea specimen. Furthermore, *tominensis* came from 1400 m. ***C. ales*** itself is reported westernmost only from Myanmar. The Red Sea form is tentatively included in *ales*; but more material is needed for firm conclusions.

C. philippinarum is well depicted in Springsteen & Leobrera (1986 pl. 86 fig. 2). It is a unique, very untypical *Ctenoides*, lightweight, fragile, ovate-oblique and very distinct from the inflated, almost equilateral, more solid *concentrica*. However, 4 years earlier than by Prince Masahito & Habe, it was described as ***C. cebuensis*** by Stuardo. Furthermore, from the Philippines, Bohol a second species is known, resembling *cebuensis*, but it seems to remain smaller, the largest seen is 14.5 mm. In shape it is even closer to *Divarilima*, with very small wings, but without pseudotaxodont teeth. The sculpture is radial with weak spines as well. It seems to be **undescribed**.

The ***annulata***, ***lischkei*** (*syn. dunkeri*, *japonica*), ***ferescabra***, ***corallicola*** complex is difficult. Stuardo (1968) considered *annulata* valid from the Red Sea to Japan and *japonica* (= *lischkei*) living from Java to Japan. Iredale's *corallicola* has been perceived as close or identical to *lischkei* and Iredale's *ferescabra* as close or identical to *annulata*. Furthermore, Stuardo introduced ***C. parajaponica*** from Andaman Sea, Phuket, 17.3 mm, close to *lischkei*, but smaller and with more than 100 ribs. The main differences between *annulata* and *lischkei* are larger size, with fewer and prickly scaled ribs in the former, whereas the latter has more and smooth ribs and stays smaller. Thus, the condition is comparable to the CAR pair *scabra* and *mitis*. Iredale's *ferescabra* is the scaly species and *corallicola* the non scabrous species. There is little doubt that both, *annulata* and *lischkei* occur in Australian waters and that *ferescabra* is a synonym of the former and *corallicola* of the latter, as stated by Stuardo. Lamprell & Whitehead (1992 sp. 94) came to the same conclusion in *annulata*, but did not depict the smaller and more uncommon *lischkei* (syn. *corallicola*); Iredale applied *ferescabra*, and Schröter, 1788 is invalid. From the material studied, *annulata* grows larger and is much more common.

Hayami & Kase (1993) described ***C. minimus*** from subtidal caves, but did not compare with any other species. Oliver & Holmes (2004) doubted the distinctiveness from *annulata*. Their view is shared; morphologically no clear distinctive features were found; furthermore, in all localities mentioned (i.e. Phil, Bohol; EChi, Okinawa) *annulata* also lives. Unless new evidence can be presented, *C. minimus* is perceived a synonym of the widespread and common *annulata*.

Stuardo's ***samanensis*** was later named *miamiensis* and his ***atlantica*** instead *obliquus* by Mikkelsen & Bieler, 2003; Stuardo's original names and type localities were deliberately changed. Both later names are considered unnecessary nom. nov. and Stuardo's names and type localities are here reinstated.

C. vokesi is difficult, but appears to be a good species, placed in between group I and III. Compared to *mitis*, which is perceived as close in sculpture and rib number, it also seems less translucent, the posterior hinge line due to the less ovate size straighter. If the identifications are correct, then *vokesi* was dived at 15 m in Yucatan, Cancun on sandy bottoms and also in WInd, Guadeloupe within normal dive depths. Thus, it appears as uncommon sublittoral rather than as bathyal species.

OU4: ***Divarilima***: Stuardo (1968) recognized 2 distinct groups which may merit subgeneric distinction, once better known.

Whereas all other species are close to the type species in sculpture with fine, flat, smooth riblets, ***D. mortenseni*** from Indonesia has been characterized with an unique sculpture "strong, scaly ribs each subdivided once or twice and separated by still finer riblets of a modified *Ctenoides* type". Except sculpture, otherwise *mortenseni* seems close to the other species in shape, size and habitat. As far as is known, it has not been reported since; the single type specimen is in ZMUC.

Obviously, in addition to *abscisa*, a species closely resembling ***sydneyensis*** occurs in the Western Indian Ocean (Red Sea, through Reunion to Zululand). Stuardo, 1968 described ***D. apoensis*** from the Philippines and the South China Sea as close to *abscisa*. As main differences he stated the much smaller relation of hinge line to the inner border of the lunule. This is indeed well visible in Kilburn (1998)'s pictures of *abscisa* fig. 46 compared to *D.* aff. *sydneyensis* fig. 49. The size of approximately 9 mm fits well; however, the depths differ and currently also the disjunct biogeography. As both were based on very small lots, the Indian Ocean aff. *sydneyensis* should be compared to the 4 *apoensis* specimens in USNM (holotype: USNM 298763). It may be that *apoensis* has a much wider range.

Gibson & Gibson, 1982 described ***D. handini*** as subspecies of *albicoma*. It was even synonymized by authors. However, morphology, size, biogeography, and the subtidal depth do not fit *albicoma* and indicate two distinct species. Diaz & Puyana (1994) reported it also from Colombia and characterized it well. Stuardo (1986) characterized *albicoma*.

Thus, currently 8 or 9 *Divarilima* are globally recognized.

OU5: ***Acesta***: Usually *Acesta* and *Plicacesta* are differentiated. However additionally, Stuardo (1968) and Lamy (1930) recognized *Callolima*. Stuardo (1968) further named a 4th group, though with a question mark, the ***borneensis***-group with *borneensis*, *butonensis* and *mori*. However, his analysis of this latter group is not very convincing. Furthermore, Marshall (2001) placed *saginata*, a species somewhat similar to *borneensis* and *butonensis*, in *Acesta* and Coan et al. (2000) placed *mori* also in *Acesta*. Once, these rare species are better known Stuardo's idea might be investigated again. At present only 2 subgenera, apart from *Acesta* s.s. are applied.

Plicacesta has been accepted by Coan et al. (2000) for *sphoni*. Stuardo (1968) included here are also *A. diomedae* (type Abbott & Dance, 1986 p. 320 fig. 3) and *smithii*, the type species from Japan and the East China Sea. These are usually characterized by medium acestid size, with numerous low ribs, and strongly crenulated margins. However, the 3 species included here do not appear very closely related and this subgenus might be artificial. *Smithii* and *sphoni* are thin and fragile, but quite distinct in shape; *diomedae* has been described as thick and heavy and is markedly distinct in shape from *smithii*. Stuardo (1968 p. 141) indicated that *diomedae* may eventually be better placed in ***Plagiostoma***. *Sphoni* and *diomedae* are only tentatively placed in *Plicacesta*.

Bartsch, 1913 based his ***Callolima*** on the hinge, with a shallow, broad resilium. He further stated weak sculpture, termed as obsolete or zigzag patterned by Stuardo (1968). In addition, the two well known *Callolima*, *rathbuni* and *philippinensis* are the two largest limids known, both over 220 mm and are easily recognizable in yellowish-white colors, unusual in limids except in *Acesta citrina*. Although synonymized by many authors, *Callolima* appears as most easily recognizable subgenus.

The most common *Acesta* in Philippine waters is the rather fragile ***rathbuni***, locally found in larger numbers. It is a virtually smooth species, the radial sculpture very weak. The type is depicted in Abbott & Dance (1986 p. 326 fig. 1). Stuardo (1986) stated a distribution from Phil, Mindoro to Indonesia, Banda Sea and a maximum size of 208 mm (Phil). Lamprell & Whitehead (1992 sp. 92) depicted *rathbuni* also from NW. Australia. Huge specimens studied W. off Port Hedland, 450 m in mud; reach a size of more than 220 mm. I was not able to state marked differences to Philippine specimens, confirming Lamprell & Whitehead's identification. This gives *rathbuni* a larger size and a wider range than reported before.

A. philippinensis and ***A. bartschi*** (syn. *smithi* Bartsch non *smithii* Sowerby III) were both described from the Philippines, found in about the same depths and the same sizes. Apart from a slight difference in the narrowness of the shape, no major differences were mentioned; nor were any added by Thiele, 1918, who renamed Bartsch's *smithi*. Bartsch's original of *smithi* shows an elongated, divided muscle scar, which would be unique in *Acesta*. Indeed, specimens seen from the East China Sea, have a somewhat roughened area beneath the usual acestid ovate-elongated muscle scar, which is similarly also visible in Philippine specimens and which may have been the cause for Bartsch's peculiar drawing. As otherwise the shape in *philippinensis* is somewhat variable, I fail to recognize *bartschi* as distinct. Stuardo (1968) came to a similar conclusion. ***A. marissinica*** described as *Callolima* from Amami Isl., reported from China larger than 210 mm (WAN01), is yellowish as well and has a sculpture of fine radials, termed sinuous by Japanese authors. Bartsch stated originally wavy for *philippinensis*. The type of *marissinica* is depicted in HIG01 B252. Specimens studied from the East China Sea, identified as *marissinica* are perceived indistinguishable from Philippine *philippinensis* and are considered synonymous. *A. philippinensis* is the largest limid, and attains sizes of more than 250 mm.

Stuardo, 1968 depicted as third *Callolima* Thiele's ***niasensis*** from Sumatra. The MfN syntype 69777 has been studied. *A. niasensis* is close to *philippinensis*, though smaller, white and with a rougher, less dense zigzag sculpture. ***A.* (*C*) *niasensis*** appears as valid species. It is poorly known regarding maximum size, exact distributional range and variability.

Marshall, 2001 described ***maui*** and ***saginata***. He also depicted Bartsch's smaller *celebensis* specimen, and Prashad's "*celebensis*", which represent a distinct species. Prashad's opaque white specimens from Indonesia, with a translucent white border should be compared to Smith's *indica*, which is opaque white with numerous fine radials as well. Smith's species is depicted in THI20, pl. 4 and ANA09 pl. 13. Prashad's species appears neither in shape, nor in color identical to *butonensis* or to *borneensis*. *A. smithii* is also opaque white, but has much fewer, broader ribs, and a distinct shape. For the time being *A. "celebensis"* Prashad, 1932 is treated as **undescribed**, possibly identical to *indica*.

A. excavata and ***A. angolensis*** are close; Nolf (2005) elaborated the differences. A large specimen, 146 mm, off Sao Tomé has been identified as *A. angolensis*. This might be the Northern limit of *angolensis*. Nolf verified the presence of *excavata* to Senegal and assumed a presence also off Ivory Coast and off Cameroon. ***A. angolensis*** is more compressed, thinner and more fragile, with a weaker sculpture; the lunule is bordered by a ridge. Both have also been depicted and accepted as distinct by Stuardo (1968)

Furthermore, Stuardo, 1968 described ***A. sanctaehelenae***, a smaller specimen from St. Helena with a broader hinge and a stronger sculpture than in *angolensis*. It is known from the ZMUC type lot and 2 further ZMUC specimens, shallower, but from the same locality.

OU6: ***Limaria***: This is a large and difficult genus. The differences among species are in general subtle. Stuardo (1986) differentiated the *inflata*-, the *pellucida*-, the *fragilis*-, the *dentata*-, and questionably a *fenestrata*-group within *Limaria*. He considered *Limatulella* as weak limariid subgenus. Stuardo described globally 12 new limariids, apart from the approximately 30 species already known. From the material at hand, Stuardo's view is here largely followed. On the other hand, many of Beu (2004)'s and Kilburn (1998)'s conclusions in limariids are not shared.

The ***inflata*-group** encompasses a few, strongly ventricose, comparatively large, rather solid, ovate species, which gape weakly. This group is easily recognizable. Stuardo (1968) based it on the type species (= *tuberculata*) and this group can therefore be equaled with ***Limaria*** s.s. (syn. *Winckworthia*). *L. orbignyi* the type OD of ***Submantellum*** is a comparatively large, ventricose, moderately gaping species. It is perceived as closer to *tuberculata* than to *hirasei*. Thus, *Submantellum* is synonymized with *Limaria* s.s. Lamy, 1930 as well placed his *orbignyi* between *basilanica* and *rotundata*.

The ***pellucida*-group** is similar, but contains species, which are more fragile and smaller, only moderately ventricose, generally stronger gaping than Limaria s.s., especially so anteriorly. Stuardo included here also *hirasei*, which is the type, OD ***Platilimaria*** and which is sufficiently close to the CAR *pellucida* to identify this group with *Platilimaria*.

The ***fragilis*-group** contains species, which are marked distinct, compressed-flat, elongate subquadrate, widely gaping on both sides. Stuardo (1968) and Lamprell & Whitehead (1992) synonymized Iredale's *parafragile* with *fragilis*. As *parafragile* is the type species OD, this group can be equaled with Iredale's ***Promantellum***, a combination already used by Rehder (1980). The ***dentata*-group** is quite similar to the *fragilis*-group, usually flat, fragile, elongate and strongly gaping as well. Despite their usually smaller size these specimens are perceived too close to *Promantellum* to be separated. The number of ribs varies among species and dentate margins are also found in typical *Promantellum*. Thus, unless genetic differences could be revealed, Stuardo's *dentata*, *broomi*, *hyalina*, *kiiensis*, *locklini*, *parallela* and *pluridentata* are also included in *Promantellum*.

Limatulella encompasses species related to *Limaria s.s.*, smaller, somewhat less ventricose, thinner, with very numerous radial ribs, but almost or completely closed valves. Stuardo (1968) analyzed *loscombi* and stated a few anatomical differences to *Limaria*.

L. fenestrata does not match anything seen as yet. It is questionably placed in *Limaria*. However, the single bathyal left valve was not analyzed.

Thus, 4 subgenera *Limaria*, *Platilimaria*, *Promantellum* and *Limatulella* are considered useful for the more than 40 extant species.

The European ***L. hians*** is typically closer to *fragilis* than to *pellucida* and included in *Promantellum*. This is mainly based on the Southern forms, or ***L. glaciata*** (v. Salis 1793) obviously from Italy (= Lamy's var. *mediterranea*;

levigata Risso). Stuardo (1968), similarly to Tebble (1976), analyzed northern specimens from Scotland, somewhat more inflated, more ovate shaped and placed it instead in the *pellucida* group. However, Nolf (2006) presented the series from Scotland to Canary Isl. and Lucas (1981) gave an excellent overview of the forms found in European waters. Lucas stated the more compressed form present in GB, Azores, Madeira and Med and included it in *hians*, followed by Nolf (2006) and CLEMAM. Nonetheless, a genetic analysis would be helpful to confirm that only one species is present. ***Lima dehiscens*** Conrad, 1837 has been placed throughout the globe; first between Philippines and Tahiti, as syn. of *fragilis* (SOW430); Thiele (1920) placed Conrad's Fayal Isl. in California (= *hemphilli*), but Lamy (1930) recognized Conrad's Faial on the Azores. *L. hians* in the elongate, gaping Med form is known from the Azores and is fitting Conrad's OD well. *L. dehiscens* is considered the same as *glaciata* (= *hians*).

Lamarck's ***linguatula*** was synonymized with *fragilis* (Lamprell & Whitehead, 1992) or with *hians* (Deshayes, 1830; Lamy, 1930). The type ought to be in Geneva with a size of 34 mm. However, in the box MHNG 1088/6 only an unmarked *Limaria* is present, measuring less than 28 mm. Lamarck's type is obviously lost and *linguatula* is best considered a nom. dub.

A large, inflated *Limaria* s.s. occurs occasionally from Florida to Brazil. It is usually termed ***inflata*** and well depicted by BRASIL together with *pellucida* from Brazil. Nolf (2006) also recognized this inflated species from Florida to Brazil. He considered it similar to *tuberculata*, but obviously distinct. However, in specimens studied from Florida and Bahamas no marked differences to European forms could be detected and for the time being these two are considered conspecific. The largest Caribbean specimen seen is 37.5 mm. As juveniles are more compressed, less gaping and resemble also in sculpture *loscombi*, it is not excluded that Orbigny's ***cubaniana*** was instead based on a juvenile specimen of the Caribbean ***tuberculata***. Unfortunately, Carpenter in Winkle just commented on Orbigny's 541, but not on 542.

Obviously, two species are hidden behind the Caribbean ***L. pellucida***. One is rounded anterior, inflated, with fewer ribs, and considerably less gaping, snowy white; the other is angulate anterior, more compressed, stronger ribbed, and especially stronger gaping anterior, it is occasionally yellowish white colored. C. B. Adams type is depicted in CLE50 pl. 43 figs. 8-9. This and the indication close to the non gaping *loscombi* leave no doubt that the rounded, less gaping species conforms to *pellucida*. The more common species is indeed similar to *hians* and closer to *Promantellum*. It has been named ***pullei***, by Stuardo, 1968 type locality Florida, Lake Worth, holotype MCZ 244320. In modern US literature this distinction got lost. Specimens depicted from N.C. (e.g. Porter & Houser, 1994) or Florida (Rehder, 1998 "Audubon Guide") are instead referable to the more common *pullei*. I am currently unable to confirm that true *pellucida* occurs in the US (but certainly from Bahamas to Brazil). On the other hand, Stuardo analyzed 28 samples and reported also true *pellucida* from Florida. The southernmost *pullei* seen came from Grenada (but nothing, as yet, from Brazil). As the records in US literature are confused, more work is necessary to clarify the habitats and the exact distribution of these two *Limaria* species. Stuardo placed them in distinct groups and this view is shared.

L. (***Limatulella***) ***burryi*** from Florida, Sanibel-Palm Beach described as very close to *loscombi* was not reported since. However, Stuardo (1968) had 8 samples from MCZ only. He gave 9.8 mm as size and a sublittoral range.

L. hyalina has been removed from *Limatula* and included by Stuardo (1968) in *Limaria*. The type is also depicted in JOH89 pl. 9 fig. 2. Stuardo placed it in the *dentata*-group, but the extent of gaping is not visible, nor was it mentioned in the OD. Thus, it is only tentatively placed in *Promantellum*. Waller (1973) reported it also as *Limaria* from the Bermudas. However, Waller's species is much closer to a juvenile *pullei* than to the type of *hyalina*.

From **PAN**, in addition to *hemphilli*, *orbignyi* and *pacifica*, Stuardo depicted at least one further unnamed *Limaria* from the Gulf, Concepcion Bay. The specimen(s) are in the lot USNM 268108.

The IND ***Limaria basilanica*** is close to *tuberculata*. The type is depicted in HIG01 B364. Stuardo (1968) stated *basilanica* extending to Western Japan only. However, Okutani (2000 pl. 444 sp. 17) is perceived as true *basilanica* which extends the distribution to central Japan and give a maximum size of 50 mm. The largest NWA-specimen studied is 43 mm.

Instead of one widely distributed ***Limaria*** (***Promantellum***) ***fragilis*** at least 7 distinct species occur. Stuardo (1968) and older authors considered ***fragilis*** restricted to the central and western IND, neither occurring in SAF, JAP nor in HAW. The typical form (e.g. Thiele, 1920; Stuardo, 1968 pl. 8 fig. 23-25; Wells et al., 1990 sp. 361, Christmas Isl.) is elongate, roughly ridged, generally with 24-28 ribs. This species occurs from the Maldives to Polynesia, including Philippines and Australia, but is not found in SAF/Mozambique (= *delagoensis*), nor EAfr, Mauritius, Rodrigues Isl., Seychelles (= *mauritiana*), nor Arabia (= *persica* and *angustana*), nor HAW (= *auaua* and *parallela*), and not in China-Japan (= *kiiensis*)

L. mauritiana is a smaller, broader, more ovate species with approximately 20 ribs. Jarrett (2000 sp. 575 "*fragilis*") from the Seychelles is this species as is Oliver et al. (2004 "*fragilis*") from Rodrigues Isl. and Spry's "*parafragile*" from Tanzania. Thiele's ***Lima tenuis*** from Mauritius and Tanzania is perceived the same. However, as Dufo's ***natans*** was described from the Seychelles, it is not excluded that this is the earlier name. Unfortunately, the whereabouts of Dufo's type are currently unknown. Obviously, Lamy (1930) did not find it either.

H. Adams' ***Radula tenuis*** was originally described from the Red Sea and subsequently variously interpreted. It is preoccupied by Leach's earlier *Limaria* (= *hians*). Furthermore, no type could be located in BMNH. Consequently *tenuis* is treated as preoccupied nom. dub. The comparatively broad, rare 15.2 mm species from the SE. Persian Gulf depicted by Stuardo, 1968 and named ***Limaria persica*** is perceived as valid species.

In addition, Oliver (1995 sp. 986) depicted a distinct opaque white much larger, narrow species from Arabia, Oman to the Persian Gulf also under *fragilis*. Neither true *fragilis*, nor any of Stuardo's *Limaria* is fitting. However, Sowerby II, 1872 described ***L. angustata***, a large narrow *Limaria* from unknown locality. Stuardo approached it with reservation to *hians*, but Lamy (1930 p. 114) clearly stated it distinct. Although the type could not be localized at BMNH, Sowerby's species is well depicted and perceived to fit Oliver's fig. 986 in shape and size well. A further conspecific specimen has been studied from the Philippines. As such *angustana* is among the largest limariids found in the IND, known at least from Arabia and the Philippines.

In the Red Sea book, published 3 years earlier, Oliver (1992) depicted another species, which is true *fragilis*. However, as quite often "typical", instead of true Red Sea, material was used by Oliver (1992); the exact locality of this specimen pl. 14, 7a-b is unknown. True *fragilis* is currently not known from the Red Sea.

Also the "widely" distributed ***orientalis*** has been divided by Stuardo (1968) into 4 distinct species: *orientalis* (Central IND, type HIG01 B365), *pseudoorientalis* (JAP), *imitans* (SA), and *africana* (SAF). This view is shared, and *marwicki* (NZ) is here added.

Lamprell & Healy (1992) included in their S. Australian sp. 97 "*orientalis*" (= ***imitans***) also Iredale's ***vigens***. However, *vigens* was described as quite distinctly ribbed and much larger species from Qld. Iredale, 1939's OD fits instead *basilanica* well and *vigens* is considered synonymous. True *imitans* is restricted to SA-NSW, as proposed by Stuardo. Whether Cotton's SWA *orientalis* record from Fremantle refer to the same species could not be confirmed.

Iredale's ***Promantellum noverca*** and ***delicatule*** are rarely treated. Stuardo considered the latter valid and doubted the former, Lamprell & Whitehead (1992) did not mention either. The tropical *L. noverca* shares many traits with small true *orientalis*, not yet reported from Australia, but from adjacent tropical waters. *Noverca* is perceived as juvenile specimen. *P. delicatula* is considered as uncommon, valid species from Qld with about 50 fine ribs.

Stuardo (1968) did not treat the NZ "*orientalis*". However, specimens studied from N. Isl. are not perceived to represent true *orientalis*, which has marked fewer and more pronounced ribs. Furthermore, the NZ species also grows larger, is more slender in shape and has fewer, lower ribs compared to the SA *imitans*. Powell (1979) considered his ***Lima marwicki*** of 1929 the same and this name is applied for the NZ *Platilimaria*.

Obviously, not treatable by Stuardo (1968) was *L. kawamurai*, just described in 1972. However, Stuardo described ***L. pseudoorientalis*** deep water, from Tosa Bay with 22 mm, 18-23 ribs, only very moderately gaping. Just 4 years later Masahito & Habe, 1972 described from Tosa Bay *L.* (*Limatulella*) *kawamurai* with 20 ribs, 21.8 mm, not gaping. Higo et al. (2001 B366) depicted the type and placed it in *Limaria* next to *orientalis*. All evidence points that *kawamurai* is a junior synonym. *Pseudoorientalis* appears also to equal Kira (1972 pl. 53 fig. 2) erroneously termed *hakodatensis*. Although characterized with 30 instead of 20 ribs, Okutani (2000 pl. 445 fig. 23) seems also this species.

L. orientalis and *pseudoorientalis* are close; the latter with more numerous ribs, both quite fragile. It is possible, that Poutiers (1981)'s non-depicted *kawamurai* from the Philippines refers instead to *orientalis*. At present, *L. pseudoorientalis* is not known outside of Japanese and East China waters.

Hakodatensis itself is a quite distinct, broader, more ventricose species (Habe, 1971 pl. 54 fig. 7; Okutani, 2000 pl. 445 fig. 21). ***Lima angulata var. minor*** Grabau & King, 1928 from the Yellow Sea was not treated by Stuardo, and variously by subsequent authors; either as earlier name of *tomlini* (Bernard et al., 1993) or as synonym of *hakodatensis* (WAN01). Zhongyan (2001) depicted only the latter from the Yellow Sea, but gives no synonyms. *L. minor* was beach found, the Bay there is just 15 m deep, and was the only limid reported from Beidaihe; the bathyal *tomlini*, also distinct in shape, can therefore be excluded. From OD and habitat, *hakodatensis* is not excluded and Wang (2001) is followed.

The true identity of Okutani (2000's pl. 445 fig. 24 *fragilis*) could not be resolved. It is indeed close to small *fragilis* but the ribs more numerous, the hinge line smaller, the shape centrally broader, the gaping is unknown. It may be an **undescribed** species from Kii.

Regarding **SAF** limariids Stuardo (1968) and the older literature is followed. It appears that Kilburn (1998) misinterpreted at least 3 of the 5 *Limaria* species treated. In SAF instead occur *rotundata* (= "*tuberculata*" Kilburn; see Nolf, 2005; Barnard, 1964; Stuardo, 1968 designated Jeffrey's Bay as type locality), *delagoensis* (= "*fragilis*" Kilburn; see Stuardo, 1968) and *africana* (= "*orientalis*" Kilburn; see Bartsch, 1915; Turton, 1932; Stuardo, 1968). Furthermore, Kilburn's "*loscombi*" should be compared to Stuardo's *abbotti*; true *loscombi* seems to have twice the rib number, to grow larger and to be somewhat more inflated (see also Nolf, 2006). Finally, Kilburn's *guttula* seems indistinguishable from Stuardo's earlier *plana*.

Regarding *tuberculata* no author followed Kilburn (1998) and ***rotundata*** is well depicted in Steyn & Lussi (1998) or Nolf (2005).

The Durban/Mozambique "*fragilis*" (Steyn & Lussi, 1998 sp. 844) with more and finer ribs and a much narrower hinge is quite distinct from the true *fragilis*. Stuardo, 1968 described ***delagoensis*** from Inhaca and assumed Barnard's *fragilis* to be the same. Boshoff (1965) found this species prolifically in Inhaca, 35.7 mm, mostly under coral blocks. He compared and confirmed identity with Barnard's specimens.

Earlier, Turton, 1932 described a small, 13.5 mm species from Port Alfred as ***Lima subventricosa*** with 22 ribs. Kilburn (1998) considered it synonymous to "*fragilis*" (= *delagoensis*). However, this was one of Turton's drift wood "Lucky log" species with a likely origin outside SAF (i.e. from a location, where *Anomia aenigmatica* occurs). Unless a growth series unveils its identity, *subventricosa* is considered a nom. dub. with a dubious type locality. On the other hand, Turton's *Lima arcuata* non Sowerby II, 1843 found in Port Alfred fits *delagoensis* well.

L. africana has been described by Bartsch, 1915 based on Turton's material from Port Alfred and well depicted on pl. 38 fig. 4. Bartsch described a thin species, gaping at the lateral border and at the middle of the ventral border, sculptured with about 50 fine radiating riblets. Turton (1932) added "Near *rotundata*, and young specimens look much alike, but adults are seen to be more closely ribbed, and more on a slant". This species does not fit true *fragilis* in shape, size or ribbing as purported by Kilburn (1998). *Fragilis* has generally only about half the number of ribs, a quite distinct elongated shape and grows considerably larger. As recognized by Barnard (1964) and Stuardo (1968) *africana* is also distinct from *delagoensis* (= "*fragilis*" Kilburn, 1998), which has a distinct shape and still fewer ribs. *Africana* fits well in shape, umbones and ribbing Kilburn (1998) "*orientalis*". Indeed, Kilburn identified Turton's OXUM (presumably true) *africana* material as his "*orientalis"*. True *orientalis* as depicted by Prashad (1932) or Stuardo (1968) from the Central IND is quite distinct and not known from SAF. Thus, *L. africana* is perceived, as originally described and accepted by Stuardo (1968), a valid species confined to SAF and possibly also in S. Mozambique.

L. cumingii from the Philippines is unique, almost closed, but shaped and sculptured like *Promantellum*. Iredale, 1939 described with ***stertum*** a very similar species from Qld, which may even be conspecific. Both are virtually unknown. Due to the closed shell Stuardo placed both in *Limatulella*; due to sculpture and shape Iredale considered both *Promantellum*. As these were described from very small specimens approximately 10 mm, it may well be that both placements are wrong. Habe and Kosuge, 1966 described ***Mantellum perfragile*** from more than 16 mm specimens from Palau (type: MOR79 fig. 2C). They compared to *stertum*, but not with *cumingii*. *Perfragile* has later also been reported from the Philippines and personally found off N. Borneo, 18.3 mm, in 21 m, silty bottom. *L. perfragilis* approaches the conditions found in *Platilimaria*. It is not excluded that *cumingii* is the juvenile form. Growth series should be analyzed to clarify their affinities and the distributional range. For the time being, *cumingii* and *stertum* are listed as s.l., and *perfragilis* as *Platilimaria*.

Limaria dentata is a characteristic, quite small species with a few quite strong ribs. Specimens are well depicted in Stuardo (1968 pl. 7 fig. 13, Maldives-Fiji), Morton (1979 fig. 2D, Indonesia). Also Zhongyan (2004 pl. 138 fig. H, Gulf of Thailand-Guangdong) seems to be this species. *Dentata* does not occur in Japan, the species living there is instead Oyama's larger ***kiiensis*** (see Kira, 1972; Okutani, 2000 pl. 445 sp.25 "*dentata*").

Morton 1979 described ***L. hongkongensis*** from Hong Kong and stated a similar specimen from the Andaman Sea. He compared *hongkongensis* accurately with many species. However, he did not compare with *kiiensis* and ***pluridentata***. These two are close (Stuardo, 1968 p. 164 pl. 7). The former is known from Japan, the latter from Java to Fiji and the Philippines. However, *kiiensis* has a rougher ribbing (Okutani, 2000 pl. 445 fig. 25 "dentata"), whereas *pluridentata* has a finer more regular ribbing, and is occasionally broader or more angled. From Philippine material studied *hongkongensis* is perceived to be the same as *pluridentata*, but distinct from *kiiensis*. Stuardo stated a size of 19.8 mm for *pluridentata*, Morton (1979) gave 16 mm. The largest Philippine specimen seen is 24.3 mm; *L. kiiensis* grows larger, up to 29 mm. Zhongyan (2004 pl. 139 fig. C "*fragilis*") from Guangdong with about 40 ribs and 25 mm seems instead also *pluridentata*.

OU7: ***Limatula***: This is by far the largest genus in limids with more than 100 species. Almost every second limid is a *Limatula*. Stuardo (1968) and Fleming (1978) worked in-depth and independently on this genus.

Stuardo (1968) recognized more than 90 extant species globally, of which more than 40 new; Fleming (1978) listed approximately 150 species, of which less than half extant and about 10 new from the SW. Pacific. Stuardo (1968) proposed 9 species-groups and one s.l.-group; Fleming (1978) recognized 4 subgenera, of which 2 new.

Their views and their groupings do not match. The differences start right at the beginning in the interpretation of the European type species. Whereas Fleming (1978) considered the NZ *suteri* as typical *Limatula*, Stuardo correctly perceived it as distinct and placed it in a separate group. Fleming considered *maoria* as *Limatula* s.s., whereas Stuardo (1968) correctly placed it in the *bullata* group. Neither *suteri* nor *maoria* are close to the European type species. Fleming also considered *strangei* and *tensa* close to *subauriculata*. Stuardo placed them close to (*Stabilima*) *tadena*. Fleming understood his *Limatuletta* very wide and heterogeneous, whereas Stuardo placed *auporia* and *insularis* as s.l. quite remote from *japonica*. Fleming understood *Squamilima* wide and misinterpreted *pygmaea*, whereas Stuardo focused and placed *setifera* and related species in a distinct group and *pygmaea* in *Limea*.

Overall, Stuardo applied a restricted view of *Limatula* s.s., and discriminated further groups. Stuardo's view of *Stabilima* is wider than Fleming's including also *tensa* and *strangei* and narrower in excluding the *aequatorialis*-group. Their view of *Antarctolima* is relatively close. Their view regarding *Limatuletta* is marked distinct.

As Stuardo had a global view, characterized the species more precisely and further analyzed much more material, including some of Fleming's "new" species, Stuardo's view is followed. Fleming did not describe the hinge and the dentition, thus, the attribution of some of his new species is only tentative.

Stabilima is applied for Stuardo's *bullata*-, ***Antarctolima*** for his *hodgsoni*-, and ***Limatula*** for his *subauriculata*-group. ***Limatuletta*** is here restricted to a few species close to the type OD *japonica* (type HIG01 B383); two other species placed here by Fleming namely *spinulosa* and *delli* and by Kilburn's *intercostulata* seem sufficiently close. *L. insularis* and *auporia* do not seem closely related and are placed s.l. as proposed by Stuardo. *L. j. colmani* appears unrelated and instead close to the *setifera*-group. Certainly, a better understanding of this subgenus is necessary to be confidently applied.

Stuardo's other 6 groups are numbered, but not named as yet. Here a consensus is necessary for further steps. Consequently 10 groups and an s.l. are applied for *Limatula*.

- *aequatorialis*-group: = unnamed **II**; Small species, generally less than 8.5 mm, hinge border with microscopic pseudotaxodont teeth, strong squamose or nodulose ribs, no median sulcus; crenulate ventral margin; restricted to IND.

- *bullata*-group: Here included is *tadena*, the type OD ***Stabilima***. This subgenus encompasses smaller, but also the largest limatulids, ovate-elongate, ventricose species, with large, projecting auricles, narrow ribs, no median sulcus, and crenulate ventral margins.

- *hodgsoni*-group: *L. hodgsoni* became the type OD of ***Antarctolima*** Habe, 1977. Here included are 7 short, subtriangular and rather broad, rather large species from ANT and adjacent waters with small auricles.

- *jeffreysi*-group: = unnamed **III**; small, less than 11 mm; bathyal; very thin valves, broadly ovate, oblique; small auricles, no median sulcus, fine ribs, weakly scaled or serrated, hinge smooth.

- *nodulosa*-group: = unnamed **IV**; often large, up to 18.5 mm, spindle shaped, narrowing dorsally, inequilateral, hinge anteriorly placed, with well developed pseudotaxodont teeth, nodulose ribs, usually median ribs stronger, separated by a sulcus.

- *regularis*-group: = unnamed **V**; similar to *Limatula*, usually larger, up to 20 mm; generally shorter and broader with a marked posterior hump, fine ribs, weak median sulcus; Atlantic and North Pacific.

- *setifera*-group: = unnamed **VI**; small, less than 10 mm; ovate, flat umbonally, inflated, thin, sharp spiny ribs, opaque-white, small auricles; hinge finely dentate; margins dentate

- *subauriculata*-group: This is the type species of the genus, SD Gray, 1847. This group equals ***Limatula*** s.s. This subgenus encompasses small species, generally less than 10 mm, ovate-elongate, with very small, weak auricles, sharp ribs, umbones very prominent, generally with median sulci, hinge thick and smooth.

- *suteri*-group: = unnamed **VII**; small to medium, elongate, slightly oblique, hinge smooth and long, prominent auricles, fine ribs with fine commarginal striae, weak median sulcus, hinge smooth, margin weakly dentate, confined to NZ.

- *japonica*: This is the type OD of ***Limatuletta***. A few species, ovate, inflated, strongly radially ribbed, weakly auricled with a smooth hinge and a broad resilifer are included.

- s.l.: Here placed are *vermicola* and *impedens*; further *cladosetifera*, *baliensis*, *subtilis*, *isosubtilis*, *kurodai*, *mindorensis*; but also *laminifera* and *kinjoi*, as well as *insularis* and *auporia* and a few more. Various subgenera appear hidden, but much more material and work is here necessary for progress.

Two superficially similar species occur in the Magellan Strait ***Limatula*** (***Antarctolima***) sp. and ***Limea*** (***Gemellima***) ***pygmaea***. Both were misidentified as *Limatula pygmaea* by modern authors.

Thiele (1912 pl. 17 figs. 6-8) depicted 3 specimens from the Magellan Strait. In 1920, he stated fig. 6 the juvenile of fig. 7 and named these (erroneously) *falklandica*; he identified the distinct species fig. 8 (1912) = pl. 10 fig. 7 (1920) as true *pygmaea*, fitting Philippi's cited OD, locality and size. This species has been accepted as representing *pygmaea* by Dell (1964) and by Stuardo (1968). Philippi's type is lost (DELL64), no neotype was found designated as yet. Thus, Thiele (1920) ***pygmaea*** pl. 10 fig. 7 is here designated **plesiotype** to stabilize *pygmaea*. Furthermore, Dell (1964) analyzed and depicted the holotype of ***L. falklandica*** A. Adams, 1863 and declared it synonymous, an opinion shared by Stuardo (1968).

Thus, *pygmaea* is a solid, comparatively thick, ovate-elongate species reaching about 15 mm, with comparatively few strong ribs. Most important is the hinge. Thiele (1920) is cited "Sie besitzt eine schmale, deutlich gezähnelte Schlossleiste und würde daher zu Limea gehören, deren Merkmale sie auch sonst aufweist, …". Thiele recognized this species as *Limea*, placed it in his monograph between *Limatula* and true *Limea*, but hesitated to attribute it correctly. Earlier, Sowerby II in Reeve (1872, Monograph *Lima*) remarked the same close resemblance of *falklandica* to *sarsii*. Virtually all authors accepted ***martiali*** Rochebrune & Mabille, 1889 as synonym; but *martiali* was described as ***Limea***, not as *Limatula*. Stuardo (1968) finalized, stated *pygmaea* also anatomically close to *sarsii* (= *crassa*) and formally included *pygmaea* in ***Limea*** (***Gemellima***).

The other species, Thiele's pl. 17 figs. 6-7 (1912) = pl. 10 figs. 5-6 (1920) "*falklandica*" (= *Limatula* (*Squamilima*) "*pygmaea*" Fleming, 1978 fig. 98) is a true *Limatula* with a typical limatulid hinge. As stated by Thiele (1920) this species is more fragile, with thinner valves and has finer ribs. It is the species usually depicted by modern authors as *Limatula pygmaea* from the Magellanic region (e.g. Forcelli, 2000 sp. 487). This species is most likely ***L. deceptionensis*** described by Preston, 1916 from the Shetlands. Significant is an ovate, almost equilateral shape with prominent umbones. It appears that Preston depicted a sparsely ribbed specimen; Stuardo (1968) depicted a more than double sized, stronger ribbed specimen from there, accepted as identical by Allen (2004). Specimens studied, 8 mm, from the Shetlands, are in between and virtually identical to Magellanic specimens. As indicated by Stuardo (1968) *deceptionensis* is, except hinge, close to *pygmaea* and it is most likely, that *deceptionensis* is responsible for most limatulid subantarctic *pygmaea* records, including Fleming (1978).

The species recorded by Rios (1994) from S. Brazil and from Scarabino (2003) from Uruguay, Rocha as *L. pygmaea* should be reanalyzed to verify its true identity.

Stuardo further described another *Antarctolima* with fewer ribs than *hodgsoni* and trigonal oblique shape as ***L. thielei***. The type from off S. Chile is MCZ 27856.

Stuardo (1968) further removed ***L. macquariensis*** from the unwarranted *pygmaea* synonymy and depicted the quite broad, rather short sublittoral type.

Stuardo (1968) removed also ***L. kerguelenensis*** from the unwarranted *pygmaea* synonymy and depicted the ZMUC holotype from Royal Sound. Troncoso et al. (2001) added additional data.

Thiele's ***L. ovalis*** from nearby Gauss station and Enderby Land seems very close, but was depicted and considered distinct by Dell (1990) and by Stuardo (1968).

Finally, Stuardo, 1968 added a narrower species as ***eltanini*** NZ, Antipodes Isl. to *Antarctolima*. This should be compared to ***L. vigilis*** Fleming, 1978, also reported from the Antipodes.

Stuardo placed 17 species in ***Stabilima***. However, from the distribution range in Fleming (1978) and from the specimens seen, ***arafurensis*** seems indeed within the variability of ***tadena*** and is therefore here not recognized.

Born's NHMW holotype of ***bullata***, a single valve from "Barbados" is 37 mm. It fits Stuardo's interpretation and the corrected type locality Phil, Sorsogon, also accepted by Fleming (1978).

L. tensa from near the tip N. Qld, Eagle Isl. is a difficult species. The type is depicted in FLE fig. 40. I am not convinced that Lamprell & Whitehead (1992 sp. 105, N. Qld-NSW), or Fleming (1978 fig. 41, Sydney, Port Hacking) are conspecific. Stuardo, 1968 further depicted the similar ***L. macmichaeli*** from Masthead Reef (type AMS C 18852), which grows larger and has less, stronger ribs. This may fit Lamprell & Whitehead's and Fleming's NSW and Lord Howe Isl. specimens. Thiele's ***jacksonensis*** from Sydney has a distinct ribbing.

Fleming's ***L.*** (***S.***) ***ponderi*** seems from habitat, biogeography, and morphology identical to Stuardo's earlier ***coralensis*** from off Qld, Caloundra, whereas ***L.*** (***S.***) ***iredalei*** is a broader and smaller species, also from E. Australia.

Based on 22 lots, Stuardo described a common species as ***L. barbarensis*** from California, Santa Catalina Isl. This is the only *Stabilima* mentioned from the East Pacific. From exactly the same type locality Bernard, 1988 described a common shallow water limid as ***L. californica***. There is no doubt that both represent the same species. *Californica* was synonymized with the also shallow water *L. saturna* from British Columbia by Coan et al. (2000). Furthermore, they included ***L. macleani*** in the *saturna* synonymy. However, this action is not shared, considering depth (560 m), size (14.1 mm), and morphology with a slender shell slightly humped shell, with weaker auricles, and an obscure medial furrow. ***Macleani*** is considered a distinct species, placed in Stuardo's *regularis*-group close to *vladivostokensis*, *gwyni* and *hyperborea*.

Obviously, Coan et al. (2000) identified Southern material from Vancouver and Washington as *attenuata*, whereas Stuardo (1968) considered ***attenuata*** confined to the Bering Sea and described the larger 10 mm ***georgiensis*** from B.C., Gulf of Georgia. On the other hand, Stuardo's pl. 11 fig. 28 cf. *georgiensis* from Forrester Isl. seems identical to what Coan et al. (2000 pl. 35) depicted as *attenuata* from Kodiak. The topotypic *attenuata* from W. Alaska, Nazan Bay in Stuardo pl. 13 fig. 54 seems narrower, with more prominent umbones, weaker shoulders and a broader ribbing. It is open, whether a highly variable, widely distributed species, or instead 3 similar species, with an undescribed intermediate from Kodiak to Forrester occur. At present the data is combined and *georgiensis* is listed as a questionable synonym.

Coan et al. (2000) identified Californian material as ***L. similaris***, whereas Stuardo (1968) restricted *similaris* to Cedros Isl. south to the type locality Panama Bay. Instead, Stuardo considered ***L. albatrossi*** from Monterey and Los Angeles, Malaga Cove (= type locality) distinct. The species depicted from L. A. by Coan et al. (2000 pl. 35) indeed seems to fit *albatrossi* better than the *similaris* paralectotype (Keen, 1971, Panama Bay), or lectotype Stuardo (1968, Cedros Isl.). Thus, Stuardo's view is followed. Stuardo placed both species as *Limatula* s.s.

A large member of the *nodosa*-group ***L. woodringi*** Stuardo, 1968 was recorded from bathyal off San Diego, but is not represented in modern literature. Compared to the similar-sized *vancouverensis* it has a rougher ribbing, a distinct spindle-shape, narrower at the ends and broader centrally and lives bathyal instead of abyssal.

As Monterosato (1878) and Thiele (1920), later also Allen (2004) considered *Ostrea nivea* Brocchi, 1814 the same as ***Limatula gwyni***. Stuardo (1968) could not detect differences between recent and fossil specimens. According to Sherborn, ***Ostrea nivea*** has been validly proposed and is not preoccupied. As it has been mentioned many times after 1899, I see no reason not to apply Brocchi's earliest name for this well known European species. Warén (1980) analyzed the types of ***Lima elliptica var. laeviuscula*** Jeffreys, 1864 and did not consider it a separate taxon. It is considered a further synonym of *nivea*. *Lima "nivea"* of Risso and Philippi are instead the same as *subauriculata* (LAM30, STUAR).

Lima cuneata Forbes, 1844 is not resolved. It was considered close to *subovata* (THI20), close to *nivea* (ALL04), or without opinions (LAM30, STUAR, and CLEMAM). It is currently treated as nom. dub.

Stuardo, 1968 demonstrated that the WAF species reported by Nicklès, 1955 as *gwyni* is distinct and named it ***L. guineensis***.

L. demiradiata and ***L. bisecta*** Allan, 2004, both described from single or very few, probably juvenile specimens, are hard to interpret. More material should confirm that both are indeed valid species.

L. subauriculata has been restricted by Stuardo to the East and North Atlantic, Floridan and Caribbean records were excluded.

L. subovata is another typical *Limatula*, known from Europe and Boreal waters. Allan (2004) confirmed Stuardo's view and gave additional distribution data. At least some "*subovata*" records from Florida and the West Indies are referable to *L. regularis*. Verrill & Bush, 1998 well differentiated ***regularis*** from the often confounded *subovata*.

Stuardo (1968) analyzed 81 lots of ***L. regularis*** from Chesapeake Bay, Cape Hatteras through Florida to the Virgin Isl. There is little doubt that ***L. hendersoni*** Olsson & McGinty, 1958 described from Panama, but indicated with an overlapping distribution is only the juvenile form. Comparatively broad specimens depicted from Columbia as *hendersoni* (DIA94) are barely distinct from the *regularis* type (JOH89 pl. 9 fig. 3). Furthermore, *hendersoni* was originally just compared to the quite distinct *subauriculata* and the original type lot contained at least 3 different species (STUAR). Nonetheless, the huge northern sizes of *regularis* are not known from the South.

Stuardo restricted ***jeffreysi*** to the East Atlantic. Records from Florida and the Gulf are instead referable to ***L. stegeri***.

Stuardo (1968) tentatively included ***L. laminifera*** in the regularis-group, but the marked commarginal lamellae, size and habitat do not fit well. On the other hand, the shallow water ***L. nippona*** (type HIG01 B375) and the deeper living ***L. koreana*** seem to fit better into the *regularis* group than to *japonica*.

The Russian ***L. vladivostokensis*** is well depicted in EVS06 p. 48. It is a somewhat humped species, growing up to 18.2 mm in Russian waters, placed by Stuardo in the *regularis*-group, close to *hyperborea*. *Vladivostokensis* does not appear to occur on the Japanese Pacific side. The smaller and slender species, with a pair of strong radial ribs centrally named so from Japan (e.g. Okutani, 2000 pl. 445 fig. 28) represents instead Stuardo's ***L. surugensis*** described from Suruga, Central Honshu. This belongs to the nodulosa-group. According to Stuardo, this species also accounts for some earlier *L. subauriculata* records from Japan.

Another Japanese species, a true *Limatula* s.s. close to the European *subauriculata*, is ***L. tsiukensis*** from the Sea of Japan.

Kilburn (1998) treated the **SAF** *Limatula* and depicted

Thiele's types. ***L. exigua***, in Kilburn's interpretation as thin, oblique species with weak ribbing fits instead better into the *jeffreysi*-group. Earlier, Barnard (1964) and Stuardo, (1968) considered *exigua* closely related to *agulhasensis* and *densecostata*. These two are maintained in the *aequatorialis*-group.

Kilburn, 1975 described ***vermicola*** from Mozambique as closely related to *leptocarya* but stronger sulcate medially. In 1998, based on additional material, he recognized *vermicola* as common species lacking a strong sulcus, which approaches it further to *leptocarya*. However, the Arabian ***leptocarya*** has with 26 only half the rib number of the SAF species, with about 60 ribs, thus, specific distinction appears well justified. Stuardo (1968) could not find a close relation to any group and placed *leptocarya* s.l. He also restricted the latter to Arabian waters; Prashad's records from Indonesia and Borneo are instead referable to species of the *bullata*-group.

Stuardo (1968) placed ***pusilla*** from the Red Sea, ***madagascariensis*** and ***arabica*** from the Persian Gulf in the *aequatorialis*-group with minute (microscopic) pseudotaxodont teeth. *L. pusilla* has been restricted by Oliver (1992) to the Red Sea only.

Thiele's "*pusilla"* from Dar es Salaam was identified as distinct from A. Adams-original by Stuardo, 1968 and considered identical to his *arabica*. On the other hand, Stuardo did not analyze *leptocarya* and placed it s.l. Specimens studied from the UAE fit Melvill's *leptocarya* OD well, but are generally more slender than the original drawing. In ribbing, shape and presence of minute pseudotaxodont teeth they closely approach Stuardo's ***arabica*** and the latter is considered the same. This gives *leptocarya* a range from the Persian Gulf to Tanzania.

OU8: ***Limea***: Stuardo (1968) analyzed this genus in-depth on a global scale and proposed 3 subgenera ***Limea*** (syn. *Isolimea*), ***Notolimea*** and ***Gemellima***; all three have been well characterized. Stuardo used a variety of criteria, especially hinge types, but also shell morphology, size, habitat and biogeography. He demonstrated that ***Isolimea*** is instead a synonym of *Limea* with the same hinge structure and ***Escalima*** a distinct genus. Salas (1994), followed by Peñas et al. (2006), and CLEMAM accepted *Notolimea* as genus for *crassa* and *clandestina*. However, Stuardo had earlier placed *crassa* in *Gemellina* and *clandestina* seems better placed there as well. Allen (2004) on the other hand, though based on limited material, emphasized the continuum, discarded *Notolimea* and only accepted *Limea*.

Going through the global, currently approximately 30 *Limea* species, then a grouping is well justified. Stuardo's approach is perceived as most practicable, best exemplified and his views are largely shared. Most *Limea* are barely known. The large majority is less than 5 mm. 14 new species have been described by Stuardo, of which one seems synonymous to a Japanese fossil, the other species are perceived as valid.

Allen (2004) advocated a separation into the Northern ***sarsii*** and the Southern ***crassa***. He compared specimens from the N. Bay of Biscay, 47.6°N, 7.2°W with Tebble's picture of a Med specimen. Stuardo (1968) had too little material, used the better defined *sarsii* and listed *crassa* as doubtful synonym. Salas (1994 and 1996) stated a gradation from elongate to ovate forms in the material analyzed from N. Atlantic to Sardinia, used *crassa* and synonymized *sarsii*. Specimens studied from Italy, Corsica, 500 m are much closer to the Northern *sarsii* as characterized by Allen, than to Tebble's Med specimen. Here Salas is followed, and *L. crassa* is considered somewhat variable in shape and widely distributed. The hinge, as depicted by Lucas (1980) or Allen (2004 fig. 39) fits Stuardo's type D (*Gemellima*), whereas the *Notolimea* hinge has a much stronger dentition and a smaller ligament pit (Stuardo, pl. 23). True *Notolimea* is currently unknown in Europe, but is predominantly IND.

The ***bronniana*** record of Rios (1994,"*Limea browniana*") from N. Brazil, 100 m with 18-20 rounded ribs and 5 mm represents very doubtfully Dall's species, which has been restricted by Stuardo (1968) to the US coast and the N. Gulf. Unfortunately, Rios picture is not the Brazilian species itself, but a reproduction of Dall (1890 pl. 14 fig. 9). Brazilian material should be compared to the sublittoral *L. pseudobronniana* and *barbadensis* Stuardo, 1968. Usually, only 1 ***Limea*** is listed from Florida. However, in or around Floridan waters at least 5 *Limea* species occur at various depths as demonstrated by Allen (2004) and Stuardo (1968). Stuardo based his CAR species on 90 *bronniana*, 29 *pseudobronniana*, 32 *barbadensis* and 7 *lata* samples.

L (***L.***) ***limopsis*** is well known from Japan. Kilburn (1990) identified this species also from SAF (Transkei-Zululand), comparing it with Okinawa material. Stuardo (1986) did not treat *limopsis*, originally described as Pleistocene Amami fossil. However, he named a quite similar species from the Philippines ***Limea*** (***Limea***) ***cenolata***. The hinge in both species is the same, typical *Limea* s.s. As also the maximum size for *limopsis* 5 mm fits the 4.9 mm for *cenolata* and as Kilburn reported *limopsis* also from bathyal depths, it is most likely that only one widely distributed species is involved. Thus, Kilburn's view is shared and *cenolata* is synonymized. Hayami & Kase (1993) reported *limopsis* also from subtidal caves.

L. (***N.***) ***crenocostata*** has been described from SAF, Transkei. Dead loose valves only were found bathyal in 180-300 m. It is close in sculpture to *crassa* with crenulate commarginal lamellae, but has a distinct hinge, close to the *Notolimea* condition. A specimen from Maldives, Felidhu Atoll, dived in subtidal caves in about 30 m, proved to be identical externally and very close in hinge and is tentatively placed as conspecific. ***L. limopsis*** is also known from bathyal depths and subtidal caves.

Stuardo, 1968 renamed *Lima* (*Limea*) *ceylanica* Thiele, 1920 non A. Adams, 1864 (= *Limatula*, KIL90) from Tanzania, 50 m, 3.5 mm as ***L.*** (***Notolimea***) ***tanzaniensis***. Kilburn, 1990 described ***L.*** (***Notolimea***) ***drivasi*** from Zululand, also Reunion and Mauritius, 3.4 m, 25-52 (180) m. Thiele & Jaeckel (1931) added some more features to Thiele, 1920's *ceylanica*. Comparing this to Kilburn's OD, I fail to recognize *drivasi* and *tanzaniensis* distinct and the former is synonymized.

Kilburn (1998) stated the minute, 2 mm shallow water ***Lima kowiensis*** Turton, 1932 from Port Alfred to belong into PHILOBRYIDAE, but he could not attribute it to any known genus. Stuardo (1986) earlier placed *kowiensis* in *Gemellima*. A recently described minute, 1 mm European species ***L.*** (***Gemellima***) ***clandestina*** indeed shares some traits and should be compared to fresh SAF *kowiensis* material. For the time being Stuardo is followed and both species are placed in *Gemellima*.

L. torresiana Smith, 1885 has been described as *Limatula*, no teeth were mentioned. Melvill & Standen (1891 pl. 2 fig. 19a) depicted from the same localities and same shallow depths specimens closely resembling in sculpture and number of ribs. These show inside a broad resilifer, no significant teeth are visible; but vanishing or very minute ones can not be completely excluded. *Notolimea* definitely does not fit. On the other hand, *torresiana* does not fit in shape, strong marginal crenulation and lacking auricles into *Antarctolima*, which otherwise has a scaly sculpture and lacks dentition. As proposed by Stuardo it is tentatively placed in *Gemellima*, the BMNH and NMWZ material should be reanalyzed.

As concluded by Stuardo (1968), the hinge configuration of the Japanese ***Limea tosana*** (very minute hinge teeth and a large resilifer) is typical for *Gemellima*, but quite distinct from *Notolimea*. *Tosana* is neither a *Limatula*, nor a *Notolimea*.

L. (***G.***) ***obscura*** Stuardo, 1968 described from sublittoral NW. Honshu was not found reflected in modern Japanese literature; the type lot is USNM 319471a.

Also ***L.*** (***G.***) ***alaskensis*** Stuardo, 1968 described from sublittoral Gulf of Alaska was not found reflected elsewhere; the type lot is USNM 220511a. ***Limatuletta coani*** Bernard, 1988 with a special hinge appears instead to represent a *Limea* (*Gemellima*) related to *rehderi* and *tosana*. However, the larger size and the abyssal habitat are distinct from *alaskensis*.

Whether ***Limea lirata*** Allen, 2004 is here correctly placed, should be confirmed. Shape, hinge, surface sculpture and abyssal habitat do not match *Limea* well.

Overall, in limids, our knowledge is just at the very beginning. Instead of the conventionally accepted 125 global species, Stuardo's findings with approximately 250 species proved much closer to the reality. Largely, his analyses are understood as accurate. Stuardo (1968) presented a promising start in limids. The neglect of his work is unjustified, as stated in the introductory remarks.

6.31 TRIGONIIDAE

PA1: The few extant *Neotrigonia* have been treated by A. Adams (1850, 3 species), Reeve (1860, 4 species), Sowerby II (1884, 5 species), Iredale (1924, 1 new), Habe & Nomoto (1976, 1 new) and Lamprell & Whitehead (1992, 7 species). Schultz (1996) studied 7 extant species, gave excellent pictures and a substantial comparison.

Bednall (1878) as well as Darragh (1986 and 1998, in Beesley et al.) treated fossil and recent trigoniids. Unfortunately, Darragh worked with hypotypes and misinterpreted *kaiyomaruae*.

A. Glavinic (pers. com.6/09) indicated that *bednalli* may be the same as *margaritacea*. As her findings could not yet be studied in detail, here the conventional view is presented.

In addition, on the tropical West Australian coast a further undescribed species occurs.

Thus, currently 8 species are listed.

Graf & Cummings (2006) demonstrated that the placement of TRIGONIIDAE near UNIONOIDEA within PALAEOHETERODONTA is justified.

PA2: ***Neotrigonia***: 15 names are available for the extant species. Rarely treated are: *Trigonia jukesii* A. Adams, 1850 from Cape York. *Trigonia nobilis* A. Adams, 1854 without locality, *Trigonia dubia* Sowerby II, 1884 from Tasmania and *Trigonia* (*N.*) *crebrisculpta* Odhner, 1917 from NW. Australia.

The type species ***T. margaritacea*** from Tasmania to NSW is the largest species, rather ovate, comparatively high, with usually 22 or 23 (range: 21-25) rather narrow ribs, comparatively far apart. It is the only species commonly reaching more than 40 mm, Lamarck, 1819 gave 46 mm, the largest seen is even 57.7 mm. *Margaritacea* is very conservative in narrow ribbing and in colors, internally nacreous pearly white or whitish-rose, outside whitish or whitish-rose. The periostracum is thin, brownish. ***T. nobilis*** was described by A. Adams, 1854 as ovate, white, without locality. Sowerby II (1884) depicted such a white specimen and considered *nobilis* synonymous to *margaritacea*, a view shared by Hedley (1918). No type could be located in BMNH; but from Adams' OD Sowerby's view is followed.

Iredale, 1924 pl. 33 compared his more trigonal, much smaller, deeper water, spiny ***gemma*** with equal sized, more ovate, less acutely spined *margaritacea*. Bednall (1878) and Hedley (1918) had earlier reported *gemma* from NSW as *acuticostata*. However, McCoy's true *acuticostata* was considered fossil only by all subsequent specialists. Darragh (1986) depicted the lectotype. Tenison-Woods preoccupied ***reticulata*** also from NSW, 83 m was recognized as this species by Iredale (1924). *N. gemma* has been described from NSW, off Green Cape, but extends according to Darragh (1986) to E. Victoria and Qld, Tin Can Bay.

The most common Australian neotrigoniid is also the most variable and the most difficult. It is known from SWA, King George Sound, SA, Tas to Victoria, Western Port Bay. This species was well characterized by Bednall (1878) p. 79 as "*margaritacea*" from Gulf St. Vincent, but Bednall considered *margaritacea* distinct from *pectinata*. Verco, 1907 saw ***T. bednalli*** from the Gulf St. Vincent originally as variety of *margaritacea* with "very compressed shape, its narrow ribs, its large, oblong, plate-like spines, broader at their free than at their attached ends". As stated by Cotton (1961), such specimens from SA have usually approximately 26 ribs. Cotton described ***N. horia*** from the very eastern part of SA, Beachport, stating it larger, up to 35 mm, narrower, more numerously ribbed, up to 30 ribs, and more elongate, subrhomboidal in shape. However, his *horia* was not accepted distinct by subsequent Australian authors. Darragh (1986) depicted both holotypes. Earlier Sowerby II, 1884 characterized ***Trigonia dubia*** from Tasmania. In subrhomboidal, stronger truncate shape, in dark purple color, and also in its more common distribution *dubia* would fit *bednalli* quite well. However, no type could be located in BMNH and the exact sculpture of *dubia* is unknown. Consequently *dubia* is treated as nom. dub. *N. bednalli* is the most common neotrigoniid, quite widely distributed along the Australian South coast. It has in general more ribs than *margaritacea*; usually approximately 26 (range 24-30). The colors are much more varied, rose, all purple, yellowish or whitish. As recognized by Bednall (1878) the dark brown periostracum is generally stronger than in *margaritacea*. The ribs may be quite narrow as in typical *horia*, or quite broad as in typical *bednalli*, but these are quite regularly plaited, compared to the trigonal spiny sculpture on narrow ribs in *margaritacea*. *N. bednalli* is variable in inflation, from quite compressed to moderately inflated; it is the second largest species, reaching approximately 40 mm. *N. bednalli* is a colder water species. It generally extends from Victoria, Western Port Bay to SWA King George Sound. However, a single sample has been seen from SWA, Houtman Abrolhos.

T. lamarckii from S. Qld-NSW is the second species described and, in conservative shape and ribbing, does not pose any problems; Quite easily recognized is also the most recent species, the characteristic ***N. kaiyomaruae*** from SWA with very dense commarginal lamellae, well captured and compared by Schultz (1996). Recent material from Rottnest Isl., 87 m could be identified as *kaiyomaruae* as well.

T. jukesii has been described by A. Adams, 1850 as third species of *Trigonia* from N. Qld, Cape York in addition to *T. margaritacea* and *T. lamarckii*. However, Adams overlooked that Gray, 1847 described with ***T. uniophora*** exactly the same species from the same locality Cape York, also from 6 fathoms, and also received from Jukes. Very likely *jukesii* is even an obj. synonym of *uniophora*; Sowerby II (1884) and Smith (1885) confirmed synonymy and corrected Reeve's erroneous association with *lamarckii*. *N. uniophora* is a highly variable species, in color from white, to rose-yellowish to all purple (NWA). The number of ribs usually 24-26, varies from 22-28, the strength of ribbing is quite variable, occasionally very weak posteriorly. Characteristic, apart from the tropical NW.-NE. Australian and New Guinean distribution (EAS85), is a comparatively small size, generally less than 30 mm, irregular knobby sculptured ribs, at least centrally and a comparatively strong furrow. Undoubtedly, Odhner's yellowish-red ***crebrisculpta*** with 28 ribs fits well to the *uniophora* analysed. The largest specimen seen from Port Hedland is 30.4 mm. Taylor & Glover (2004) reported *uniophora* also from NWA, Dampier Archipelago.

The uncommon ***T. strangei*** from NSW is best compared to *uniophora*. *N. strangei* is similar in shape, size and ribbing. However, the furrow of *uniophora* is lacking, the nodules on the ribs are more regular in *strangei*, the ribs are in general less 21-22 and have a quite strong commarginal interrib sculpture; the shape is more quadrate, almost equal in height and width. The color in all specimens seen is cream. It usually measures less than 25 mm, but the BMNH type species from Sydney is huge and nearly reaches 40 mm.

In addition, from the tropical West Coast, Port Hedland and Shark Bay, Exmouth Gulf specimens are known which are in 22-23 regularly noduled ribs and sculpture distinct from *bednalli*, but comparatively close to smaller *strangei*. However, their shape is less ovate; the ribbing less dense and the nodules on the ribs fading posteriorly. The color is rose-white and the size of the largest specimen seen is 27.8 mm. This second species on the tropical west coast is **undescribed** as yet. Taylor & Glover (2004) reported in addition to *uniophora* also "*bednalli*" from NWA, Dampier. Their BMNH-material has been studied and proved to consist of 2 wet and 5 dry conspecific samples. These represent this undescribed species and may be used as type material.

6.32 CRASSATELLIDAE

QN1: Most authors accept approximately 40 global crassatellids. However, the number of valid species is much higher, at least 85 species are known, most from the Indo-Pacific and some undescribed.

Many authors contributed to this family, most notably, Reeve (1842-43), Loebbecke & Kobelt (1881-86), Lamy (1917) and Coan (1984-2000). Furthermore, Lamprell (2003) recently described 2 new "*Crassatina*" species and depicted 8 types. Unfortunately, the WAF type species *Crassatina triquetra* was not analysed; instead Lamprell's 8 "*Crassatina*" are perceived to represent 6 distinct genera, 4 existing and 2 here newly described. In addition, all 4 types depicted on fig. 3 seem to bear an erroneous type locality.

Salaputium is perceived as disposal bin for difficult and usually rare species. Some distinct genera are hidden behind. However, lack of material hinders here progress.

Modern phylogenetic analyses are virtually absent and the crassatellid genera and their relations are not well known.

Chavan's high level repartition in CRASSATELLINAE and SCAMBULINAE is at least well supported by morphology, byssate mode of live and by biogeography.

Barely treated after Lamy (1917) were the small crassatellids described by A. Adams, 1854 from China and Japan. However, some species could recently be isolated in BMNH.

QN2: Closest to the fossil type species in all major respects and here placed in ***Crassatella*** s.s. are the few, but quite difficult SAF species.

Comparatively easy are ***C. subquadrata*** Sowerby II and ***C. tenuis*** Sowerby III. As stated by many authors, most notably by Tomlin in Barnard (1964), the two BMNH holotypes leave no doubt that *tenuis* is the juvenile, smaller, more compressed and more fragile form of the earlier *subquadrata*. This is a transversely ovate, rather compressed species, white under the weak horny periostracum. The regular distant, erect, about 20-25 commarginal lirae may be quite acute especially so anteriorly. It is a large species, the types are less than 35 mm, but Barnard gives 40 mm and the largest seen from off Cape Point is even 46.7 mm. *C. subquadrata* is currently only known from the Western Part of SAF, i.e. Cape St. Blaize-Cape Point, deep sublittoral from 80-190 m. It is uncommon. LOEB86 pl. 8 fig. 9 closely approaches the holotype of *subquadrata*.

Another uncommon species is ***C. capensis*** a nom. nov. for Sowerby III's preoccupied ***C. africana***. Here the sculpture consists of approximately fifty rounded commarginal low ribs, more clearly expressed in smaller specimens. The color is yellowish-brown. The BMNH holotype represents a medium size specimen. Barnard gives 45 mm as maximum size and synonymized Tomlin's *odhneri*. *C. capensis* appears more widely distributed, especially eastwards, and lives shallower.

A smaller and more common pair is ***C. crebrilirata*** Sowerby II and ***C. angulata*** Sowerby III. As agreed by virtually all authors the smaller, subrectangular *angulata* is a form of the larger, somewhat higher and more inflated *crebrilirata*. Both types are present in BMNH. This is in general a transverse-elongate species, the umbones rather close to the anterior end; especially juveniles are marked truncate.

The sculpture consists of rather irregular low commarginal ribs. This is the most colorful SAF crassatellid and is also found with reddish-yellowish umbones, in pinkish-yellowish, whitish or yellowish with brownish tented pattern or streaks. The adult form, very close to the type of *crebrilirata* is well depicted in LOEB86 pl. 8 fig. 10. *C. crebrilirata* is generally less than 30 mm, Barnard gives 28 mm, the largest seen is 28.6 mm (Jeffreys Bay). It has a comparable bathymetric range to *capensis*, but occurs on the East side, most often found around Port Elizabeth in 70-100 m.

The fourth true SAF *Crassatella* was characterized by Barnard (1964) as Sowerby III's ***gilchristi***. Here, the type could not be located, but Sowerby's OD and picture are accurate enough to recognize this species. From the specimens analysed, this is a solid, compressed to moderately inflated, ovate to occasionally elongate species with a comparatively thick, brownish periostracum; the sculpture consists of rather broad, slightly raised commarginal ribs. The lunule and escutcheon are deeply inset and the adductor scars impressed. The margins are in most specimens rougher crenulate than in the other SAF species. This is a medium sized species, usually between 30 and 35 mm, Barnard gives 37 mm as maximum size. This species is mainly found in the Western part and seems quite common in Hout Bay. *C. gilchristi* appears **closest to the fossil type species** of *Crassatella*.

All evidence points that a 5th true, but rare *Crassatella* occurs in SAF waters. Barnard refused to accept the "Chinese" *pallida* in the SAF faunal list, although Sowerby, confirmed by Tomlin had identified a specimen from Cape St. Francis, 137 m as *pallida*. Barnard (1964 p. 452) listed it instead as ***Crassatella ?tenuis aberr***. However, nothing close to ***C. pallida*** is known from "China". *Pallida* is instead another Samarang species with an erroneous type locality. The type is depicted by Lamprell (2003 Fig. 3 G-I). The 2 BMNH syntypes share all features which are typical in SAF crassatellids. In somewhat lamellate sculpture *pallida* approaches *tenuis* (= *subquadrata*), in shape and inflation it is very close to *gilchristi*. The deeply incised lunule and escutcheon are characteristic for the SAF forms. *C. pallida* is currently only known from 3 specimens and the exact distribution and bathymetric range therefore unknown.

Barnard's other 5 SAF "*Crassatella*" *sowerbyi*, *abrupta*, *natalensis* and *pilula* are all valid species but belong to distinct genera. For the unique *C. burnupi* Vokes created a new genus ***Crassasulca***.

Vokes, 1973 described ***C. riograndensis*** from S. Brazil, the type species of ***Riosatella***. As indicated by Coan (1984), he apparently overlooked the earlier ***C. uruguayensis*** Smith, 1880, which was based on smaller specimens from Uruguay. The BMNH type lot consists of two smaller 4.5-15.3 mm well preserved specimens. The largest syntype a subquadrate, whitish specimen, with about 20 regular commarginal ribs conforms well to similar sized S. Brazil *riograndensis*. Larger *uruguayensis* have a weaker ribbing and are usually all white. From the available material both *Riosatella* species *uruguayensis* and *brasiliensis* reach approximately 40 mm and occur in Brazil. However, ***brasiliensis*** extends tropical to Aruba and *uruguayensis* temperate to Uruguay.

Thiele & Jaeckel's ***Astarte aequatorialis***, described from a small single valve from Kenya, appears close and may belong here as well.

QN3: ***Eucrassatella***: Coan (1984) synonymized ***Hybolopholus*** with *Eucrassatella* with sharp morphological arguments. However, having all American and all Australian/Melanesian species side by side it is not excluded that indeed two distinct lineages are present, but difficult to diagnose. A revival of the former is only indicated if clear genetic differences among these biogeographically disjunct groups are found. At present the question of convergence or common ancestry is open and Coan's view is followed.

E. ***speciosa*** A. Adams is of 1854 not 1852 (DUNCAN).

Coan (1984) advocated synonymy of ***antillarum*** and ***digueti***. This view was not shared by subsequent Caribbean authors (e.g. MALAC), also not by Macsotay & Campos (2001), who further accepted *montserratensis* as *antillarum* variety, but this latter form is well within the variability of *antillarum*. I also do not share synonymy of the Pacific and the Atlantic species. Equal sized *E. digueti* are generally more inflated, more elongate, and less high and have a stronger reddish brown periostracum, but both may attain a similar size of approximately 105 mm.

As concluded by Coan (1984) ***Eucrassinella*** as well as *E. manabiensis* and *E. aequatorialis* Cruz, 1980 from Ecuador were based on juvenile *gibbosa*, which are more compressed and have broad deep commarginal ridges.

Crassatella corbuloides Reeve, 1842 was described from unknown locality. The holotype from the Museum Stainforth is now present in BMNH 1953.4.15.9. This specimen conforms to Reeve's statement "assuredly distinct" from any other Australian species. Nonetheless, Loebbecke & Kobelt (1881) and Lamy (1917) considered it Australian, whereas no Australian author (i.e. Iredale, 1924; Darragh, 1964; Lamprell & Whitehead, 1992; Beesley et al., 1998) accepted *corbuloides* from there. Recently, a specimen was obtained from Solomon Isl., Guadalcanal, Marau Sound. A close comparison with Reeve's type revealed that this specimen fits *corbuloides* well. *C. corbuloides* is a short and gibbous species, rounder and more inflated than *cumingii*. It also appears to remain smaller than all Australian species. Well visible are the comparatively small muscle scars, whereas in *cumingii* all scars seen are larger and brown. Loebbecke & Kobelt's *corbuloides* specimen was said to stem from Maluku. If this proves correct, then a distributional range Maluku, New Guinea, Solomon Isl. might be possible. Further present is BMNH 1996110 labeled "probable syntypes" of ***Crassatella obesa*** A. Adams, 1854. The type lot consists of 4 specimens. However, there is little doubt that these are the true syntypes and the darkest and largest the depicted syntype fig. 2. Iredale (1924) considered *obesa* a juvenile *C. cumingii*; but A. Adams described and depicted both species in the same paper. Instead *obesa* closely approaches *corbuloides* and is perceived conspecific; the indicated type locality for *obesa* New Zealand is definitely erroneous. The type of ***C. lapidea*** Reeve could not be isolated in BMNH. In the Loebbecke Museum, Düsseldorf a 36 mm specimen of ***C. "lapidea"*** Kobelt, 1886 is present, bought from Sowerby under this name, but without locality. The same species is present in the BMNH general collection labeled "*lapidea* Reeve, Mindoro [e.g. Philippines], Prof. Griffin". However, that this should indeed represent Reeve's species has been correctly doubted by Kobelt. This specimen does not resemble any Australian species, but seems instead to represent a ventrally smooth *C. corbuloides*, as also concluded by Lamy (1917). Reeve's *lapidea* itself is without type not identifiable, *Nipponocrassatella* is even possible, but *lapidea* remains a nom. dub. *Eucrassatella* specimens are currently not known from the Philippines.

Darragh (1964) treated the difficult Australian forms; he depicted most types and accepted 5 species, a view here shared. ***E. donacina*** does indeed occur in the type locality Shark Bay, as selected by Darragh. Thus, it extends much further north than Dongara as accepted by Bryce and Well (1988). *E. donacina* is very heavy and the largest Australian species, reaching more than 120 mm. The type species from Tasmania and SE. Australia ***E. kingicola*** remains smaller and has usually red umbones. ***E. cumingii*** is still smaller, strongly ridged and occurs on the E. coast. Darragh synonymized here Iredale's various forms. Similar to *cumingii*, but growing larger and being usually radially rayed is the West Coast ***E. pulchra***. This species grows quite large, but is variable in shape, moderately to strongly attenuate.

Certainly, Reeve's ***decipiens*** is the most difficult species. Reeve depicted from the Museum Stainforth a moderately attenuate, strongly radially colored specimen with a few anterior ridges, smooth medially and posteriorly. Specimens closely resembling are known from SWA, Perth as selected by Iredale (1924). Lamprell & Whitehead (1992 sp. 174) twice depicted *pulchra*, but no *decipiens*; their *"decipiens"* is close in size, shape and ribbing to the holotype of *pulchra*. Abbott & Dance (1986 pl. 326 fig. 7) is also *pulchra*; but Wells & Bryce (1988 sp. 597) fits Darragh (1964 pl. 1 fig. 3). Loebbecke & Kobelt (1981 pl. 5) have *decipiens* well. Wells & Bryce gave Albany to Shark Bay, but large, virtually smooth specimens known from Port Hedland are perceived conspecific, giving *decipiens* a tropical extension. Reeve compared *decipiens* with *kingicola*, but even closer is *pulchra* which occurs in the same area. *E. decipiens* has a weaker ribbing, restricted to the anterior part, in some almost vanishing; the anterior portion is shorter, less expanded.

QN4: ***Nipponocrassatella***: This small group encompasses rather compressed, smaller species with a crenulate margin. Japanese authors usually accept 3 species: the ribbed ***N. nana***, the smooth ***japonica*** and the small, ovate ***adamsi***. At least the 2 larger ones *nana* and *japonica* are exceedingly variable in shape and convexity throughout growth, in colors and *japonica* even in strength of sculpture.

Ovate, radially colored specimens as the type of ***N. japonica*** (HIG01 B765s = Reeve pl. 3 fig. 19 "*donacina*") occur (= Kira, 1972 pl. 53 fig. 12; coll. auth.); others are more elongate, less high, uniform brownish red, sometimes ventrally covered with black deposits. In general, *japonica* is a rather compressed, smooth, brownish species. A single specimen of A. Adams ***Crassatella obscura*** originally described from the China Seas, 10 mm glued on a M.C. (Museum Cuming) wood board could be isolated in BMNH. It fits the OD and might be the holotype. Kobelt (1886 p. 38) obviously considered it valid and mentioned Museum Cuming, Lamy (1917) mentioned it, but could not place it. *Obscura* is a small *Nipponocrassatella* and possibly the earlier name for ***N. japonica***. Unfortunately, no similar sized *japonica* material was available for a firm conclusion.

Lamprell (2003 figs. D-F) selected a neotype for ***C. nana*** and placed it in *Crassatina*. However, the WAF type species *Crassatina triquetra* is markedly distinct in sculpture, shape and convexity and *Nipponocrassatella* is instead applied for this species, following Japanese authors. The acutely pointed, strongly rounded ribbed BMNH *nana* neotype, though without any locality, is perceived as compressed juvenile. Fortunately, small specimens from China, Zhejiang are close. *N. nana* grows more than 40 mm in Chinese and slightly smaller in Japanese waters. Usually *N. nana* is uniformly cream brownish-white or in Japanese specimens reddish colored. However, occasionally streaked forms are found, which approach the lost type of Adams & Reeve, 1850.

Kobelt's 2 syntypes of ***C. loebbeckei*** 1216 and 1514 now in Düsseldorf, described without locality, have been studied and conform well to medium sized *nana*.

QN5: ***Bathytormus***: The simple hinge configuration, somewhat less the shape, of the US fossil type species ***Crassatella protextus*** Conrad, 1832 is comparatively close to the ***C. radiata*** group, but marked distinct from *Crenocrassatella*.

The *radiata*-group encompasses smaller, rather compressed, strongly curved and ridged, often strongly colored forms. In most a fine radial sculpture is strongly expressed. From the material at hand between the Red Sea and Japan at least 4 species occur. Sowerby I depicted *radiata* in the Tankerville catalogue; the mentioned "probably Australia" location does not match, but Reeve (1843 sp. 12) from Singapore conforms well to the OD. Such strongly curbed, radially colored forms are often found in the Andaman Sea and in the Gulf of Thailand, extending west to Arabia and east to Vietnam. Consequently, Singapore is here selected as **type locality**. Internally *radiata* is uniformly colored, usually dark purplish brown or orange in worn species with white margins. The largest specimen, 33.4 mm was collected off W. Thailand, Phuket area. As indeed conspecific whitish specimens devoid of radial streaks occur, it is likely that Preston's ***C. obsoleta*** from Andaman Isl. is a mere color form as concluded by Lamy (1917). Nonetheless, the type at ZSI should be analysed for confirmation.

Also from Singapore Kobelt described ***acuminata***, which is more pointed, cream white, more compressed and with marked less ribs. It also seems to stay smaller than *radiata*. Such specimens have been found in the Singapore area, 18 m in mud.

Another species has been described by Lamy as ***jousseaumei***. This is comparatively shorter, less rostrate, with weaker broader and more closely spaced ribs, well depicted by Oliver (1992 and 1995). The two MNHN syntypes have been studied. Tentatively, a closely similar specimen from Sulawesi is placed here. However, it is not completely excluded that two closely similar species are present, as the variability in *jousseaumei* is barely known.

Also placed here is Reeve's ***ziczac***. *Crassatina* as proposed by Lamprell (2003) does not match, having no furrow and a simple commarginal sculpture. Instead *ziczac* fits in hinge, sculpture, furrowed shape and colors well into *Bathytormus*. The adult form is more trigonal in shape as is the large lectotype (LAK03 figs. 2 G-I); in smaller specimens the furrow is stronger expressed. *Ziczac* has originally been described from the Philippines; specimens have also been analyzed from the Andaman Sea, W.

Thailand. Furthermore, a specimen from Japan, Wakayama Pref. appeared too close to be separated. Smaller specimens are vividly colored inside, as still visible in the smaller of the 2 BMNH paralectotypes, in large specimens these colors fade and the large lectotype is inside whitish.

QN6: ***Crenocrassatella*** The type species *Crenocrassatella*, OD is ***Crassatella foveolata*** Habe, 1951 fig. 208 (= HAB522 pl. 23 fig. 20, Taiwan, Kiirun) **non** Sowerby II, 1870.

Sowerby's type from China Seas is depicted in HIG01 B769. Such elongate, strongly rostrate specimens are known from Vietnam, but not from Taiwan, The Japanese Pliocene (Otuka, 1937 fig. 39 a, b) or extant Taiwanese species (Kira, 1972 pl. 53 fig. 14) on which Habe based his *Crenocrassatella* is shorter, smaller, more inflated, with a much rougher marginal crenulation and a somewhat narrower ribbing. Following Otuka, the earliest name for this easternmost species is ***Crenocrassatella yagurai*** (Makiyama 1927). It is possible that C. *sulcata* Reeve, 1843 non Lamarck was a misplaced *yagurai* as stated by Habe (1952).

Related to these two, is Lamarck's ***rostrata*** from the Indian Ocean. Lamy (1917) depicted the juvenile syntype. A more characteristic and larger, almost 60 mm syntype ink marked 4 is present in MHNG 1082/67. Other than concluded by Lamy (1917), Kobelt's huge, 62 mm *C. sulcata* (pl. 8 fig. 1-2) non Lamarck is also perceived as *rostrata*, thus, the locality Australia is correct. Very similar specimens are known from W. Australia reaching these sizes.

The BMNH holotype of Reeve's ***C. jubar*** also from W. Australia surpasses in shorter shape, in finer sculpture and in more vivid coloring the variability of Lamarck's *rostrata*. It is perceived as uncommon, but valid species. Kobelt (1886 sp. 24) illustrated further specimens. The exact distribution, except W. Australia, and the habitat of *jubar* is currently unknown.

The SAF ***C. sowerbyi*** Lamy, 1917 though smaller, fits here in irregular commarginal sculpture, shape and dentition best.

QN7: ***Indocrassatella*** is perceived as useful grouping for comparatively inflated, subquadrate, rather thin and small species, with well marked impressed, almost smooth lunule and escutcheon and a crenulate margin. They have a quite dense commarginal sculpture. All species live in deeper water. Close to the type species ***indica*** in shape, but marked smaller is the SAF ***pilula***.

I. natalensis is somewhat more compressed, but also presents a well marked lunule and escutcheon.

QN8: ***Crassatina***: Kobelt's type OD is Reeve's ***Crassatella triquetra*** and has been located by subsequent authors in WAF. It has been studied in some lots from there and was also collected in Ghana. This is a characteristic trigonal, solid, comparatively large species with a simple dentition in a broad and strong hinge plate, a knoblike marginal crenulation, and a sculpture of irregular, very low, broad commarginal ribs, fading posteriorly. It is usually white with interrupted radial rose streaks. Juveniles may be rose, also internally rose colored, faded in adults. The hinge configuration is close as depicted by Lamy (1917 p. 201) for *contraria*; the cardinals 2 and 3b in *triquetra* are stronger and uncurbed, both laterals slightly longer. Other than concluded by Lamprell (2003) nothing from IND is particularly close and his synonymy of *Talabrica* or *Nipponocrassatella* species or *Chattina* species is not shared.

Instead *Crassatina* is here restricted to few E. Atlantic forms close to the type species.

Closest is ***C. paeteli***, well known from Senegal. This is a smaller, highly variable species, with a more convex ventral margin. The color ranges from dark brown, reddish, and yellowish to white. At present *paeteli* is mainly known from shallow water. An old lot in the BMNH with 5 valves bears the label *Crassatella picta* Gray and is undoubtedly conspecific. However, this appears to represent a ms. name only, Sherborn does not list it. Whether Cosel's ***C. alba*** is indeed distinct from *paeteli* or only a white, deeper water form is open. Unfortunately, Cosel (1995) just compared to *triquetra* and *fusca* which are both undoubtedly distinct in shape, size and color. Furthermore, Smith, 1881 described earlier a 4.5 mm, white ***Crassatella knockeri*** from Benin, a species neither considered by Cosel. It has been depicted by Kobelt (1986 pl. 8 fig. 11). Lamy (1917) considered it very close to juveniles of *paeteli*. Smith' OD with a whitish, transparent specimen indeed points into a juvenile; however, the hinge configuration does not fit larger *alba* or *paeteli* precisely, but the shape excludes *Salaputium*. Unfortunately, no growth series including minute *paeteli* and no Benin material was available. Nonetheless, it can not be excluded that *knockeri* is indeed the valid earliest name and *paeteli* and *alba* synonyms.

A very old species is the WAF ***Venus contraria***, recognized by Chemnitz and latinized by Gmelin. It is usually placed in ***Crassatina***, but does not fit there in sculpture, inflation and shape. The sculpture is scissulate, one part is commarginal, the other is oblique, a very uncommon condition in bivalves. The shape is more ovate than *Crassatina*, slightly to markedly truncate posteriorly and adult specimens are strongly inflated. For this unique group ***Scissulatina*** is proposed, *C. contraria* is herein designated as **type species**, OD. As dentition, solidity and biogeography are shared, *Scissulatina* is understood as subgenus of *Crassatina*. *Scissulatina* equals *Crassatina* Dall, 1903 non Kobelt, 1881.

Furthermore, Nicklès, 1955 described ***C. angolensis*** from a single left valve, which shares the same divided sculpture, but is even more inflated, narrower in shape and pronounced truncate. He compared his Angolan species with the closely similar *C. corrugata* Adams & Reeve, 1850. The type of the latter has been depicted by Lamprell (2003 fig. 3 A-C). ***C. corrugata*** is a Samarang species, with a high chance of locality error. As far as is known, *corrugata* has never been recollected in the type locality, Philippines, Sulu Sea. Kobelt's Japanese location was not confirmed either. From the specimens and labels in the Loebbecke collection (LMD), it appears that Kobelt misidentified a comparatively short *nana*. Nicklès compared his *angolensis* with *corrugata* and stated two differences, namely size and sculpture. However, as he only had a single *angolensis* valve and as only two or three *corrugata* specimens are currently known, size is insignificant. Both lots are in the 20 mm range. A comparison with the two BMNH *corrugata* syntypes revealed, that sculpture is virtually identical. Furthermore, shape, strong truncation and color offer no distinguishing marks. All evidence points that the Samarang *corrugata* is instead of Angolan or of western SAF origin and the earlier name for *angolensis*. It is currently understood as second *Scissulatina* as recognized by Lamy (1917). However, this tentative conclusion needs confirmation by additional and unambiguously located material.

From Australia a somewhat similar genus with two small species is known, ***Fluctiger*** Iredale, 1924. It has been recently placed in CRASSATELLIDAE by Beesley et al. (1998). In *Fluctiger* the sculpture is divaricate instead of scissulate. Both species are obviously very uncommon as well. The exact condition of the ventral margin, e.g. crenulations was not mentioned in either OD.

Despite Fischer-Piette & Vukadinovic (1975)'s placement in *Gafrarium*, Dunker's ***Circe undata*** from unknown locality appears instead to belong into this family. However, an unambiguous specific placement was not possible and the type seems lost (not MfN). It is treated as nom. dub.

QN9: ***Chattina***: Lamprell, 2003 described two characteristic species *rikae* and *suduirauti* as *Crassatina*. Some other IND species are close, two as yet undescribed. However, this group does not fit the referred WAF genus, or any other known group. These specimens are virtually identical in hinge configuration and subquadrate shape to the Oligocene *Chattonia*. The umbones are situated very anterior, not central as in *Crassatina*. The anterior portion is short, rounded, the posterior portion extended, broadly truncate. The regular, comparatively strong, rounded commarginal ribs are often confined to the anterior portion, faded on the posterior slope. However, other than *Chattonia*, these specimens have a finely crenulate margin. Members are more solid, moderately compressed, with fewer and stronger ribs and in general also larger than *Indocrassatella*. This group is here termed ***Chattina***, combining main features of *Chattonia* and *Crassatina*. The comparatively large ***C. suduirauti*** is herein designated as type species. All *Chattina* are deeper water species, usually found below 100 m. Most are quite uncommon. The size is mostly less than 25 mm. Typical is a white base color, often with strong, irregular patterns of rose, red or yellow. This group is mainly found around the Philippines. Specimens extend to tropical Australia (***suduirauti***) to Natal (***abrupta***) to Arabia (***omanensis***) to EChi (*suduirauti*) and to Okinawa (***rikae***).

Smith, 1906 described ***Crassatellistes omanensis*** from a huge, 35 mm single specimen off Oman in 420 m. He stated it close to *abrupta*, but all white, more compressed and with more continuous costae. Specimens closely fitting are known from the Philippines, though smaller and only about 150 m deep. These are assumed to be conspecific; but Smith's type at ZSI could not be analysed as yet.

Also here placed is the ***C. picta***-complex. At least the comparatively large, but untypical specimen depicted by Oliver (1995 sp. 1072) from Arabia fits *Chattina* well. The smaller, more ovate and stronger ridged lectotype is depicted in HIG01 B768 (also LAK03 fig. 2 J-K). The BMNH type lot contains in addition to the lectotype 3 1/2 further specimens. If these are conspecific, as assumed by Lamprell (2003), then Oliver's "*picta*" from Arabia is an undescribed species. However, as mentioned by Callomon in sched. the smaller *picta* specimens (= Lamprell's paralectotypes) may possibly be distinct. More material of this rare species is needed to settle this issue and to clarify if a highly variable or up to 3 species are involved.

A further species is known from the Philippines, Aliguay Isl., 140-160 m. It is solid, rectanguloid, with about 15 strong rounded ribs; both specimens known are approximately 6 mm only. It is brownish red with white streaks and has a lanceolate lunule. ***Crassatella truncata*** A. Adams, 1854 was originally described from deep water in the China Sea. A 5.8 mm specimen fitting the OD well could be isolated. The BMNH wood board from M.C. bears the locality Japan. However, from there nothing similar is as yet known. The Philippine specimens are matching well and are understood to represent this barely known species with a not yet established distributional range.

At present 2 further *Chattina* appear **undescribed**:

A species known to date from a single specimen from the East China Sea, from 300 m is 13.3 mm, very compressed, whitish with brown blotches and streaks.

Another undescribed species may be confounded with *suduirauti*. However, its shape is more trigonal, the umbones more central, the coloring is more vivid than typically found in *suduirauti*, containing yellow streaks and blotches. Similar sized *suduirauti* are also more compressed. This new species appears to grow smaller, the largest present is 18 mm. Specimens are known from the Philippines and Indonesia.

In both cases additional material is necessary for a description.

QN10: ***Talabrica***: Most species are quite uncommon and rare in collections. Due to an identical location, Iredale (1924) considered ***T. banksii*** synonymous to the type species ***T. aurora***. May (1958) considered them distinct, depicted both, but only stated for *banksii* "type from Banks Strait"; May did not give any indication on collection of *banksii*. Lamprell (2003) considered them distinct as well, depicted the *banksii* type and stated it had not been recollected since in Tasmania. On the other hand, OD and type species of *banksii* conform precisely to *T. bellula* from NZ, Northland. There is very little doubt, that *banksii* is not Australian but bears an erroneous type locality and is a junior synonym of *bellula*.

Crassatella simplex Kobelt, 1886 was also described from unknown locality, with a non crenulated margin. However, some *bellula* are very weakly ribbed, appearing virtually smooth. As otherwise shape, size, sculpture and yellowish-reddish color fit precisely, *simplex* appears to be a further synonym of *bellula*. The type could not be located (non systax).

A single specimen of A. Adams ***Crassatella concinna*** originally described from China Seas, 8.1 mm glued on a M.C. wood board, but labeled Japan could be isolated in BMNH. It fits the OD and might be a syntype or even the holotype. Kobelt approached it to *simplex*, but Lamy (1917) considered it distinct. However, the strong regular, commarginal sculpture, the colors and the locality are reminiscent of ***T. sagamiensis***. Similar sized Japanese specimens should be compared to verify if *concinna* is the earlier name for Kuroda & Habe's species.

QN11: ***Salaputium***: The type species ***fulvidum*** has been described from NSW, Sydney area. It is a minute, colored subtriangular ovate species, moderately compressed, with a marked curbed, prosogyrate umbo and a finely crenulate margin. The sculpture is of rather strong commarginal ribs only. Very few of the species conventionally placed in *Salaputium* appear close. Comparatively near seem ***janus***, ***micrum*** and ***probleemum***.

The S. Australian ***productum*** has a much weaker ribbing and a distinct elongated shape with the umbones quite marginal. A similar species, apparently undescribed with the umbones even more marginal is known from off Borneo, 73 mm, 2-5 mm.

Thin, elongated forms with a fine commarginal sculpture and virtually smooth margins encompassing *unicum* and *sublamellatum* are not typical representatives either and need also a new generic placement. ***Crassatella sublamellata*** Kobelt, 1885 was originally (Nachr. blatt 17:186) described from Japan and depicted in (1886 pl. 7 fig. 11). It has been briefly mentioned by Yokoyama (1920), but not recorded from Japan since. However, a small series with 3-5 mm specimens has been available from subtidal caves from Palau, 38 m in bottom sediments. The smallest are in shape very close to Hayami & Kase, 1993 "***Salaputium" unicum***, whereas the largest approaches Kobelt's species. There is little doubt that *unicum* is only a juvenile cave form of *sublamellatum* changing shape during its growth and becoming more elongate, subrectangular in adults. Kobelt's type locality "Japan" appears correct, but may be better interpreted as Okinawa Islands instead of mainland Japan. Some features resemble the fossil ***Mediraon***, but the sculpture and the marginal crenulation are distinct.

The Australian ***C. scabriliratum*** was placed in *Salaputium* by Iredale & McMichael (1962) and in *Talabrica* by Lamprell & Healy (1998). However, none of these genera fit this elongated species with a radial interrib sculpture. The fossil ***Remondia*** shares a few traits, but not the sculpture, more likely a new genus is necessary as well. ***C. rhomboides***, elongate as well, also with a radial interrib sculpture and weakly ventrally denticulate is not close to *Salaputium*, but seems congeneric to *scabriliratum*.

The minute ***C. discus*** was placed in *Salaputium* by Cotton (1961) and Iredale & McMichael (1962) but in *Talabrica* by Lamprell & Healy (1998). It is closer to *Salaputium*, but does not fit particularly well in shape.

Also the minute ***C. securiforme*** was placed in *Salaputium* by Iredale & MacMichael (1962) and in *Talabrica* by Lamprell & Healy (1998). It does not fit either.

Definitely the Australian *Salaputium*-complex requires much more work. It appears that a couple of undescribed genera of minute species are present.

From WAF 4 "species" *congoensis*, *dakarensis*, *marchadi* and *modesta* have been reported by various authors. These fit *Salaputium* quite well in essentials and are tentatively placed here. Whether phylogenetic data support this view, or whether a further genus is necessary, is open. The oldest name is H. Adams ***Gouldia modesta***, originally described from Tunisia, but reported from WAF by Ardovini & Cossignani (2004). The hinge configuration of *modesta* is well depicted in Lamy (1917 p. 251 *C. planata*). Indeed, comparing *modesta* from Med, Morocco, Tétouan with specimens from W. Sahara or with Cosel's *marchadi* from Senegal, I could not detect marked differences and ***marchadi*** is perceived a junior synonym. Cosel (1995) did not compare with Adams' species. Furthermore, Nicklès (1952) saw *congoensis* also in Gabon and Marche-Marchad (1958) reported it from Senegal. I doubt, that Thiele & Jaeckel's ***congoensis*** 3 mm, from 44 m, Congo River mouth is distinct and other than based on juvenile, somewhat worn, whitish specimens of *modesta*.

Cosel's ***Crassatella dakarensis*** is perceived as distinct and broader *Salaputium*, the umbones closer to an orthogyrate position. Ardovini & Cossignani (2004 pl. 278 fig. 1 cf. *marchadi*) is instead understood to represent *S. dakarense*.

QN12: ***Crassinella*** are quite similar to *Salaputium*, but byssate and due to a reverse, opisthogyrate position of the umbones placed in SCAMBULINAE. This American genus is due to HAR66, COA79 and ITU98 quite well known.

Redfern (2001) discussed the variability in ***C. dupliniana*** and synonymized *aduncata*.

Whether ***Crassinella lata*** G. W. Nowell-Usticke 1969 from Virgin Isl. is indeed a *Crassinella* and not a tellinoid should be verified at AMNH.

C. torresi trigonal, white, 3.5 mm, compressed with about a dozen thin commarginal ribs does not fit *Salaputium*, where placed by Australian authors. As stated by Harry (1966) this is instead a *Crassinella*. However, no *Crassinella* is currently reliably known outside the Americas, and as far as is known, nothing close to *torresi* has ever been refound off Australia or elsewhere in the Indo-Pacific. Lamprell & Healy (1998 sp. 731) just copied Smith's data and picture. Instead, H.M.S. Challenger collected also in Caribbean waters. All evidence points that *C. torresi* is a comparatively large *martinicensis* with an erroneous type locality.

Despite an excellent paper by Coan (1979) the 7 Panamic species stay difficult. Large, 6-7 mm smooth Panamic specimens, usually labeled "*varians*" are instead smooth ***C. pacifica***. As stated by Coan ***C. varians*** is instead a very small, almost equilateral species, less than 3.2 mm.

6.33 ASTARTIDAE

QM1: This difficult family has been treated by many authors. Hanley (1843), Philippi (1847), Sowerby II (1854 and 1874 Icon.), Smith (1881), Dall (1903), Lamy (1919), Ockelmann (1958), Scarlato (1961), Lubinsky (1980) and many more contributed.

Here 4 genera with slightly fewer than 40 species are recognized.

QM2: ***Astarte***: Recently two authors with distinct species concepts treated astartids. Coan et al. (2000) treated the Pacific species. However, it appears that they synonymized some Atlantic species too much with their Pacific forms. Just one year later, but not considering the above work, Høpner Petersen (2001) published a book on Arctic and Baltic *Astarte*, important as he selected and depicted many types. He renamed or described 14 new species. Here it appears that many of his "new" species are within the variability of well known forms. However, *A. belti*, *A. falsteri* and *A. vaigati* may, in the end, turn out to be valid species, in addition to *A. sericea* and *A. crassa* (syn. *A. neocrassa*).

Nevertheless, the number of valid *Astarte* is unknown and without large scale genetics and very large global collections not solvable. Here, nearly 30 true *Astarte* are recognized, but instead, it is not excluded that in 3 generations approximately 20 species as proposed by Coan et al. (2000), or up to 40 species as proposed by Høpner Petersen (2001) will be widely accepted.

Coan et al. (2000) and Høpner Petersen (2001) did not accept or use subgenera, a view here followed. ***Rictocyma***, at first glance the most distinct group was based on juveniles with strong irregular sculptures. Adults may have quite regular ribs approaching the ***Nicania*** condition. Also the extent and strength of ribbing or the shape is not an appropriate criterion. The arguments for a generic separation of the solid, heavy ***Filatovaella*** with a broad hinge plate as proposed by Russian authors and accepted by Chavan in Moore (1969), appear too weak and were not shared by Coan et al. (2000).

Crucial are smooth or crenate margins, the base for ***Tridonta*** vs. ***Astarte*** and for separation of many astartids. It is well known, that juvenile astartids in otherwise consistently crenate forms may have smooth or at least very weakly crenate margins. However, at least in 7 species, in *A. undata*/*mortoni*, in *longirostra*/*magellanica*, in *sulcata*/*scotica*/*anholti*, in *castanea*, in *subaequilatera* from W. Atlantic, in *crenata* from the Bering Sea and in *concha* from Florida smooth margined adults have been described or have been studied; likely this is also the case in *acuticostata*. There is little doubt that *mortoni*, *magellanica* and *scotica* are synonyms of their counterparts as concluded by many authors. Sexual maturity, hence, adult stage, is in bivalves reached at about 1/3 of maximum size as elaborated by various authors, notably Ockelmann. Consequently, the marginal character in these species can impossibly correlate with maturity, as stated by Smith (1881). Whether this is indeed a gender issue in the dioecious astartids with smooth male as proposed by Ostroumoff (see LAM19) is not confirmed as yet. On the other hand, in some species only sharp, smooth margins are known, which could correlate with species with a monoecious reproduction. It is, therefore, not excluded that strong subgenera within *Astarte* may be found along monoecious vs. dioecious species.

As stated by Høpner Petersen, for the type species *Astarte* OD, namely ***A. scotica*** from Scotland no type is present. There are many hints in older British literature and Brown (1844) depicted a specimen. *Scotica* was first understood as smooth margined species, close but smaller than the crenate *sulcata*. Very early *scotica* was synonymized with ***A. sulcata***. Tebble (1976) stated *sulcata* as crenate, smooth margined specimens occasionally found, but a size was not indicated. However, in the BMNH general collection ample *sulcata* material is available, also many samples of var. *scotica* from Scotland, which could serve as neotype. In one lot the largest specimen, 16.1 mm proved smooth margined. A further Scottish lot from Firth of Lorn, 50 fms, contained, in addition to many crenate *sulcata*, also an equally large, 27.4 mm smooth margined specimen. This is not far from the known maximum size of *sulcata* and clearly excludes the smooth juvenile vs. crenate adult formula. Without doubt large smooth and large crenate *sulcata* occur at the same place. Instead, Høpner Petersen (2001) restricted *sulcata* to crenate forms and redescribed smooth margined forms as ***A. anholti*** from Kattegat. However, he just may have separated the male from the female. *A. sulcata* itself is more variable in shape than usually depicted; often ovate, but occasionally only slightly longer than high.

A. neocrassa from W. Greenland does not belong near or in *elliptica*, but is very close to certain *sulcata* forms, e.g. from Liverpool. It is much shorter and more inflated than *elliptica* and has a thicker hinge plate. Høpner Petersen (2001) admitted that *A. compressa var. crassa* Leche, 1878, though described as fossil from the Kara Sea, Nowaya Semlja may be the same species. Leche's fossil type fig. 3b is virtually identical to recent material from Greenland. ***A. crassa*** Leche, 1878 has been validly proposed, it is not preoccupied and is recognizable. Lamy (1919) accepted *crassa* as distinct from *elliptica*, where he only synonymized Leche's fig. 2. Schander (2001) did not accept *A. neocrassa* either. Consequently *A. neocrassa* is considered a junior synonym of *A. crassa*. Should this rather rare species turn out to be mixed margined as well, then synonymy with *sulcata* may be indicated.

A. borealis is in the understanding of most modern Asian, American and European authors a variable species, widely distributed from Japan and the Baltic Sea to circumarctic. Høpner Petersen (2001) selected a neotype from Iceland, interpreted it very narrowly and restricted its distribution to Greenland, Iceland and N. Norway, excluding the Baltic Sea and the Pacific. His selection fits the normal understanding. However, there is little doubt that *borealis* is much more variable and that many of Høpner Petersen's newly described species are within the natural variability of *borealis*. ***A. nuuki***, solid, 38 mm, ellipsoid, comparatively flat, commarginal ridges in the upper third from W. Greenland has been depicted by Jensen (1912 pl. 4 fig. 1d-e), identified by him as *A. placenta*. Høpner Petersen (2001) considered *placenta* Jensen distinct from *placenta* Mörch and named it *nuuki*. I fail to understand *nuuki* other than a compressed, umbonally ridged *A. borealis*, as e.g. also depicted from Russia by Scarlato (1981 figs. 237-249, especially fig. 239). Lamy (1919) characterized this synonymous form as *semisulcata*. ***A. moerchi*** is the same as ***A.*** (***Tridonta***) ***semisulcata var. placenta*** Mörch, 1869. Høpner Petersen (2001) argued that Mörch's *placenta* is unavailable, introduced in synonymy of *A. richardsoni* Reeve, 1855. Although *moerchi* is stated as n. sp. it is based on Mörch's original Spitsbergen material. On the other hand, Høpner Petersen explicitly considered the base for his unavailability, namely Reeve's ***richardsoni*** from Canada distinct. As such *A. moerchi* would qualify as unnecessary nom. nov. However, *richardsoni* has consistently for more than 100 years been considered a juvenile *borealis*. It indeed seems hard to argue that the smaller *richardsoni* (pl. 10) from Canada should be distinct from the larger *nuuki* (pl. 8) from W. Greenland. In addition, small *borealis* from NW. Germany or the Baltic Sea conform well to *richardsoni*. Mörch's *placenta* was synonymized with *borealis* by virtually all modern authors. I fail to perceive *moerchi* as valid name and other than a quite typical *borealis*. I further fail to accept Høpner Petersen's Baltic Sea species ***A. fjordi*** and ***A. nordi*** as other than a quite typical *borealis* as found in these waters (ZETT02). It is even not completely excluded, that *A. silki* and *A. bornholmi* may be interpreted as extreme *borealis* forms.

On the other hand, *A. borealis var. sericea* was synonymized with *borealis* by Coan et al. (2000). Ockelmann (1958) considered it as an intergrading variety to *borealis*. Lamy

(1919) considered it as a variety, but did not synonymize it. Høpner Petersen considered *sericea* valid, depicted Posselt's types from Scoresby Sund, E. Greenland (pl. 11) and also identified specimens from Spitsbergen conspecific. ***A. sericea*** Posselt, 1895 does not fit into the *borealis* analysed. It is a comparatively small species. Accepting *richardsoni* as typical juvenile *borealis* and considering the position of the pallial line and the indistinct lunule in *sericea*, both unlike *borealis*, then *sericea* seems indeed to be a valid species. For the time being Høpner Petersen is followed. Genetic comparisons would be helpful to confirm distinctiveness.

A. arctica is similar to ***borealis***. Following Coan et al. (2000) this is a slightly smaller, more ovate species almost equal in height and length with a smooth ventral margin. Not always, but typically the muscle scars are larger, the surface is smoother, the periostracum darker and the hinge plate thicker and more solid than in *borealis*. Coan et al. (2000) synonymized here Bernardi's *rollandii*, well depicted by Scarlato (1980). Høpner Petersen did not identify any species as *arctica*, which he considered Canadian and undefined. However, his ***A. jenseni***, solid, 36.3 mm, triangular ovate, thick, blackish brown periostracum, large scars, smooth margins, thick hinge from Iceland fits well in what is usually understood as *A. arctica*.

From the **Baltic Sea** conventionally 3 species *A. elliptica*, *borealis* and *montagui* are reported. Høpner Petersen (2001) accepted *sulcata* and *montagui* only to the Kattegat, recognized *elliptica* from the Baltic and described ***A. fjordi***, ***belti***, ***nordi***, ***bornholmi***, ***silki***, ***falsteri***, ***anholti*** and ***klinti*** as new. As such he recognized 11 species from the Kattegat to the Baltic Sea proper. If Høpner Petersen's view is correct, and if astartids have to be distinguished much more narrowly, then the number of extant *Astarte* may be globally much higher. The reactions on Høpner's proposal were rather helpless. CLEMAM did not accept any species as valid, classified most as questionable under *borealis* and some inc. sedis. Unfortunately, Schander (2001)'s "book review" proved, except for refusal of *neocrassa*, to contain more questions than answers. Fortunately, this complex is under work at the Leibniz-Institut, Warnemuende, Germany. The current status can be summarized as follows (Dr. Zettler, pers. com. 2/09): Genetically astartids are very difficult. In the Baltic Sea morphologically the 3 well known main forms *A. borealis*, *elliptica*, and *montagui* are clearly distinguishable. Occasionally, forms are found which are difficult to place properly. It further appears that some forms described by Høpner Petersen (e.g. *silki*, *bornholmi*) are nowadays extinct and no longer genetically analysable. The results of their findings will be published in due course. For the time being, these 8 new Baltic species described by Høpner Petersen, 2001 are treated as follows:

As stated above, there is little doubt, that *A. nordi* and *fjordi* fall into *borealis*, possibly also the now extinct *A. silki* and *A. bornholmi*. Definitely, *A. anholti* from the Kattegat should be genetically compared to *sulcata* from GB and Scotland. The small, rather ovate *A. klinti* may turn out to represent *montagui*. ***A. falsteri*** could not be associated with any known form and appears to be a valid species. Neither shape, position of the umbones, nor thick hinge or pallial sinus matches the many *borealis* studied. No *falsteri* seen to date measured more than 23 mm, whereas *borealis* easily grows twice this size. ***A. belti*** seems to be valid as well. Specimens from the Baltic Sea did not match *borealis* in shape, thickness, strong hinge, or in position of the pallial sinus, but seem to conform well to *belti*, which also shows strong distortions, especially umbonally.

One of the most difficult species is ***A. crenata***. Ockelmann (1958) saw various subspecies. Unfortunately, he only analysed Arctic Greenland and Jan Mayen material. Coan et al. (2000) saw *crenata* widely distributed with many synonyms, notably also *subaequilatera* and *crebricostata*. Neither view is shared. Coan et al.'s characterization fits the original, as well as boreal Pacific and Arctic forms but not the boreal Atlantic forms. Consequently, following Dall (1903) and European authors the NW. Atlantic *subaequilatera* and the NE. Atlantic *crebricostata* are here separated as valid species.

Sowerby II (1874) was able to identify his larger, but preoccupied ***A. oblonga***, with Gray's juvenile specimens from Arctic Canada, Prince Regent's Inlet. Dall (1903) based on original material characterized *crenata* well. From the material studied, this is a high Arctic species in the Atlantic, becoming boreal in the Pacific only. Specimens from Hudson Bay and Bering Sea are close to these ovate, rather thin, finely ridged types. As depicted from the Pacific by Coan et al. (2000) these specimens have thin hinge plates. Uncommonly smooth margined forms are found (Bering Sea, 25 mm). ***A. derjugini*** from the Okhotsk Sea is a further typical representative. Japanese authors name *crenata* as ***A. filatovae***.

As stated by Dall (1903) ***A. subaequilatera*** is perceived as distinct and valid species, ranging from US Boreal waters, from where originally described, to Florida and at least to Roatan, Honduras. It is more solid, typically more trigonal and the hinge plate thicker and broader. In large adults the margins are often smooth, a feature rarely seen in true *crenata*. Along the US East Coast 4 recognizable forms are found. The northern ovate-trigonal, typical form, growing to 40 mm is intermediate in density of ribbing, a second higher, narrow form, acutely beaked, a third shorter, more inflated form, with somewhat finer ribs and darker periostracum (= *whiteavesii*) and, finally, a comparatively small southern form, with rougher ribbing, extending far into the Caribbean. The mix of smooth and crenate margins is also found in these forms. However, whether these forms indeed only represent one highly variable species is at present open. Dall (1903) saw two species, but the smaller Caribbean and the high, narrow form may be unnamed.

From the material seen so far, the Iceland specimens are perceived to represent *subaequilatera*, but not true *crenata*, and not *crebricostata*. Madsen (1949) further recorded *A. acuticostata* below 200 m from Iceland.

A. acuticostata has been well depicted by Warén (1980) and Lubinsky (1980). This is a small mainly ARC bathyal species less than 15 mm. Most authors considered it valid. It appears that here also smooth and crenate margined specimens occur (HOP01, p.16)

As Sowerby II (1854), Smith (1881), Dall (1903), also CLEMAM kept ***A. crebricostata*** M'Andrew & Forbes, 1847 distinct. This uncommon N. European species is not close to *crenata*. It is more solid, somewhat approaches *subaequilatera*, but is less ovate, more truncate and often higher in shape, with a denser ribbing. According to Smith (1881) adult *crebricostata* have always a crenate margin, whereas large *subaequilatera* from Nova Scotia are often found smooth margined. Lubinsky's Canadian "*crebricostata*" are instead perceived as *crenata*. The type of *crebricostata* from the Shetlands could not be located, but a large lot collected by M'Andrew in the Finnmark is present BMNH 1856.7.7.50, which could serve for a neotype selection. This lot may also contain the comparatively low specimen figured by Sowerby II (1874 fig. 10) which seduced authors to synonymize it with *crenata*. Usually, *crebricostata* is a comparatively high species. *Crebricostata* is Norw (= NE. Atlantic boreal), not known from Iceland.

Two uncommon species have been described from Virg (= NW. Atlantic boreal): ***A. quadrans*** Gould, 1841 and ***A. portlandica*** Mighels, 1844. Both have been described as small species and variously interpreted since. Jeffreys (1872) considered *quadrans* as juvenile of *castanea*. Subsequent authors (EAS81, DAL031 and LAM19) did not follow, but considered these two conspecific; others saw *portlandica* as a variety of *quadrans*. Abbott (1974) accepted *quadrans* as valid, but did not mention *portlandica*. Coan et al. (2000) included *A. quadrans* in the *crenata* synonymy, but did not list *portlandica*. However, Lermond (1908) recognized both as valid, occurring in Maine, from Casco Bay to Eastport and both distinct from *subaequilatera* and from *castanea*. From the OD's there is little reason not to follow Lermond's view, all the more, as convincing arguments to accept *portlandica* as synonym of *quadrans* were not encountered as yet. Certainly, more material is necessary for firm conclusions.

The common Northwest Atlantic ***A. undata*** was described with crenate margin. Sowerby II, 1874 described ***A. mortoni***, closely similar and from the same area as smooth margined species. In the *undata* analysed, exactly half had smooth and half had crenate margins. As otherwise no major differences were detected, *undata* is perceived as variable in marginal crenulation and *mortoni* synonymous, as already concluded by Smith (1881).

From Atlantic and Pacific material at hand, other than synonymized by Coan et al. (2000), I do not perceive ***alaskensis*** the same as ***elliptica***. Together with Asian and European authors these are considered distinct and both valid species. Lubinsky (1980) came to the same conclusion and saw *elliptica* only from Eastern Canada and eastwards. Japanese and Russian authors, most recently Evseev & Yakovlev (2006), applied *alaskensis* for Japanese and Russian material. The Pacific species is in general higher, more compressed; the ribs are less and more distant, giving it a widely spaced impression. Usually, it also grows larger, but both species have typically smooth inner margins, prosogyrate beaks and a dark periostracum.

Consequently, also the preoccupied European ***A. intermedia*** Sowerby II, 1854 was differently interpreted. Whereas European authors considered it synonymous to *elliptica*, Coan et al. (2000) considered it as *crenata*. From indicated biogeography, ribbing, margins and shape Smith and Lamy is followed and *intermedia* is perceived the same as *elliptica*. The type was not located.

Høpner Petersen (2001) accepted *elliptica* only from Iceland, the Faroe Isl. and Denmark. From Greenland he described ***A. elonga***. However, from known biogeography of *elliptica* (e.g. LUB80), from size, from shape and ribbing and from the variability seen, I fail to accept *elonga* as other than a somewhat elongated form of *elliptica*. Quite similar specimens are also known from W. Scotland.

The last Arctic species proposed by Høpner Petersen, 2001 is ***A. vaigati***, 30 mm from West Greenland and Iceland. This is Jensen's fig. 4g "*elliptica*". It is comparatively high in shape, ventrally with a vanishing ribbing. It is not close to the *elliptica* specimens as yet studied. Finally, it may be an extreme *elliptica* form as interpreted by Lubinsky (1980) or a valid species. For the time being it is listed separate.

A. ioani was described from Kamchatka and ***A. compacta*** earlier from Puget Sound. However, heavy, solid, deeper water specimens from the Bering Sea (33.5 mm, 380 m) are difficult to attribute. Instead, they appear to connect these two species, also biogeographically well and *ioani* is considered a junior synonym. *A. compacta* is a quite solid species with a broad hinge plate and strong teeth, the pointed umbones are subanterior, the lunule at least in some unequally divided. *Compacta* appears to grow larger and to occur deeper in the Russian part of its range.

A. hakodatensis Yokoyama, 1920 was described as Honshu fossil and living in Hokkaido, Hakodate Bay. From the nearby S. Kuriles ***Nicania inaequilatera*** Filatova in Scarlato, 1981 was described. However, neither biogeography, shape, the 12 mm-size, nor the sublittoral habitat offers distinguishing marks. *A. inaequilatera*, originally just compared to *montagui*, but not to *hakodatensis*, is here considered a junior synonym of the latter.

The number of species behind ***A. montagui*** from Scotland is unresolved. Dall (1903) saw 6, Lubinsky (1980) saw 5, Coan et al. (2000) saw 1 species, but with some queries. From the material at hand, at least 2 species are present. Typical, European *montagui* are generally small, less than 20 mm, rounded-trigonal, finely ribbed, rather inflated as adults; ***A. banksii*** from Spitsbergen most likely is the same. Whether true *montagui* indeed occurs around Canada is open. The American specimens grow much larger, up to 45 mm and are generally more elongate. It is most likely, that true *montagui* is restricted to the Boreal East Atlantic and that a distinct Russian/W.US/Canadian Arctic species, possibly ***striata***, is present, reaching twice its size. Russian specimens (e.g. Scarlato, 1981 figs. 250-254 *orientalis*, figs. 255-256 "*fabula*", figs. 260-264 "*warhami*") do not appear close to European material. Instead these are all perceived conspecific and the same as depicted as *"montagui"* by Coan et al. (2000). However, here a solution needs the type material and resolution of the true identity of *globosa*, *laurentiana* and *soror*. This complex needs more work.

Following Lubinsky (1980) at least the mainly E. Canadian ***A. warhami*** Hancock is separated from the *montagui* complex. Neither the distinct juvenile "*Rictocyma*-like" sculpture nor a similar size was encountered in European material, which is generally less than 20 mm, and usually more inflated with a finer, more regular ribbing. Lubinsky synonymized here *fabula* with convincing arguments; Smith (1881) recognized the latter as distinct from *montagui* as well and synonymized Sowerby II's *semilirata*.

In Caribbean waters, many smaller astartids are found. The largest species is a *subaequilatera* form, measuring up to 25 mm in Floridan and Roatan waters. Furthermore, Dall, 1886 described ***globula*** and ***smithii*** and in 1903 ***liogona***. It seems that the latter species, *A. liogona*, has not been refound since. From off Key West, Florida, a specimen 10.1 mm, in 3-400 m (11/62, research vessel, live taken) resembled Dall's OD. The *castanea*-like shape shows acute, rounded beaks, eroded in Dall's specimen, a rather smooth surface with irregular ridges mainly toward the ventral margin, a strong hinge plate and a dark brownish periostracum. However, the margin is smooth. Together with color, broad hinge and shape this small Floridan specimen was interpreted as *castanea*, enlarging its range significantly southwards. Some, almost 30 mm *castanea* from Nova Scotia have also smooth margins, whereas Smith (1881) and Abbott (1974) stated the margins crenate. It appears that *castanea* has this smooth/crenate marginal combination as well and that *A. liogona* is only a Southern form found small and deep water at the end of range.

From Florida another small species is well known. This is ***Astarte nana*** "Jeffreys" Smith, 1881 = ***Astarte nana*** "Jeffreys" Dall, 1886. However, this name is twice preoccupied; first by a German fossil of Reuss, 1844 (SHE). Second, Jeffreys, 1864 also used *Astarte sulcata var*. *nana*. According to Warén (1980) no locality was designated and the *nana* type could not be found. On the other hand, Dall (1903) referring to specimens in the USNM-collection stated under *whiteavesii*: This, …, while I find it labeled by Jeffreys "*sulcata* variety *nana*," though it has no close resemblance to *sulcata* da Costa". It is therefore possible that true *nana* was the earlier name for the American *whiteavesii*. However, the type seems now lost and Jeffreys' *nana* is best treated as preoccupied nom. dub. This leaves the small Floridan astartid without name. Here ***Astarte concha*** is proposed as **nom**. **nov**. *A. nana* "Jeffreys" Smith, 1881 non Jeffreys, 1864 nec Reuss, 1844. Smith (1881) gave Florida, off Conch Reef as type locality. *A. concha* is a small species less than 10 mm, but solid, rather flat, rounded trigonal with more than 20 strong, regular commarginal ridges and a broad hinge plate. It is cream, yellowish-brown to rose in color. Smith stated smooth margins, Dall (1903) added "crenate only when perfectly mature". In specimens seen, 5-6 mm had smooth margins; 8-9 mm had crenate margins.

Dall, 1903 further mentioned ***A***. ***nana*** var. ***trigona*** from the Gulf of Mexico and Florida reefs, a more convex and triangular variety. As all *A. concha* specimens seen so far are quite conservative in shape, rather compressed and rather broad and well confirming to Dall's figure, it appears that this more inflated, narrower "variety" might instead represent a distinct valid species. However, Lamarck, 1819 described the fossil *Cypricardia trigona*, which was placed by Deshayes, 1830 in *Astarte* (SHE). It may therefore be that a further, rare astartid lives in Floridan waters, which needs a new name.

QM3: Giribet & Peñas (1999) reviewed ***Goodallia***, described two new and accepted all in all 5 European species. Lamy (1919) well depicted the hinge configuration.

It should be emphasized that ***G***. ***macandrewi*** does not occur in the Mediterranean Sea proper. Instead ***G***. ***micalii*** is found there.

QM4: ***Digitaria***: This unique genus is perceived monospecific.

The familial and generic placement of ***Astarte agulhasensis*** Thiele & Jaeckel, 1931 from SAF, Aghbas is open. *Astarte*, where originally placed and also placed by Barnard (1964) does not fit. In sculpture, shape and habitat *agulhasensis* shares some traits with *digitaria*. However, the crenate margin and the dentition do not match the *Digitaria* condition. *Propecuna* shares some traits, however, here the size and the dentition do not match and sculpture only very superficially. Faute de mieux *agulhasensis* is here misplaced for the time being.

6.34 CARDITIDAE

QH1: This is one of the most neglected larger families in BIVALVIA. Except Coan (1977) and an excellent Diplomarbeit (bachelor thesis) of Hain (1985) from Philipps-University Marburg, Germany, very few modern treatments are available and phylogenetic data is virtually absent.

Boss (1981) stated 50 carditiids. Here, excluding condylocardiids almost 140 species are recognized.

Highly complex is also the generic attribution. Globally, in excess of 50 extant species were described as *Venericardia*. However, this is a fossil genus only, without any recent species. Consequently all described venericardiids had to be placed elsewhere.

"Faute de mieux" Chavan in Moore (1969)'s view is to a large extent applied. However, the various groups placed in CARDITAMERINAE appear quite distinct and this subfamily appears too large. Many suppressed genera/subgenera are here recognized. In some cases further genera and subgenera are necessary and many carditiids are undescribed as yet. Definitely much more work in this scarcely known family is necessary.

Older monographs are available from Reeve (1843), Deshayes (1854), Clessin (1888), Dall (1903) and Lamy (1922). In addition, a multitude of dispersed papers is present.

Reeve's type material is mostly well preserved in BMNH; it demonstrated some surprising results. Many IND carditiids were described by Deshayes, 1854, never depicted, but most types are unambiguously available in BMNH.

The large majority of Clessin's type material was destroyed in Stuttgart. Despite 16 new names proposed in 1888-9 no valid carditiid bears today Clessin's name. Most are synonyms, some are junior homonyms, and in few cases, Clessin's name had to be rejected as nom. dub. Clessin's single, widely accepted name *Cyclocardia ferruginea* proved to be an invalid misspelling for a *Megacardita*, as recognized by Lamy (1922). Thus, the well known Japanese *Cyclocardia* must here be renamed.

QH2: ***Cardita***: The large BMNH syntype series of Reeve's ***C***. ***fabula*** from the Alboran Sea does not offer special features compared to the type species ***calyculata***. *C. calyculata* is in shape, inflation and color quite variable as the many named forms witness, listed by CLEMAM and discussed by Lamy (1922). *Mytilicardes* Blainville (inv.) has first been latinized by Anton, 1838 as ***Mytilicardita*** and Linnaeus' *calyculata* originally selected as type. As such *Mytilicardita* is an objective synonym of *Cardita*.

Reeve, 1843 described a 33.6 mm ***Cardita distorta*** from the Red Sea. However, nothing close occurs there. Lamy (1922) well recognized *distorta* and placed it in New Zealand; but there no author accepted *distorta*. 3 syntypes are present in BMNH. The shape is rather solid, uniquely irregular, somewhat twisted, outside yellowish-brown, inside white. These rather large carditiids have been compared to ***C. aoteana*** Finlay, 1926 from NZ, Oamaru. They proved conspecific and Lamy's findings are here confirmed, without doubt *aoteana* is a junior synonym. The **type locality** of *Cardita distorta* Reeve, 1843 is herein corrected to NZ, Dunedin Harbour.

A somewhat related form, but consistently much smaller and more variable in color is found in S. Australia. This is usually termed ***C. excavata*** Deshayes, 1854 by Australian authors, neglecting Lamy's conclusion. However, Lamy (1922) depicted Lamarck's ***Cardita aviculina*** described from King Isl. and Shark Bay and demonstrated *excavata* as junior synonym. Lamy further depicted and synonymized ***Cardita citrina*** Lamarck, 1819 from Australia. As indeed yellow *aviculina* occur in NSW, this view is shared. Lamy further included Tenison-Woods ***tasmanica*** in synonymy, an action confirmed by Lamprell & Whitehead (1992 sp. 161). Specimens from Albany and Perth proved inseparable from NSW specimens. Thus, both *aviculina* locations of Lamarck appear correct. *C. aviculina* is understood as endemic S. Australian species; Lamprell & Whitehead gave for the synonymous *excavata* a distribution from WA-SA-NSW-Central Qld. Lamarck gives a maximum size of 24 mm; Lamprell & Whitehead state a maximum size of 25 mm, but usually *C. aviculina* grows less than 20 mm.

However, Lamy's further synonymy of ***Cardita muricata*** Sowerby I, 1833 (not preoccupied by *Chama muricata* Poli, 1795) is not shared. This is a valid species. The BMNH type series represents a distinct more solid, larger specimen, whitish outside, often purplish-brown colored inside. *Muricata* has been described from Polynesia, but is wider distributed westwards and extends to Indonesia, but is not as yet known from Australia. *C. muricata* is in shape closer to the well known *variegata*, but has a stronger, sharper ribbing, a ventrally stronger curbed shape and a distinct, weaker coloring. *Muricata* also grows larger than *aviculina* and is often found in excess of 25 mm. It is likely that ***C. albida*** Clessin, 1888 with a lost type is this species.

Lamprell & Whitehead (1992 sp. 160)'s attribution of tropical Australian specimens to *muricata* is not shared. The common Australian species, known at least from NWA, Cape Keraudren, Broome, NT, Darwin, Qld, Portland Roads to Turkey Beach grows much larger to almost 40 mm, is instead elongate in shape, less inflated and has usually a flatter ribbing. Instead, ***Cardita essingtonensis*** Deshayes, 1854 from Darwin matches precisely. Both, Smith and Lamy (1922) approached *essingtonensis* to Reeve's earlier ***C. pica*** from the Philippines, and Lamy formally synonymized the former with the latter. This action has been shared by Prashad (1932). Comparing specimens collected in the Philippines with a large variety of northern Australian ones, then these are indeed very close. Unless genetic data prove otherwise Lamy and Prashad are followed.

C. variegata is the most common and best known IND species. All specimens seen are quite uniform in white base color with dark-brown spots. Most characteristic is the strongly serrate interrib sculpture. Occasionally strongly spined forms occur, sharing the same interrib sculpture and colors. Deshayes in Maillard, 1863 reported *variegata* from Reunion. In addition, he described from there a similar species as ***C. caliculaeformis*** with a smooth interrib sculpture and more uniform colors. Oliver et al. (2004 fig. 8) depicted such a specimen, as *C. "variegata"*. Furthermore, the serrate interrib sculpture is also lacking in ***Cardita turgida*** Krauss, 1848 non Lamarck, 1819 from nearby Natal and SAF (Steyn & Lussy, 1998 sp. 888 *C. "variegata"*). All evidence points that a valid, but misunderstood species is present in the SW. Indian Ocean. In addition to more uniform colors with often lacking dark spots, the interrib sculpture is smooth, the shape is straighter, less expanded and the lunule trigonal, whereas in true *variegata* it is rounded to elongate. The largest specimens, more than 35 mm, are found in Natal, whereas specimens from further West are smaller and living deeper. As in *variegata* almost smooth ribbed and very spinose forms occur.

From above angle Reeve's 3 BMNH 1963689 syntypes of ***Cardita radula***, described from unknown locality, contain 2 distinct species. The large, beautifully colored depicted syntype pl. 1 fig. 2 is here selected **lectotype**. The smallest syntype is conspecific. These two have the same shape and interrib sculpture as *variegata* and are perceived synonyms; Lamarck's *subaspera* has the same colors. The 3rd specimen with weaker colors, straighter shape and smooth interribs may have originated from Natal and is the same as Krauss' preoccupied *turgida* (= *caliculaeformis*).

Cardita nodulosa Japanese authors non Lamarck, 1819 seems to be a small **undescribed** *Cardita*. It is definitely not close to Lamarck's solid large Australian *Megacardita*. A lot from off N. Borneo, Sarawak, carditiid shape, with 14 strongly spined ribs, from 75 m, approximately 4 mm seem to belong here, Okutani gives 15 mm. Obviously this species is common in Japan and should be described by Japanese authors.

Hayami & Kase, 1993 described ***Cardita uruma*** from subtidal caves from Ryukyu Islands. They compared it with "*nodulosa*" auctt. and stated it distinct. However, they did not compare with ***Glans kyushuensis*** Okutani, 1963 (type HIG01 B741). This is instead a *Cardita*, which has a very similar shape, also 20 scaled ribs and is also a small species. I fail to recognize *uruma* distinct. *C. kyushuensis* is widely distributed and has also been dredged in 100 m off New Ireland, 6.5 mm.

Following most modern authors ***Cardita crassicosta*** is understood as widely distributed, large, highly colored species, internally glossy white, which extends into the Indian Ocean. As bright red colors are common, it is not excluded that some enigmatic Indian Ocean *C. nodulosa* or *C. rufescens* records are instead referable to Lamarck's *crassicosta*. *C. nodulosa* is only known from Australia and *C. rufescens* only from W. Africa.

Cardita senegalensis Reeve, 1843 is a well known, common WAF species. It usually occurs in brownish color, but bright red specimens are occasionally found. ***Cardita rufescens*** Lamarck, 1819 was described from unknown locality and then placed in the Caribbean or in the Indo-Pacific. However, as concluded by Dautzenberg (1891) and well curated the 35 mm MHNG holotype is without a doubt conspecific and the earlier name for *senegalensis*. The **type locality** of *Cardita rufescens* is here clarified as Senegal, where many such specimens have been personally collected. *C. rufescens* is too close, also in dentition, to the European type species to justify any subgeneric distinction under ***Jesonia***. Lamy (1922) clearly synonymized *Jesonia* and Hain (1985) arrived at the same conclusion.

Lamy (1922) stated Philippi's ***C. excisa*** from Hawaii as close to the type species. Kay (1979) listed ***Cardita excisa*** Philippi, 1847 from Insulae Sandwich as height 1 mm; length 2 mm species and stated not recognized since. However, *C. excisa* has been precisely described p. 91 sp. 28 as height 6.4 mm, length 10.6 mm with 19 ribs similar to *calyculata* but with a more sinuous ventral portion. There is no doubt that *excisa* matches the OD of ***Arcinella thaanumi*** Dall, Bartsch & Rehder, 1938 precisely. According to Sherborn *C. excisa* has been validly proposed and is not preoccupied. *A. thaanumi* is a junior synonym.

Kay (1979) synonymized the 3 remaining DBR species ***cruda***, ***laysana*** and ***hawaiensis*** together with Sowerby's *muricata* with Lamarck's endemic *aviculina* from S. Australia. This view is not shared. Inferring from Dall, Bartsch & Rehder's OD, synonymy with *muricata* is highly unlikely. However, it is not excluded that various sizes of the same Hawaiian form were described as three distinct species. For the time being the most common ***Cardita hawaiensis*** (Dall, Bartsch & Rehder 1938) is here selected to represent this species.

Inferring from the much smaller maximum size and the lower number of scabrose ribs the Panamic "*aviculina*", i.e. Isla del Coco, off Panama is neither Lamarck's, nor Dall, Bartsch & Rehder's but instead an **undescribed** Panamic species.

QH3: ***Beguina***: Although the BMNH type series is quite uniform, in reality ***B. gubernaculum*** is a highly variable species, encompassing white, brownish or mixed, short broad to very elongate, and strongly to weakly ribbed forms. It is basically an Indian Ocean species.

QH4: **THECALIINAE** contains small, byssate carditiids with the rare, clearly expressed sexual dimorphism. The female has an invaginated incubatory chamber at the ventral margin, whereas the males have straight ventral margins. Globally two genera were recognized. Whereas the SAF ***Thecalia concamerata***.shares many features with *Cardita*, ***Milneria*** represents a marked distinct lineage, but its phylogenetic relations are unknown. Except sexual dimorphism there is not much to connect these two genera.

However, there is a further, obviously unrecognized brood chamber species from NZ. Finlay, 1926 described ***Cardita brookesi*** as small species, without serrated interribs against *Cardita variegata*. Powell (1979) clearly indicated the outgrown marsupial chamber in some. As in *concamerata* this chamber is present in female specimens, whereas males have a straight ventral margin similar to *Cardita*. Here ***Powellina*** is proposed as new genus within THECALIINAE. *Powellina* contains a small, transversely trapezoidal, and inflated as adult, strongly ribbed *Cardita*-like species with an external, expanded outgrown, shelly brood chamber in females. The lunule is deep, small and heart shaped. Maximum size known is 16.5 mm (Auckland area). This new genus is so far monospecific and accommodates the New Zealand *Cardita brookesi* Finlay, 1926 as type species, OD. The new genus honours A. W. B. Powell for his truly outstanding contributions to our knowledge of the New Zealand molluscan fauna. Compared to *Thecalia* the new genus has an external brood chamber, situated ventrally and not an internal one. In addition, the surface sculpture disposes of 15-20 strong, densely lamellate scaled, very close set ribs, whereas in *Thecalia* the ribs are fewer, weaker, and distantly placed. The lunule in *Powellina* is deeply inset, heart shaped and not weak and elongate. *Milneria* has also an external brood chamber. However, the brood chamber is level with the ventral margins and covered by a periostracum. In *Powellina* it is an outgrown, shelly, almost smooth part of the surface sculpture and no periostracum is visible. In addition, *Powellina* has about double the rib number of *Milneria*, without the typical angulation of the latter. The interstices are small, smooth, without any crossbars. The lunule is heart shaped deeply inset and not elongate and comparatively weak.

Overall, ***Thecalia*** and ***Powellina*** are closer to each other and approach *Cardita*, whereas ***Milneria*** is marked distinct and its correct placement in THECALIINAE is doubted. Genetic data is missing.

QH5: ***Cardites***: Sherborn considered *Cardites* and *Cardites antiquatus* as validly proposed. Chavan in Moore (1969) accepted *Cardites* also as valid and based on this his new subfamily CARDITESINAE. The type species is the European *antiquatus* with a depressed, shallow, elongated lunule.

Overall, various groups are placed in *Cardites*. Possibly, phylogenetic data may give a better base for recognition of more than one additional genus.

Cardites rufus from the Red Sea is quite variable in color and shape. Lamy (1922) recognized that Reeve's ***C. angisulcata*** from unknown locality is the same. In addition, there is an enigmatic ***Cardita castanea*** Deshayes, 1854 described from Australia, but never recognized there. Lamy approached it to *rufus*. *C. castanea* has been well depicted by Deshayes fig. 11 and 3 BMNH syntypes are present. The ribbing and the coloring clearly reveal that *castanea* is a Red Sea species and a junior synonym of *rufus*. Its type locality is herein corrected accordingly. Furthermore, Deshayes, 1854 described another enigmatic ***Cardita jukesi***, also from Australia, depicted as fig. 14. The figured syntype is present and proved synonymous as well. The type locality is corrected herein accordingly. *C. castanea* was based on smaller, more ovate *rufus* specimens, *jukesi* on a larger, more than 35 mm and more elongated specimen. This development is continued in the largest *rufus* currently known, 51.9 mm, Hurgada, beach collected there in 7/85, which approaches a rectangular shape. *C. rufus* is currently only known from the Red Sea and Prashad (1932)'s Indonesian records should be re-examined.

C. floridanus is also in dentition and lunule cognate to ***C. laticostatus*** but not to *affinis* or to *radiata*. Both are not very typical *Cardites*, but match here also with respect to mode of live better than in the strongly byssally attached *Carditamera*. ***C. micellus*** and ***C. beebei*** do neither fit *Carditamera* nor *Cyclocardia* and both are placed here. These two are even closer to the European type species than are *floridanus* and *laticostatus*.

Close to the PAN ***C. grayi*** is the WAF ***C. umbonata*** Sowerby III, 1904. This uncommon species is even more inflated and oblique. From the OD there is no doubt, that

Actinobolus africanus Marrat, 1878 from WAF meant Sowerby's species. However, this name was not found used anywhere; the sparse listings (LAM22, NIK55, FNN93, ARC04) all used *umbonata*. Bernard (1984 fig. 235) depicted *umbonata* well from Gabon and Dance (1977 p. 244) from the "Panamaic Province". *Actinobolus africanus* Marrat, 1878 is a forgotten name and here declared nom. obl. based on ICZN Art. 23.9.2. Thus, ***Cardita umbonata*** Sowerby III, 1904 is a **nomen protectum**.

Based on BMNH type material Smith (1885 p. 211) synonymized ***C. cardioides*** Reeve and ***C. cumingii*** Deshayes with ***C. canaliculata*** **Reeve**. The two BMNH type series of *cardioides* and *canaliculata* are indeed very close. Both species were described by Reeve in 1843, and both from the Philippines. Larger specimens seem to become slightly more elongate with a few ribs more, whereas smaller specimens are more ovate with a few ribs less. Thus, Smith's view with respect to *cardioides* is followed. As such *Cardites canaliculatus* is a rather inflated ovate species with approximately 20 (range 16-24) squarish ribs. The base color is whitish with brown streaks, but almost all brown and almost all white specimens occur. Internally it is white with a brownish hue. It is usually found between 15-20 mm, exceptionally to 22 mm. In the Philippines it occurs from about 20-150 m.

On the other hand, I do not share Smith's synonymy of ***C. cumingii*** Deshayes, 1854. This species has been described from Borneo, is more elongate and attains with 44.2 mm almost twice the size of the many *canaliculatus* seen. Specimens referable have been collected off N. Borneo and here also juveniles show this distinct more elongate shape. The outside colors are similar; but inside *cumingii* is white, weakly brownish tinted in the lunular area only. ***C. crenulata*** Deshayes, 1854 also from Borneo, with 2 BMNH syntypes less than 15 mm is understood as juvenile form.

Tentatively in *Cardites* placed is also ***Cardita cooperi*** from the Indian Ocean. It has been described from a single specimen found dead in deeper water off Saya de Malha Banks and reported by Viader (1937) from the Mascarenes. The lunule is small, close to the type species, but the 20 ribs are stronger sculptured. Melvill, 1909 originally stated 20 mm, the illustrated specimen from the Maldives is considered conspecific and measures 22.2 mm.

QH6: ***Carditamera***: The extant monospecific WAF ***Lazariella*** is in dentition, but also in shape not close to ***Carditamera*** and here generically separated. Hain (1985) noted these differences as well. It is even not excluded that a genetic comparison shows a much closer relation of *Lazariella* to *Cardiocardita* than to *Carditamera*.

As understood by Chavan *Carditamera* is American and SE. Atlantic, nothing similar is known from the Philippines. Comparing Clessin's pl. 10 fig. 10-11 *philippinarum* with pl. 7 fig. 12-13 *californica* then Clessin's ***C. philippinarum*** from the "Philippines" is most likely a misplaced *affinis*. However, as no type material is present, *philippinarum* is best treated as nom. dub.

There is no doubt on the carditamerid character and very little doubt that Bruguière's precisely described ***Cardita pectunculus*** is the earliest name for the well known Caribbean ***Carditamera gracilis***. However, no locality was given; Dall (1903) did not accept this synonymy and Lamy (1922) considered *pectunculus* "énigmatique". As no type could be located, *pectunculus* must be treated as nom. dub.

C. rolani from Sao Tomé is indistinguishable from juvenile *contigua*, personally collected in Ghana together with a larger, typical specimen. An adult and a juvenile *contigua* from Ghana are depicted. Furthermore, *contigua* is known from Mauritania-Gabon, Libreville, thus, neatly surrounding the Sao Tomé type location of *rolani*. Furthermore depth ranges and habitats are the same. Consequently, *rolani* is understood as juvenile *contigua* and here synonymized.

QH7: ***Cardiocardita***: Anton, 1838's selection of ***ajar*** is here understood OD. After his designation and definition, Anton listed ***ajar***, in addition, separately as No. 368.

Cosel (1995) treated the WAF species and described two new *Cardiocardita* increasing the number to 5 members.

Whether the rare S. Australian deeper water ***Bathycardita raouli*** has any close phylogenetic relation to the common, shallow water WAF endemic *Cardiocardita* is not confirmed at all. I am even not convinced that CARDITAMERINAE is the correct placement, and VENERICARDIINAE should be considered. Following Iredale (1924 and 1962) *Bathycardita* is at least generically separated.

QH8: ***Cyclocardia***: Here largely the outstanding view of Coan et al. (2000) is followed, who treated many of these difficult species.

Including also the beaded, inflated S. American forms (e.g. ***C. spurca***, ***velutina***, ***moniliata***) it is very likely that in addition to ***Crassicardia*** more than one further subgenus is justified to properly accommodate the variability in this large genus. However, until an in-depth global review has been accomplished, all species are placed as *Cyclocardia*. A generic separation of *Crassicardia* as proposed by Scarlato (1981) would, additionally, require substantial genetic support and is not shared.

Japanese authors consistently considered Dall's ***morsei*** as synonym of ***crassidens***. However, Coan (1981) considered *morsei* a probable synonym of the NW. Atlantic type species ***borealis***. The type of *morsei* is depicted in HAB780 figs. 5-8 and HIG01 B753s. From shape, higher number of ribs and hinge, Coan's view is shared and *morsei* is synonymized with the type species *borealis*. The original locality Sagami Bay or the labeled Japan, Kii are understood as erroneous.

From the material at hand, it is very likely that ***C. novangliae*** is indeed distinct from *borealis*, more ovate, more compressed, with very low, broader ribs and a lighter, more yellowish periostracum. The lunule is weaker and *C. novangliae* appears to grow only about half size of *borealis*. Its known range is neatly within the range of *borealis*, not as much south and not as much north.

Scarlato (1981) synonymized ***C. erimoensis*** Tiba, 1972 with his earlier ***C. rjabininae***. Scarlato's conclusion was consistently neglected by Japanese authors. However, from the material studied Scarlato's view is shared. *C. erimoensis* is considered a junior synonym and *C. rjabininae* much wider distributed than usually listed by Japanese authors.

As recognized by Lamy (1922 p. 324), Clessin (1888) tried to depict ***Cardita ferruginosa*** Adams & Reeve, 1850 in his monograph, but not, as assumed by Japanese authors, to describe a new species. In his usual sloppy manner Clessin stated in the text p. 17 "***Cardita ferruginea*** Adams, pl. 6 fig. 11" and on pl. 6 fig. 11 he stated "*ferruginea* Rve p. 17". He stated red ribs with a whitish area towards the umbones, gave 20 strongly crenulated ribs and a size of 19 mm. This description does not match the venericardiid *ferruginosa* Adams & Reeve, 1850 which has only approximately 15 rather smooth ribs. Instead it fits quite well the congeneric ***coreensis*** Deshayes, 1854, which may be red and has 20 ribs and surpasses 19 mm (Okutani, 2000 pl. 469 fig. 6). Thus, the misspelled, invalid *Cardita ferruginea* "Adams & Reeve" Clessin, 1888 non *Cardita ferruginosa* Adams & Reeve, 1850 is instead most likely a synonym of *Cardita coreensis* Deshayes, 1854 (= *Megacardita* s.l.) but definitely not a valid name.

Erroneously, Japanese authors applied this name to an unrelated, smaller sized, ovate *Cyclocardia*. Scarlato (1981 p. 337) has given the references since 1951. This Japanese *Cyclocardia* has also been depicted by Clessin (1888 as sp. 56 *Cardita "vestita"* Deshayes) from Japan; Clessin pl. 12 fig. 8-9 with 20 ribs and 17 mm, conforms to Habe (1971 pl. 55 fig. 13 *C. ferruginea*) or to Okutani (2000 pl. 469 fig. 12 *C. ferruginea*). True *Cardita vestita* Deshayes, 1854 has been described from Greenland and is an old synonym of the type species *borealis*. Scarlato (1981) stated ***Venericardia*** (***Cyclocardia***) ***ferruginea orbicularis*** Ogasawara, 1977 as further synonym for the Japanese "*ferruginea*". However, this name is multiple preoccupied. The first use found is by J. de C. Sowerby, 1825 in The Mineral Conchology of Great Britain p. 145 as *Venericardia orbicularis* for a similar British fossil. Consequently this well known Japanese *Cyclocardia* is still without name. Lamy (1922 p. 324) only mentioned Clessin's error, but did not propose any replacement. Here, ***Cyclocardia nipponensis*** is proposed as **nom**. **nov**. *Cyclocardia ferruginea* Habe, 1971 non *Cardita ferruginea* Clessin, 1888 nec *Cardita ferruginosa* Adams & Reeve, 1850. Habe (1971 pl. 55 fig. 13) stated the type locality from Kyushu to Hokkaido, very common on fine sandy bottoms of 50-400 m.

C. ***moniliata*** is basically an ARG species, as specimens rarely found in approximately 180 m off Uruguay and off Argentina witness. Dall's type locality Rio seems to be the northernmost locality known. In Argentina it grows a little larger, slightly in excess of 7.9 mm. Despite its minute size it shows stronger relations to *velutina* and *spurca* than to the type species. These 3 are rather inflated, with strongly beaded ribs and may merit subgeneric distinction, in case genetically confirmed.

Philippi, 1898 described a rarely reflected species, even overlooked by Lamy (1922). He named it ***Cardita magellanica*** from Tierra del Fuego, Almirantazgo Sound as 14 mm specimen with 15 granulated ribs, white with an olivaceous periostracum. Philippi stated it closely similar to *C. compressa*, but more inflated. However, his OD fits instead Smith's earlier *velutina* better, which occurs in this area, is inflated, has beaded ribs, and is white with an olivaceous periostracum. In general, the number of ribs in *velutina* is higher, usually approximately 20. Tentatively *magellanica* is associated with *velutina*, but the type which ought to be still present in Chile should be reanalyzed.

A larger ***Cyclocardia thouarsii*** has been depicted by Dell (1964 pl. 2) and ***congelascens*** synonymized. Dell stated both described as juveniles and adults as subquadrangular, longer than high. Unfortunately, he did not give a size. Inferring from his wording and comparisons adults may grow to 10-15 mm. Adult, elongated *thouarsii* have approximately 20 ribs as well, but these appear broader than in the narrower ribbed and the also more rounded-ovate *velutina*. Definitely, these two are close.

Thus, 21 extant *Cyclocardia* are globally recognized, which may once be grouped in at least 3 subgenera.

QH9: ***Pleuromeris***: The fossil type species ***V***. ***decemcostata*** is depicted in Chavan in Moore (1969 E51 3a-c). Fossil *decemcostata* from Florida compared to recent ***tridentata*** from Florida did not prove conspecific. The type MT is less rounded, more trigonal in shape with much fewer and rougher-ridged radial ribs. Although the name giving 10 ribs are in some fossils slightly surpassed, none was seen near the up to 20 ribs of larger recent *tridentata*. Say, 1826 stated 18 ribs for his 6 mm specimen.

The Panamic ***guanica*** is texture and in hinge condition, less in sculpture, very close to the fossil type species and likely fossil as well. On the other hand, it is probable that an extant *Pleuromeris* occurs off Panama in deeper water. However, too little material hinders progress.

Pleuromeris is perceived correctly placed in CARDITAMERINAE as proposed by Chavan in Moore (1969) and as accepted by US authors; the relations with VENERICARDIINAE are not perceived close.

The NZ ***P***. ***benthicola*** is understood as valid, minute bathyal species, compared to the narrower, shallow water *latiuscula*.

Venericardia (***Cyclocardia***) ***armilla*** does not belong in *Cyclocardia* and only somewhat doubtfully in *Pleuromeris*. At least its size exceeds all known *Pleuromeris* by at least twice. Unfortunately, no specimens were available.

QH10: ***Glans***: This largely misused genus is here restricted to very few species closely matching the European type species ***trapezia***.

Glans trapezia has been clearly referenced and is the only species named *Glans* by Megerle von Mühlfeld, 1811. Herrmannsen, 1846 does not seem necessary to confirm the type designation, OD.

This is a solid, quadrangular trapezoid, truncate, and inflated species, strongly inequilateral with nodulose ribs and strongly developed laterals. *G. trapezia* is basically a minute species, usually found less than 10 mm. However, WAF giants reach slightly more than 20 mm.

Close are the Caribbean ***G***. ***dominguensis*** and the Panamic ***G***. ***carpenteri***. However, the exact mode of life for *dominguensis* is not known as yet.

It is further not excluded that the rare, minute ***Cardita vaughani*** Viader, 1951 from the Mascarenes may eventually belong here.

QH11: ***Centrocardita***: Although the type species is Mediterranean, *Centrocardita* fits the IND species, often misplaced in *Glans* much better. The type species, OD ***Chama aculeata*** Poli, 1795 is antedated by Stroem, 1768 (SHE). As applied by some modern authors *Chama elegans* Réquien, 1848 is the next available name. This is a larger, more rounded species with noduled ribs which develop into spines posteriorly and weakly developed laterals. The lunule is deep, rose colored and heart shaped.

Oliver (1995) also accepted *Centrocardita* as full genus and placed here the uncommon *echinaria*, described from Arabian waters, extending to Indonesia (PRA), with about 25 ribs. ***Centrocardita echinaria*** is a bathyal species as are many *Centrocardita*.

Close is the also bathyal WAF ***inquinata***, as concluded by Hain (1985). Very similar to small *inquinata*, also all white but with 18 instead of 14-15 ribs is Deshayes ***Cardita belcheri***. Two small BMNH specimens are present under 1963696. These bear no locality, but conform quite well to the OD and are perceived as syntypes. Deshayes gave Philippines (Cubras) as type locality. However, no Cubras could be located and none of the many deeper water carditiids studied from the Philippines came close. Thus, *Centrocardita belcheri* is perceived as valid species but Deshayes locality is unconfirmed.

The colored group around the Japanese ***Venericardia hirasei*** matches *Centrocardita* quite well, definitely better than *Glans*. The base sculpture in *hirasei* is close to the type species, as are shape, lunule and dentition. However, *hirasei* has much more, approximately 30 ribs and grows larger, apart from a quite distinct coloring. *C. hirasei* is also well known from the Philippines, but variously named there.

Higo et al. (1999) synonymized the minute ***Glans pseudocardita*** Poutiers, 1981, described from the Philippines, with *hirasei*. However, the number of ribs is here only about 20, the shape is distinct and its characteristic internal purplish-brown coloring posterodorsally is not found in *hirasei*. Instead *Centrocardita pseudocardita* (Poutiers 1981) is considered a valid, small deeper water species, occasionally dredged in the Philippines. It is further known from shallower water in SChi, Beibu Gulf and EChi, Okinawa, Naha. The largest size seen is less than 15 mm.

From the material at hand it appears that in the Philippines 2 further, as yet **undescribed** *Centrocardita* occur. Both belong into the *hirasei*-group, have less than 20 sharp ribs and are currently only known from minute specimens.

Similar to *pseudocardita* is the Japanese ***sagamiensis*** with equally 20 ribs, but with a more ovate shape and a larger size. It seems restricted to Central Honshu. Nothing seen from the Philippines is close.

However, *hirasei* is not known from Australia and Lamprell & Whitehead (1992 sp. 165 cf. *hirasei*) is marked distinct in only about 20 ribs, smaller size and whitish with pink brown posteriorly. No name is known and this species appears to represent an **undescribed** Australian *Centrocardita*. Unfortunately, no material of this uncommon species was available.

Somewhat similar, with also 20, but stronger ribs and more elongate is ***V***. (***Megacardita***) ***soyoae*** from the Japan Sea; a syntype has been recently depicted as *Pleuromeris* (HIG01 B758). However, this species is neither a *Megacardita* nor a *Pleuromeris*, but instead matches *Centrocardita* in main features better. *C. soyoae* is a small species usually found at approximately 10 mm and in 100-200 m. It is also known from the East China Sea, but variously named there.

Another group encompasses solid, inflated, knobbed, reddish forms with a deep heart shape often reddish lunule. Here belong ***akabana*** from the Red Sea, ***millegrana*** from the East China Sea and ***rosulenta*** from Australia. Japanese authors placed *millegrana* in *Glans*, Oliver (1992) placed *akabana* in *Cardites* and Lamprell & Whitehead (1992) placed *rosulenta* in *Venericardia*. Tentatively all three are place here, but probably at least a new subgenus is necessary.

Okutani (2005) recently reported ***Glans quadrangularis*** (Nomura & Zinbo, 1934) (sic!) from off Okinawa. He stated it only known from fossils and proposed to include it as Shikaku-fumigai in the Japanese faunal list. However, earlier Koyama et al. (1981) included ***Venericardia quadriangulata*** Nomura and Zinbo, 1934 in the synonymy of *millegrana*. *C. millegrana* is a quite widely distributed species and moderately variable in shape and color. Here Koyama's view is followed and only one such species is recognized from Okinawa. The largest size found in Indonesia is almost 19 mm.

Also to the *millegrana*-group belongs ***Cardita gunnii*** Deshayes, 1854. This is a small, inflated, white species with 16 broad ribs. Its locality "Van Diemen's Land" is erroneous, at least from Tasmania nothing close is known. Definitely a synonymy with *bimaculata* as stated by Tenison-Woods (1878) or with *amabilis* can be excluded, as earlier stated by Iredale (1924) based on the analysis of the "BMNH type". In BMNH a single specimen is isolated as 1963695 from the Cuming collection. The wood board bears no locality, but the specimen conforms well to Deshayes OD. This species has been accepted as such by Iredale (1924). Deshayes did not mention further specimens; it is here understood as holotype. Iredale (1924) compared it with *elegantula* from China, but *millegrana* is even closer. *C. gunnii* is considered a valid, but not localized whitish, small *Centrocardita* with 16 broad ribs.

Lamprell & Whitehead (1992 sp. 166 **"*Venericardia*" *cardioides***) is not close to Reeve's Philippine *Cardites* syntypes. They reported "*cardioides*" from NWA, 25 mm, with 22-24 strong, raised, rounded noduled ribs. From specimens studied from Regnard Bay near Dampier, it may be added that the lunule is whitish, deep inset and heart shaped and the largest specimen is 28.1 mm. Slack-Smith & Bryce (2004) reported "*cardioides*" from the Dampier Archipelago as well, found at 4 stations, 0-17 m, on soft sediments, sandy mud, and fine silty sand. On the other hand, there is an old name, namely ***Cardita squamigera*** Deshayes, 1832, originally described without locality, but placed by Lamy (1922) in Australia. Obviously, Lamy did not find any type at MNHN and the interpretations of Reeve's fig. 14 (no loc.) and Clessin's pl. 12 fig. 11 (Australia) differ. However, Odhner (1917 pl. 1 figs. 18-19) unmistakably depicted Lamprell & Whitehead's sp. 166 from Cape Jaubert as *squamigera*, found down to 20 m and up to 27 mm. Admittedly, Odhner's interpretation does not perfectly fit Deshayes' figure on pl. 10 Mag. Zool. However, instead of renaming this common and basically well known WA species, Odhner's interpretation is here accepted. His depicted specimen came from NWA, Cape Jaubert.

Lamprell & Whitehead compared *squamigera* with the S. Australian ***rosulenta***, which grows much larger and is as adult more inflated and the ribs more nodose. *Rosulenta* is found in whitish-rose colors, whereas *squamigera* is typical in white-brownish colors. *Squamigera*, as interpreted by Odhner, appears better placed here than in *Cardites*.

Once better known it is probable that at least 3 subgenera are necessary to accommodate the 16 species placed in *Centrocardita*.

QH12: ***Vimentum***: From Iredale (1925) comments it is more likely that only one variable *Vimentum* occurs in S. Australia, instead of 2 or 3 as recognized by authors. Also the arguments for separation of ***excelsior*** from Smith's type species ***dilectum*** are not very convincing. From Lamprell & Healy (1998)'s figures only sp. 721, 722 and 725 are referable to *Vimentum*. According to Iredale (1925) Tate's true ***calva*** is fossil only.

Lamy (1922) approached here also *insignis* and *sweeti*. Both were not studied and the types not traced. However, from the OD ***Cardita insignis*** belongs unlikely here.

QH13: ***Arcturellina***: Higo et al. (1999) as before Koyama et al. (1981) synonymized Prashad's ***pelseneeri*** with ***hirasei***. This view is not shared. Instead ***Cardita*** (***Venericardia***) ***pelseneeri*** is perceived as valid species, significantly distinct from *hirasei*, with a more quadrate shape, less than half maximum size, with only 21 ribs and most notably a quite distinct sculpture and hinge. Moreover, whereas *hirasei* is moderately well placed in *Centrocardita*, *pelseneeri* fits instead into *Arcturellina* as defined by Chavan in Moore (1969). Interesting is the discussion in Hain (1985 p. 154) who obviously had an *Arcturellina pelseneeri* before him and not a juvenile *hirasei* and classified it correctly. *A. pelseneeri* is a rather commonly found deeper water species, described from 73-90 m, but extending down to 200 m. Generally, it measures less than 14 mm. Prashad (1932) stated many Indonesian localities. In the Philippines, it is well known from Aliguay trawls and has also been found in Okinawa, Miyako Isl. in 100 m.

Very close in shape, sculpture, color and bathymetric range to *A. pelseneeri* is ***A. pulcherrima*** (Sowerby III, 1904) from Cape Natal. A syntype is present in BMNH; others are in SAM (BA64). It is not completely excluded, that *A. pulcherrima* may once be synonymized with *pelseneeri*. However, currently it is only known with less, 19 ribs, and of smaller size, 11 mm. In addition, missing intermediary records and the unknown variability of *pulcherrima* indicate caution at this point of time.

Less common, but occasionally found in Philippine waters, e.g. Aliguay or off N. Borneo is an alabaster white species. This species is narrower in shape, has 18-20 ribs and the largest specimens studied has been slightly smaller than *pelseneeri*. These specimens proved conspecific with the BMNH type lot of ***Cardita elegantula*** Deshayes, 1854 described from Chinese Seas. This misrecognized species is instead an uncommon deeper water *Arcturellina*, likely also living in China waters. Indeed, Zhongyan (2004 pl. 144 fig. C) depicted "*Glans sagamiensis*" from the South China Sea, 16.1 mm, solid, inflated with 21 strong noduled ribs with strongly crenulated inner margins. This species does not match *Centrocardita sagamaiensis* at all (type HIG01 B755). It appears instead as *Arcturellina* at least quite close to *elegantula*. Unfortunately, no material from South China was available.

A further species referable here is known from a few small single valves from 40 m off NE. Borneo, whitish as well, but only with about a dozen broad ribs.

Another, a famous species, appears to belong here, namely Hinds' ***Cardita abyssicola*** from the Malacca Strait. As *elegantula* it is alabaster white. However, *abyssicola* grows much larger, to 20 mm, has more, approximately 30 ribs and the shape is subrectangular. As far as is known, this rare species has not been recollected. Nothing found as yet in Philippine waters comes close to the OD.

Finally, Smith, 1904 and 1906 reported specimens from E. India and the N. Andaman Sea as ***Cardita elegantula var. conferta***. However, from his OD *conferta* is distinct from both *elegantula* and *abyssicola*. As far as is known, the number of ribs in *Arcturellina* is quite stable. The types, likely at ZSI, were not traced. The Indian *abyssicola* records (HYL02) are most likely referable to *conferta*.

Thus, as stated by Chavan in Moore (1969), *Arcturellina* occur also recent with at least 5 uncommon IND deeper water species.

QH14: ***Purpurocardia***: Following Beu (2006), I am not aware that any extant species matches the fossil ***Venericardia***. Marshall (1969) proposed instead ***Purpurocardia*** for the NZ "*Venericardia*" ***Cardita purpurata***. This is a useful grouping for recent species similar, but distinct in sculpture and hinge from true ***Venericardia***. Together with ***Megacardita*** and an eventually undescribed genus for the Japanese species, *Purpurocardia* is the only recent genus fitting VENERICARDIINAE of Chavan well.

Purpurocardia purpurata (Deshayes, 1854) is quite common in New Zealand. Sherborn's quotation of an earlier **"*Venericardia quoy*"** Gray in Dieffenbach, 1843 p. 256 is in error, Gray's passage reads "192. *Venericardia*. *Quoy*. Venericardia australis. *Quoy et Gaim.*; ii. 480, t. 78, f. 11-14". Gray clearly saw the earlier, but preoccupied *australis* placing it in *Venericardia*. The preoccupied *australis* has been renamed ***Cardita quoyi*** by Deshayes, 1854 and placed in Australia. Consequently *quoyi* has been applied by Australian authors for specimens found in deeper water off Victoria and Tasmania. However, based on BMNH type material Fleming (1951) well discussed *purpurata* and synonymized Deshayes *quoyi* and *difficilis* with the earlier *purpurata*. Specimens studied from off Victoria, 100 m, 22-24 mm are indeed indistinguishable from equal sized specimens from New Zealand. Here, Fleming's conclusions are confirmed. Lamprell & Whitehead (1992 sp. 170 "*Venericardia quoyi*") is *Purpurocardia purpurata*. This species occurs commonly in NZ and rare, deeper water in S. Australia.

The 5 mm syntypes of ***Venericardia australis*** Lamarck, 1818 which ought to be at MHNG were searched for intensely in 5/09. However, neither in the Lamarckian recent collection, in the Lamarckian fossil collection, in the general recent collection, nor in the general fossil collection was anything found. The types are lost. As the many trials in the past witness, without types no unambiguous interpretation is possible. *V. australis* Lamarck must be considered a nom. dub.

The small S. Australian ***bimaculata***, less than 15 mm, fits well into *Purpurocardia*. This is a highly variable species in color; somewhat less in shape. The ribs vary between 15 and 20, slightly broader in some or narrower in others. Comparing specimens from various SA locations with NSW specimens I was not able to differentiate Cotton's *propelutea*. As weakly admitted by Cotton in 1961 ***Venericardia propelutea*** is perceived as further synonym of *bimaculata*.

A more fragile species is the S. Australian ***amabilis***.

However, a lot studied from NSW, Cronulla identified by T. Iredale only had 24 ribs instead of the 28 indicated by Lamprell & Whitehead (1992 sp. 168). As such these specimens fit the number indicated for ***Venericardia delicatum*** Verco, 1908 from SA, Cape Jaffa. *Delicatum* is by no means a *Vimentum*, where usually placed by authors. Instead, all evidence points that *V. delicatum* is only the juvenile form of *amabilis*, which is known as adult from the same depths and the same localities. Hain (1985) placed *amabilis* tentatively in *Arcturellina*. This is a challenging view. However, from biogeography, shape, sculpture and affinity to *bimaculata*, *amabilis* is retained here. Phylogenetic data will once decide its true affinities.

The rare ***cavatica*** seems to belong also here.

QH15: ***Megacardita***: The number and naming of these huge Australian species is difficult. In addition, hybridization may occur in this group. Lamprell & Whitehead (1992) only recognized 3 species ***incrassata***, ***marmorea*** and ***preissii***. However, in addition, 5 other Australian species belong here, namely Lamarck, 1819's ***depressa***, ***nodulosa*** and ***turgida***, Menke's ***rubicunda*** and Deshayes' ***sowerbyi***. Lamy (1922) depicted Lamarck's types, most others, especially Deshayes' *sowerbyi* are in BMNH.

Finally, it transpired that instead of 3, 4 species are present in Australia and that only Lamprell & Whitehead (1992 sp. 159 *preissii*) was correctly named, though erroneously placed in *Cardita*.

As demonstrated by Lamy (1922) Sowerby's *incrassata* is a junior synonym of Lamarck's ***turgida***. The 3 BMNH syntypes of Deshayes ***sowerbyi*** proved to represent this inflated, heavy species as well.

On the West coast a 4th species is present, well depicted by Wells & Bryce (1988 sp. 595 "*incrassata*"). This is a rose-red, medium sized form with broad, rather smooth ribs and narrow interstices. It conforms well to Lamarck's ***depressa*** and Menke's ***rubicunda***. As recognized by Lamy (1922) ***Megacardita depressa*** (Lamarck, 1819) approaches closest of the 4 Australian species Sacco's fossil type species ***Megacardita jouanneti***. Compared to Lamarck's *turgida*, his *depressa* is more depressed, more rounded, the umbones less prominent. *Depressa* is generally red to rose-white colored, the ribs are broader and lower and the interstices narrower. *Depressa* also remains smaller than *turgida*.

One of the most difficult species was Lamarck's 32 mm ***Cardita nodulosa*** from Australia, Shark Bay. Lamy (1922 pl. 7 fig. 9-10) depicted the Paris syntypes. Unfortunately, Lamy then added a confusing synonymy combining a variety of unrelated species. Consequently, *nodulosa* was even depicted from 450 m off Japan as 15 mm species, whereas Lamprell & Whitehead (1992) did not even mention it. Fortunately, a further small syntype ink marked 17 is present in Geneva, MHNG 1085/89 which allowed a detailed study. Together with the Paris material a clear diagnosis was possible. Lamarck stated Australia, Shark Bay as locality, the shell oblong-trapezoidal, reddish, with 16 rounded ribs. The type locality is correct; at least in Broome this species is quite commonly found, extending NE to Qld. *Cardita nodulosa* is from shape, sculpture, hinge and texture an Australian *Megacardita*. There are not many species left fitting. *M. turgida* and *M. depressa* were already described by Lamarck, 1819 himself and *M. preissii* is distinct in shape, lower ribbing and size. Reeve (1843 fig. 19) does not match in ribbing and shape, but his fig. 12 *marmorea* fits. Furthermore, *marmorea* is a quite common species. It is found in WA and is occasionally seen in reddish colors. *M. marmorea* shares also the number of ribs, the dentition and the shape. There remains no doubt, that ***Cardita marmorea*** Reeve, 1843 is a junior synonym of ***Megacardita nodulosa*** (Lamarck 1819). *Marmorea* was originally described from larger and posteriorly smoother ribbed specimens than Lamarck's series with smaller and posteriorly stronger sculptured specimens. As *nodulosa* is the narrowest and most elongate of the 4 Australian *Megacardita* it is likely that it also grows largest. Lamprell & Whitehead (1992) gave 70 mm, a specimen measured in BMNH is almost 100 mm, but commonly *nodulosa* is found between 40 and 50 mm.

Usually, the Japanese species around *ferruginosa* are also placed in *Megacardita*. However, from Sacco's OD and Chavan's interpretation *Megacardita* instead fits the large and rather inflated Australian species with a stronger hinge. It may be that, once genetic data is available, a distinct Japanese genus in VENERICARDIINAE will become necessary. The number and naming of these Japanese species is difficult. 5 names are available. Following Higo et al. (1999) it appears that only 3 species are present. These are placed in ***Megacardita* s.l**. The oldest, a Samarang species, is ***C. ferruginosa*** (HIG01 B743) with an erroneous type locality. This is the smallest, a colored, quadrate form, highly variable in color and shape with rounded ribs, smooth or with a very weak commarginal sculpture. Sowerby's ***kiiensis*** and Yokoyama's ***cipangoana*** have been synonymized by most Japanese authors.

The second species, growing larger, with approximately 20 stronger, commarginally sculptured ribs is Deshayes ***coreensis*** and likely also Clessin's ***"ferruginea"***.

The 3rd species, Habe & Ito's uncommon ***koreana*** (HIG01 B744), is in size and rib sculpture close, but has only about half the number of ribs than *coreensis*.

The WAF ***monodi*** is perceived morphologically closest to this probably unnamed Japanese group, but likely, phylogenetic data may reveal a further, monospecific genus.

QH16: MIODOMERIDINAE:

Both ***Cardita minuta*** Scacchi, 1836 and ***Cardita corbis*** Philippi, 1836 were proposed in 1836. According to Sherborn, this reads 31.12.1836 for both. Cretella et al. (2004) stated Philippi (1844 p. 41) as first reviser, selecting his *corbis* over *minuta*. This interpretation has also been shared by Gregorio (1885) who listed *corbis* before *minuta* and by CLEMAM. Philippi (1844) further synonymized Dujardin, 1837's France fossil ***C. nuculina***, a view confirmed by Gregorio and Lamy (1922). However, despite Dall (1903)'s and Iredale (1915)'s views, as stated by Marwick (1924), the French fossil *Venericardia* ***unidentata*** Basterot, 1825 appears to represent a distinct species with a different sculpture (see also LAM22).

Gregorio, 1885 proposed ***Coripia*** as subgenus within *Cardita* for *unidentata*. At first he formally synonymized herein *corbis*, *minuta* and *nuculina*, but on page 154 he admitted *corbis* as variety. P. Fischer, 1887 selected as type SD *Coripia*, *Cardita corbis* Philippi, 1836.

The *Coripia* hinge of Chavan in Moore (1969 E53 2) should be replaced by van Aartsen (1985 fig. 3) which reflects reality better. Despite the synonymies of many authors, the two type species of *Pteromeris* and *Coripia*, ***perplana*** and ***corbis*** are in inflation and shape, in quite distinct sculpture, in dentition and in marginal crenulation by far distinct enough to be placed in two separate genera. Likely, these two genera even represent quite distinct lineages.

Coripia is much closer to the fossil ***Miodomeris*** than to *Pteromeris* in hinge, sculpture and shape. A subgeneric relation as proposed by Chavan in Moore (1969) to ***Pteromeris*** does not match. Instead Chavan's *Miodomeris* could be understood as subgenus of *Coripia*. At present *Pteromeris* is recent monospecific Caribbean, whereas *Coripia* encompasses up to 5 extant E. Atlantic species.

In addition to the type species ***corbis***, a further *Coripia*, ***jozinae*** from the Med was added by van Aartsen, 1995. Close are also SAF forms, e.g. *elata* and *agulhasensis*. This affinity has also been stated by Lamy (1922).

Sowerby III, 1892 described ***C. elata*** from comparatively large 5 mm valves and stated 16-17 rounded radiating ribs. Bartsch, 1915 described ***africana*** based on smaller 3.1 mm valves with 12 rounded radiating ribs. Barnard (1964) recognized them as synonymous, describing various growth stages only.

He then added a second species ***fortisculpta***, 3.5 mm with 8 rounded ribs, also found at the same locality as *africana*. Comparing Barnard (1964 fig. 20g) with Bartsch (1915 pl. 48 fig. 3), then these two are at least close, mainly differing in rib number.

A further species was described as ***Cardita*** (***?***) ***minima*** Smith, 1904 also from Port Alfred. However, this name is preoccupied by the Trinidad fossil *Cardita minima* Guppy, 1867. ***Venericardia*** (***Miodontiscus***) ***agulhasensis*** Thiele & Jaeckel, 1931 (Aghbas) is the next available name as synonymized by Barnard (1964). This species is very close to *elata* as well, but stronger commarginally sculptured and the ribs much less pronounced.

Thus, 2 *Coripia* occur in the Med and up to 3 *Coripia* may occur in SAF waters.

Finally, Barnard, 1964 described the incubatory ***Venericardia nuculoides***, depicted in 1969 fig. 29 a-c. *Nuculoides* does not fit here, but its correct placement is unknown.

6.35 CONDYLOCARDIIDAE

QI1: Middelfart (2002) excellently reviewed the Australian and predominant portion of this neglected family; Salas et al. (1990-91) added the smaller E. Atlantic and Coan (2003) the E. Pacific portion. Lacking is the W. Atlantic part, from where currently only 2 species are known. Inferring from WAF and PAN results, up to 10 **undescribed** condylocardiids may be expected in CAR. Further undescribed species have been mentioned by Zelaya (2005, 2 MAG), COA031 (1, Galapagos), MID02 (2-3, NZ and Micr).

On the other hand, there is a strong morphological resemblance between some condylocardiids from SAF, St Paul & Amsterdam, S. Australia and New Zealand as stated by Middelfart. It is not excluded that fewer, but more widely distributed IND species are present. Consequently, Oliver et al. (2004) synonymized Middelfart's ***Condylocuna tricosa*** with ***C. io***. Considering the brooding mode of reproduction, this decision as well as the affinities among some further species should be confirmed by broader collecting and by genetic analyses.

Another crucial topic here is the **familial composition**. Middelfart (2002 p. 111) restricted CONDYLOCARDIIDAE to minute species with an internal ligament only. He elaborated the subfamilies CONDYLOCARDIINAE (MID02) and CUNINAE (MID021). Consequently he excluded small species close to these groups, but with an external ligament (*Carditellona*, *Carditellopsis*) or with both an external and internal ligament (*Carditella*). However, the large majority of authors before Middelfart, especially Dall, Lamy, Dell, Salas and after Middelfart, e.g. Coan (2003) placed *Carditella* and *Carditopsis* as condylocardiids. Overall, these groups appear indeed better placed here than in CARDITIDAE.

Following Japanese authors, **CARDITELLINAE** Kuroda, Habe & Oyama, 1971 is here applied as third subfamily within CONDYLOCARDIIDAE for these closely related minute species, with a not exclusively internal ligament. Following Iredale & McMichael (1962)'s basic idea, most modern authors included here ***Carditella***, ***Carditellona***, and ***Carditellopsis*** (i.e. HIG99). Furthermore, the closely related ***Carditopsis*** is here added. Faute de mieux also ***Hamacuna*** with an external or inframarginal and dorsally extended ligament and with a hinge configuration similar to *Carditellopsis* and the closely similar Hawaiian ***Stenolena*** are here included. ***Saltocuna*** was declared lucinid by Middelfart (2002). However, this decision is not shared by lucinid specialists and *Saltocuna particula* (Hedley, 1902) needs further analyses. Thus, CARDITELLINAE encompasses 6 genera, without the doubtful *Saltocuna*.

Boss (1971) recognized 10 global condylocardiids. At present CONDYLOCARDIIDAE are understood as large bivalve family with clearly more than 20 genera and likely more than 150 species, many as yet undescribed.

Overall, our knowledge of this family is just at the very beginning. CONDYLOCARDIIDAE may look quite distinct after 3 further generations of researchers than is here understood.

QI2: ***Condylocardia***: Middelfart in Coan (2003) only considered the Panamic ***C. elongata***, ***kaiserae*** and ***koolsae*** matching true *Condylocardia*. Consequently ***C. digueti***, ***hippopus***, ***sparsa***, ***fernandina*** and ***geigeri*** appear misplaced. Obviously, the mainly Australian *Condylocuna* does not match well either. Instead, it seems that a renaming of the ICZN-invalidated Panamic ***Hippella***, representing a distinct E. Pacific genus could easily solve this issue. However, a phylogenetic analysis is deemed necessary to support such a move.

QI3: ***Propecuna***: If Barnard, 1964's ***lunulata*** should indeed prove distinct from fresh ***africana*** material, then a new name becomes necessary.

QI4: ***Carditella***: The type species ***pallida*** has been described from S. Chile and also occurs there. Forcelli (2000 sp. 525) conforms to the BMNH-syntypes. As such *pallida* has 14-15 ribs with narrow interstices and a somewhat trigonal-quadrate shape reaching 7.5 mm in South Chile as recently demonstrated by Reid & Osorio. *Pallida* seems confined to S. Chile.

As stated by Smith (1881) Reeve's ***tegulata*** is markedly distinct. The BMNH 1967583 syntypes show less, much stronger and raised ribs with wider interstices, the shape is less triangular, more quadrate. However, the syntypes do not conform to any "*tegulata*" of S. American authors. *Tegulata* was originally described from Chile, Valparaiso. Ramorino (1968) diligently analysed the bivalve fauna in Bahia de Valparaiso. He did not find *tegulata* there, only the more elongated *C. naviformis*. Thus, it may be quite safely to conclude that the original locality of *tegulata* is erroneous. "*C. tegulata"* of Forcelli (2000 sp. 526) from Magellan Strait is instead a larger *naviformis* than his smaller sp. 524. Reid & Osorio (2000 fig. 7J "*tegulata*") from S. Chile instead very closely approaches the type locality, the trigonal morphology and low ribs of true *pallida*; their fig. 7K not matching true *flabellum*, identified by Coan (2003 p. 59) as *tegulata*, might despite the not mentioned external ligament be conspecific. Significant is their reported size of 7.5 mm, which makes *pallida* one of the largest *Carditella* known. Soot-Ryen (1959 pl. 1 fig. 11) and Marincovich (1973 fig. 9) "*tegulata"* fit instead well preserved ***C. semen*** Reeve, 1843 better. Dell (1964) obviously studied the BMNH *tegulata*. At least his fig. 8 is much closer to Reeve's depicted syntype than Soot-Ryen's *semen*. Unfortunately, Dell did not depict any authentic MAG *tegulata* material, instead, he quoted Soot-Ryen's distinct species and erroneous distribution. All evidence points that *C. tegulata* Reeve, 1843 is **mislabeled**. As concluded by Dall, Bartsch & Rehder (1938) closest in shape is indeed ***C. hawaiensis*** from Hawaii. Inferring from Kay (1979 fig. 180E) *C. hawaiensis* has not, as stated by DBR "the ribs much narrower". Instead Kay's figure is very close to the BMNH type series of *tegulata*. Nonetheless, fresh Hawaiian material should be compared to confirm above conclusion. ***C. tegulata*** should be removed from S. American faunal lists.

In addition, to ***C. naviformis*** and ***C. pallida***, ***C. semen***, (= "*tegulata* auctt.") appears to represent a common and widely distributed species. Reeve, 1843 described ***C. semen*** from N. Chile. Inferring from the various records this species ranges from at least Peru, Callao down to S. Chile. There is little doubt, that Dunker's, not preoccupied, ***Cardium parvulum*** is this species. The type appears lost (not MfN). *Semen* also occurs inside colored. Following Dell (1964) Philippi's preoccupied ***Cardium pygmaeum*** with missing type material is treated as nom. dub.

C. exulata has been described from Tristan de Cunha, also found in Gough Isl. Dell (1964) reported it from WS88 Falklands, 118 m. However, a presence in S. America proper needs confirmation. Stempell (1899) only reported *exulata* from there, but not the similar *naviformis*, which reliably occurs in MAG. From the available data *exulata* stays smaller and lives deeper than the shallower and much larger, but morphological similar ***naviformis***. Instead of 5 as listed by Soot-Ryen (1959), it seems that only 3 *Carditella* are found in southern South America.

As analysed by Dell (1964) the Australian ***Vimentum jaffaensis*** is close to *exulata* and placed here, but not where originally described.

A quite similar species, but closer to *exulata*, 4.1 mm, brooding as well, has recently been described by Oliver & Holmes, 2004 from Rodrigues Isl. as ***Centrocardita pileolata***. Instead, this species appears condylocardiid.

Whether Thiele & Jaeckel's 3 SAF deeper water species, especially ***similis***, but also ***subradiata*** and ***valdiviae*** are indeed correctly placed here, has not been verified. All type series are in MfN, Berlin. Barnard (1964) accepted all three as *Carditella* and gave some additional information. However, ***Carditella subradiata*** Thiele & Jaeckel, 1931 is preoccupied by Tate, 1889 (= *Cunanax*). Should this SAF species prove valid, then a new name becomes necessary.

QI5: ***Carditellopsis***: Iredale & McMichael (1962) just recognized the type species ***C. elegantula*** from NSW. ***C. infans***, originally described from S. of New Guinea appears congeneric.

As stated by Cotton (1961) also ***C. valida*** appears to represent a true *Carditellopsis*, mainly known from SA.

As recognized by Habe (1971 pl. 56 fig. 1), Yokoyama, 1922's ***C. toneana*** (pl. 13 fig. 6-7) appears indeed to fit here. ROBBA's synonymy with *Carditellona pulchella* is also specifically erroneous. The latter is marked distinct as recognized by Habe (1971 p. 180). Hylleberg & Kilburn (2003) reported both species in their correct generic placement from Vietnam.

Oliver & Chesney, 1997 described ***C. martyni*** from Masirah. It is assumed that their somewhat enigmatic remark "the only related … " with respect to ***Carditella concinna*** includes external ligament without a central resilifer. However, the OD does not give any hint of this, and the type of Melvill's species from Karachi was not studied.

QI6: ***Carditopsis***: The type species, OD ***C. flabellum*** Reeve dates as of 1843. However, Orbigny's ***C. malvinae*** was proposed earlier on pl. 84 n. & f. This plate has been dated **1842** by Coan et al. (2000).

Cuna coxii Eames & Wilkins, 1957 appears to be a fossil Arabian *Carditopsis* only. The congeneric extant species is ***C. majeeda***.

Carditopsis dartevellei Nicklès, 1952 appears to be a Gabon fossil only. The congeneric extant WAF species is ***C. gofasi***.

The minute ***Carditella shimojiensis*** from subtidal caves in Okinawa and the Philippines is in missing outer ligament and large central resilium pit as well as in sculpture, better placed in *Carditopsis*. As concluded by Higo et al. (1999) *Carditella* s.s. does not match this condition.

Whereas in the SAF ***C. capensis*** an external ligament is present, I could not detect any in ***Carditella rugosa*** also described from there and accepted by all authors consulted as true *Carditella*. Instead, Sowerby's comparatively large and rather common species has only a central resilifer and is consequently misplaced in *Carditella*. It shares many features with *Carditopsis* and is tentatively placed here. However, the comparatively giant size of up to 10 mm leaves some doubts.

The SAF ***Carditopsis alfredensis*** Bartsch, 1915 does not match *Carditopsis* in dentition and sculpture. It shares some traits with *Warrana dielasma* and is tentatively placed in *Warrana*. The syntypes at USNM should be reanalyzed. Whether Thiele & Jaeckel's record from S. Angola is indeed referable to the same species is also open.

QI7: ***Hamacuna***, ***Stenolena***: The latter was originally doubtfully described as Hawaiian mytilid genus, where it does not match. Subsequently *Stenolena* was considered unplaced by most authors. However, all features together with the presumed deep water habitat and the rarity point to a position very close to *Hamacuna*. ***Stenolena hawaiensis*** Dall, Bartsch & Rehder 1938 is a rare species and has, as far as is known, not been found again since.

4 ***Hamacuna*** are uncommonly found in Australian and NZ deeper waters.

Furthermore, a lot of an **undescribed** species is present from Shark Bay, WA. Amazingly the hinge is closer to *Stenolena* and the smooth margins rule out *Hamacuna*.

Finally, Smith, 1885 described the enigmatic ***Circe obliquissima*** from off NE. Australia, Wednesday Isl., 10.5°S, 142.3°E. Both Harte and Fischer-Piette stated it non circinid or not venerid. The unique, oblique, 4 mm, white, single valve BMNH holotype is present. It appears to share most affinities with this group, but does neither fit *Hamacuna* nor *Stenolena* precisely. If locality and condylocardiid characters can be confirmed with fresh material, then presumably a new genus is necessary to accommodate this rare species.

6.36 CYAMIIDAE

RR1: This is another difficult family without any modern review or any phylogenetic data known. Many of these minute species are rare and barely known. Important is Ponder (1971) who treated many type species and synonymized GAIMARDIIDAE. Powell (1979) well depicted the NZ and some subantarctic species.

RR2: The number of valid ***Cyamium*** is difficult to assess. Here largely Dell (1964) is followed. In addition, Melvill & Standen (1912 and 1914) did not recognize Preston's Falkland ***iridescens*** distinct from their earlier, larger *falklandicum*. This appears likely. Forcelli (2000 sp. 517) bottom *falklandicum* is understood to represent this elongated species. Forcelli's two other figures, 517 top *cuneatum* and 516 *copiosum* are understood as within the variability of sp. 515 *antarcticum*.

RR3 ***Cyamiomactra***: Bernard's type species from NZ is smooth, umbonally colored and elongate-ovate, almost equilateral. Following Soot-Ryen (1959) the S. Australian ***C. mactroides*** with radial sculpture appears better placed in *Reloncavia* than here.

C. communis from SAU does not match *Cyamiomactra* either in sculpture, shape and hinge. It is tentatively placed in *Cyamium*, where it shares at least some features.

Whether Dell's radial sculptured ***falklandica*** is indeed correctly placed here, despite some similarities with *laminifera*, is open.

Following Dell (1990) it appears likely that Nicol's ***robusta*** is only a large ***laminifera***.

Lamprell & Healy (1998 fig. 453) is instead a *Legrandina*, their fig. 454 does not match the NZ *problematica*; their indicated size of 20 mm for *Perrierina bernardi* should read 2 mm.

RR4: ***Kidderia***: ***K. subquadrata*** has been variously placed. However, following Ponder (1971) and Powell (1979), Pelseneer's characteristic species is perceived closest to *Kidderia*. Whereas **Costakidderia** has a special sculpture, *subquadrata* has an unusual shape, with the beaks more central, compared to the type species ***minuta***.

K. fiordlandica is similar in shape to *subquadrata*, but has in addition the beaks capped by a prodissoconch; similarly as the more ovate, larger and northern ***auporia***. This feature is also present in the much larger ***marshalli***, which has been found at exactly the same locality and depth as *fiordlandica*. It can not be excluded that *fiordlandica* is only the juvenile form of *marshalli*. Ponder (1971) considered *marshalli* and *auporia* as untypical *Kidderia*, but did not differentiate them formally from *Kidderia*. It appears that subgeneric distinction is indicated, once better known. This group is currently placed *Kidderia* **s.l**.

It is also well possible that Powell's ***K. rakiura*** from Stewart Isl. is only the adult form of Suter's earlier ***K. acrobeles*** from the nearby Snares Isl. Unfortunately, in both cases no growth series were available for firm conclusions.

Cyamium commune Thiele, 1912 from Kerg is rarely addressed. However, there is no doubt, that *commune* belongs instead to *Kidderia*. Thiele depicted and compared *commune* with Pfeffer's *imitans* and stated the latter smaller, with broader umbones. On the other hand, Thiele (1912 p. 267-70) did not recognize Martens ***bicolor***. It appears that from color, shape, size and biogeography Thiele's *commune* is a synonym of Martens' earlier *bicolor* and Pfeffer's *imitans* is the same as Dall's earlier *minuta*.

Usually, ***Cyamionema*** is synonymized with *Kidderia*. Here, *Cyamionema* is at least subgenerically recognized. As *Costakidderia* the type OD *Cyamionema decoratum* has also a particular sculptural element, namely fine oblique radials centrally. This is found in Gould, 1850's earlier ***pusilla*** as well, whereas the erroneously synonymized *bicolor* has the typical smooth surface sculpture of *Kidderia* s.s. Forcelli (2000) sp. 507 *Cyamionema decoratum* **and** sp. 558 *Kidderia pusilla* are this species. However, there is an earlier ***Mytilus edulis pusillus*** Macgillivray, 1843 p. 236. Although accepted by Sherborn, this varietal name for a Scottish *Mytilus edulis* form is neither listed in CLEMAM, nor was it mentioned by Lamy (1936-37). It was not found in any European literature consulted and Dell (1971) could not trace this name. On the other hand, Gould's *pusilla* has been consistently recognized as valid Magellanic species (e.g. Dell, 1971 with 8 records 1850-1971; Linse, 1999; Forcelli, 2000). Here, ***Mytilus edulis pusillus*** Macgillivray, 1843 is declared a nom. obl. based on ICZN Art. 23.9.2. Thus, *Mytilus pusillus* Gould, 1850 is a **nomen protectum**.

RR5: ***Gaimardia trapesina*** (Lamarck, 1819): the 22 mm type species which ought to be at MHNG is not present. However, an old lot in the general collection bears 5 specimens from the Magellan Strait. The two smallest would concur with Lamarck's measurements and may serve, in case a neotype is really needed. These inflated, large, colored specimens otherwise conform to what is widely understood as *trapesina*, e.g. Forcelli (2000 sp. 555). *Trapesina* is a variable species in shape and colors and the most common MAG *Gaimardia*. Certainly, Rochebrune & Mabille, 1889 excelled in describing the same species 7 times from the same locality. Their type material is in MNHN. There is also no doubt, that ***Phaseolicama magellanica*** Rousseau in Hombron & Jacquinot, 1854 from the Magellan Strait represents Lamarck's species.

Morphologically, the NZ ***flemingi*** is hard to keep apart from the variable *trapesina* in shape and color; equally large specimens are also known from Orange Bay. Rochebrune & Mabille's *Modiolarca crassa* form appears very close. Unless genetic data would distinguish, *flemingi* is treated conspecific.

Hedley's ***coccinea*** from Macquarie Isl. was early synonymized by Tomlin. However, as recognized by Powell (1979) this species seems to be of consistent shorter, higher shape and smaller size and appears to represent a valid *Gaimardia*.

2 valid MAG species are represented by the small ***G. mesembrina*** from Tierra del Fuego to the Falklands and ***G. bahamondei*** from the Golfo de Arauco as well elaborated by Osorio et al. (1984) and depicted by Forcelli (2000).

A very difficult species is ***Modiolarca exilis*** H. & A. Adams, 1864 renamed ***G. adamsiorum*** by Osorio & Arnaud, 1984. From the OD and from Ponder's interpretation figs. 23-25 this is small shining red or purple species trigonal, with the umbones more central, strongly rostrate and more compressed than *trapesina*, with two cardinals and weak laterals. From shape, hinge and color it can not be conspecific with *mesembrina* as assumed by Forcelli (2000).

In addition, large specimens have been found in SE. Argentina, Isla de los Estados and Rio Gallegos. The largest is 18.4 mm, strongly trigonally rostrate, very compressed, all specimens similar colored with rose-purplish umbones and yellowish cream ventrally. Definitely, none of Rochebrune & Mabille's forms fit. These specimens are more rostrate and more compressed than *trapesina* and somewhat approach *adamsiorum*. Quite close in shape is Troncoso et al. (2001 fig. 35) from Kerg. From there *exilis* was reported by Smith. Whether these Argentinan specimens represent large *adamsiorum* or an undescribed species is open.

The true identity of ***Modiolarca pusio*** H. & A. Adams, 1864 also from the Falklands is as yet unknown. However, the "epidermide concentrice lamellosa obtecta" would exclude *Gaimardia*, where placed by authors. The type was not traced.

6.37 SPORTELLIDAE

QC1: This is a barely known family of rare species. Important are Lamy (1925), Ponder (1971) and Coan (1999).

Coan excluded ***Isoconcha*** from sportellids.

Turquetia from St. Paul, without any anatomical details, has been variously placed, also in Sportellidae. However, dentition with only a single cardinal in each valve, an internal ligament, as well as lacking pustules and shape remove it from this family (VELA pl. 5 figs. 15-17; BERN98 fig. 5). The true position of *Turquetia* is open; *Isoconcha* has a somewhat similar dentition, but a markedly distinct shape and an external ligament. Vaught (1989) placed *Turquetia* in GALEOMMATIDAE.

As such 6 genera with approximately 30 extant species are currently placed in SPORTELLIDAE.

QC2: ***Sportella***: ***S. recondita*** with an internal ligament, lacking laterals and a radial sculpture was placed in *Sportella* by some European authors (e.g. CLE, MAG95), but this was disputed by others (AAR96, REP). *Recondita* is not recognized as true *Sportella* and placed in galeommatids.

Whether the tropical Australian ***S. sperabilis*** is indeed a valid species or only the juvenile of ***jubata*** could not be verified.

Furthermore, according to Chavan in Moore (1969) the type *Sportella dubia* is smooth sculptured, whereas the Australian species placed originally and by authors in *Sportella* have a radial sculpture.

It is most likely that *Sportella* is European fossil only and that the misplaced Australian species are unrelated and require a proper new genus.

QC3: ***Anisodonta***: All evidence points that true *Anisodonta* is European fossil only. The 2 somewhat similar NZ species have been placed in *Tahunanuia* and *Austrosportella* respectively.

QC4: ***Basterotia***: Lamy (1925) and Coan (1999) treated this genus well. Coan synonymized the weaker carinate ***Basterotella***, described as Floridan fossil.

The Australian ***Eucharis caledonica***, usually placed in *Anisodonta* is instead a typical *Basterotia*, as concluded by Lamy (1925). However, very close in sculpture, shape, color and sizes are the 2 *angulata* species, namely ***Anisodonta angulata*** Dall, Bartsch & Rehder, 1938 from Hawaii and ***Eucharis angulata*** H. Adams, 1871 from the Red Sea. Koyama et al. (1981) reported *angulata* Adams from Kyushu to Honshu and synonymized *angulata* from Hawaii. No genetic data is available, but from habitat, biogeography and morphology it is indeed most likely, that only one, widely distributed *Basterotia* is present, ranging from the Red Sea through tropical Australia and Japan to Hawaii. *Caledonica* is perceived the same. Should this opinion prove erroneous, then the Hawaiian species needs a new name. The largest *angulata*, beach collected in SW. Yemen is 14.1 mm.

B. borbonica is a weaker carinate species, described from Reunion. Similar is the Hawaiian ***lutea***, but here intermediary records are lacking and both are listed separately. Sowerby's ***obtusa*** is also similar in shape, but appears shorter and more rounded. Turton (1932 fig. 1659) well depicted a specimen from Port Alfred.

The elongated specimen depicted from Japan by Okutani (2000 pl. 468 sp. 2 as "*angulata*") is instead referable to ***stimpsoni*** A. Adams, described from Kyushu.

The weaker carinate, trapezoidal SAU ***subalata*** Gatliff & Gabriel 1910 was originally described as *Saxicava*; later placed in *Hiatella* (MAY58), in *Eximiothracia* (COTT), or as European fossil *Anisodonta* (Lamprell & Healy, 1998). However, *subalata* is comparable to the Panamic ***obliqua*** and also placed in *Basterotia*.

Sphenia quadrangularis Lynge, 1909 appears closer related to *Aenictomya* Oliver & Chesney, 1997 than to *Sportella* and is placed in galeommatids.

6.38 NEOLEPTONIDAE

QD1: Whether this family is correctly placed in CYAMIOIDEA is still open. However, unless clear phylogenetic evidence of any closer affinity is presented, Thiele is followed. Definitely, molecular analyses with various venerid groups should be undertaken.

Thiele (1934) included here ***Neolepton***, ***Pachykellya***, and

Puyseguria. Salas & Gofas (1998) confirmed these, as well as the placement of ***Lutetina***. Following Salas & Gofas (1998) also ***Stohleria***, with another dentition is placed here, generically distinct from *Neolepton*. ***Bernardina*** has been included by Coan et al. (2000).

Waldo has been excluded from Neoleptonidae by Zelaya & Ituarte (2002) and placed close to *Scioberetia*.

Micropolia may belong here as well. However, thin and translucent texture, nearly equilateral shape and hinge configuration with a single strong cardinal in the left valve excludes synonymy with *Neolepton* as proposed by authors. Laseron himself considered *Micropolia* closely related to cyamiids.

QD2: ***Neolepton*** is treated as neuter (SAL98, MALAC). Salas (1998) and various papers of Zelaya are important for this group.

As stated by van der Linden (2003) it is likely that not just ***arjanbosi*** but also ***benguelensis*** is a synonym of ***N. cancellatum***.

Lamprell & Healy (1998) did not treat ***N. planiliratum***, just the later ***novacambricum***. It is most likely that only a single species is present in SE. Australia. However, lacking additional material hinders here a clear conclusion.

QD3: ***Lutetina***: Bernard (1898 fig. 1) depicted the ***L. antarctica*** hinge. Oliver & Holmes, 2004 placed here tentatively "*Lutetina" capricornea*. However, neither the tropical biogeography, nor the shallow habitat, the hinge, or the shape is perceived as fitting Vélain's type well. *Capricornea* is excluded from the monospecific *Lutetina* and should be compared to the various tropical lasaeid genera.

6.40 SOLENIDAE

RE1: Here, largely Cosel's papers are followed. Cosel also described many new species. Nonetheless, this family remains difficult and often, differences among species are subtle.

Usually, 3 genera ***Solen***, ***Neosolen*** and ***Solena*** are recognized. Habe, 1977 added the subgenus ***Ensisolen*** within *Solen* and Cosel (1990) attributed the species referable. The number of solenids may well approach 70 species. At least 2 localized *Solen* are undescribed.

As demonstrated by Hanley (1855), Lamy (1932) and Cosel (1993) ***Solen vagina*** of Linnaeus is an Indian Ocean species and the same as *Solen brevis*. The earliest type designation of *Solen vagina* is SD Schumacher, 1817. His reference to Chemnitz 6 4 28 makes it clear that Schumacher meant an Indo-Pacific species and not the European *marginatus*. However, specifically Chemnitz 6 4 28 is not Linnaeus' *vagina*, but as stated by Clessin, 1887 instead Koch in Philippi's *intermedius* (= *ceylonesis* of Leach).

Solen acinaces Hanley, 1843 was described without locality and without picture. The specimen depicted by Sowerby (1874) is reminiscent of *Ensisolen* and somewhat *gaudichaudii*. However, no BMNH type could be located and *acinaces* is treated as nom. dub.

Solen subcurvus Dunker, 1871 was described from Qld, Rockhampton similar to *brevis*. However, the type was destroyed in WWII (Hausdorf, 9/07) and *subcurvus* is considered a dubious name as well.

Solen niveus Hanley, 1856 was said to measure 75 mm. However, no locality was given and no type could be located in BMNH. Sowerby II (1874) did not mention it. It is treated as nom. dub.

Solen beckii Philippi, 1847 was depicted, but described from unknown locality. In shape and huge size of 138 mm it closely resembles Cosel's *dactylus*. However, without the missing type a firm conclusion is not possible and *beckii* is treated as nom. dub.

RE2: Mörch (1853 p. 6) and (1871 p.108 sp. 2) stated Spengler's large ***Solen rotundatus***, 1794 described from the Mediterranean as identical to *S. vagina* Pennant = ***S. marginatus*** Pulteney, 1799. Spengler used Lister 1056 fig. 5 as reference. This reference has also been applied by Chemnitz for his European species 6 4 27. Chemnitz p. 43 clearly mentioned the characteristic "länglichen kleinen Wulst" of *marginatus*. *S. rotundatus* antedates *marginatus* by five years. Furthermore, one year older than Pulteney's name is also Röding's *gladius*. ***Solen gladius*** Röding, 1798 is also based on Chemnitz 6 4 27.

Mörch (1871) based his opinion on Spengler's ZMUC type material, the "Original-Exemplare". Hylleberg & Knudsen (2001) gave the translation of Spengler's OD. According to Sherborn *Solen rotundatus* Spengler, 1794 and *Solen gladius* Röding, 1798 have been validly proposed and both are not preoccupied. Mörch's view is followed and *marginatus* is synonymized.

RE3: The purplish-red *Solen* (*Ensisolen*) from Brazil with pinkish growth zones and a yellowish periostracum, depicted in Rios (1994 sp. 1303 "*obliquus"*) is still undescribed. This was first recognized by Cosel (1985 p. 333). True *Solena obliquus* is a large Caribbean species; a presence in Brazilian waters is not confirmed. BRASIL has this species well depicted as *S. tehuelchus* from Guarapari, ES. However, Hanley's true *Solen* (*Ensisolen*) *tehuelchus* is a whitish species. According to Cosel, this **unnamed Brazilian *Ensisolen*** reaches 81 mm and ranges from Santos to Rio. In addition to Brazilian specimens, also specimens studied from La Coronilla, La Paloma, Uruguay are perceived conspecific. Consequently, this undescribed species is rather a member of the Argentina faunal province, known from S. Brazil to Uruguay.

RE4: According to Cosel, pers. com 3/07 ***Solen arcuatus*** Tchang & Hwang, 1964 is a valid Yellow Sea and East China species. It is a small elongated, rounded *Ensisolen*, of about 40 mm, similar to the American *S.* (*E.*) *viridis*. However, *Solen siliqua var. arcuata* Jeffreys, 1864 is a well known, earlier European *Ensis*. The Yellow Sea species is a junior homonym, thus, ***Solen*** (***Ensisolen***) ***tchangi*** is proposed as nom. nov. The type locality, as originally described is Tsingtao, Lienyun Port (Kiangsu Province), China. Holotype and paratype are deposited in the Institute of Oceanology, Academia Sinica, Tsingtao, China. This species is renamed after one of the original authors. Obviously, *S. tchangi* is uncommon. Nothing close was found in Zhongyan (2004).

RE5: ***Solen gracilis*** was applied by 3 different authors for 3 different species. The valid *gracilis* is a fossil, named by J. de C. Sowerby, 1844. Later Philippi, 1847 named a Philippine shell so. Even later Gould, 1861 named a *gracilis* from Hokkaido. The Hokkaido shell was renamed *gouldii* by Conrad, 1867. Most authors agree that *S. gouldii* is the same as ***S. strictus*** earlier described from Hokkaido also by Gould, 1861. The range of *S. strictus* includes the temperate waters of Japan and the Yellow Sea, currently excluding Taiwan. Sowerby II (1874 sp. 17, Reeve's Icon.) depicted this Japanese species well, but erroneously under Philippi's name. Clessin, 1888 renamed Sowerby's = Gould's *gracilis* unnecessarily *incertus*.

A similar species occurs in tropical Vietnamese and Chinese waters. This species was described by Cosel, 2002 as ***S. thachi*** from Vietnam, as a replacement for *Solen strictus* auctt. non Gould, 1861 with a range from Vietnam to Taiwan.

Earlier than Cosel, Bernard, Cai & Morton, 1993 renamed *Solen gracilis* of Philippi as ***S. xishana*** from the S. China Sea, Hainan, Xisha Isl. The shell described by Philippi, 1847 (rectilinear, similar to the Mediterranean *siliqua* (= *Ensis minor*)) seems different from *gracilis* of Gould, but has not been unambiguously recognized since. Philippi's species, described from the Gruner collection, is in all probability lost (DANC86). None of the Chinese specimens depicted in Zhongyan (2000, pl. 151) fits Philippi's OD well. Bernard, Cai & Morton's nom. nov. is best considered indeterminate.

RE6: Hanley, 1842 p. 12 named and depicted Gray's BMNH MS species as ***S. guinensis***, but not as *guineensis*. The latter name is preoccupied, the former not. *Solen guinaicus* Cosel, 1993 is an unnecessary nom. nov. Cosel (1993) identified ***Solen lamarckii junior*** Chenu, 1843 as the same WAF species and selected a type locality in Guinea.

RE7: ***Solen kempi*** and ***S. annandalei*** were described by Preston, 1915 from E. India. *S. annandalei* is 5 times as long as broad, *S. kempi* 7 times, hence, much more slender. Cosel (2002 fig. 36-37) depicted the slender *kempi* which also shows a much longer umbonal muscle scar than *annandalei*.

As stated by Cosel (2002), Annandale & Kemp, 1916 confounded the type figures, their fig. 8 with the slender species is instead *kempi*, and their fig. 9 is the type of the broader *annandalei*. Ghosh (1920) characterized *S. annandalei*, not *S. kempi*.

RE8: ***Solen grandis*** was originally described from the Philippines and subsequently widely reported, from the Andaman Sea to Japan. However, specimens compared from Singapore, S. China, Beibu Gulf and Japan reveal, that two closely related species are present. Dunker's huge broad species is mainly known from Japan, but ranges along the China coast to Beibu Gulf and likely to Vietnam. Subsequently, Dunker (1882) identified Japanese specimens as *grandis*. This species is not known from the Philippines. The species depicted by Tuaycharoen & Matsukuma (2001) from W. Thailand, Satun as "*grandis"* conforms instead to the Singapore specimens. These grow smaller, less than 100 mm, are more strongly truncate and inside rather bluish-white than rose-white. All evidence points that the original type locality of *Solen grandis* Dunker, 1862 is erroneous and that instead an **undescribed** species occurs at least in Thailand and Malaysian, possibly also Philippine waters.

RE9: ***Solen philippinarum*** Hanley, 1843 is instead a *Solena*. Sherborn's attribution to Reeve is not correct; it was depicted by Hanley pl. 12 fig. 42 (early in 1843), and described also by Hanley in PZSL, p.101 (December, 1843). Originally, Hanley described it from the Philippines as nearly allied to Lamarck's colored Caribbean *ambiguus* (= *obliquus* Spengler) and stated it white and devoid of colored rays. Based on Hanley's locality, it has also been listed by Hidalgo (1903) from the Philippines. Sowerby II (1874) erroneously synonymized *philippinarum* with *ambiguus*, but gave Panama and Philippines as localities. Dall (1899) accepted synonymy of *S. philippinarum* depicted by Sowerby II (1874 fig. 21b-c) with *rudis*.

However, nothing similar to *philippinarum* is known from the Philippines and *Solena* is represented by 2 American species only; *obliquus* in the Caribbean, and *rudis* in Panama. In the BMNH no specimen was isolated as Hanley's type. However, the species depicted as fig. 21b-c by Sowerby II (1874) as *Solen ambiguus* from M. C. ink marked No. 7 was isolated by an earlier curator and is still present. It measures 123.5 mm and the label read Tacloban [i.e. Philippines]. Hanley, 1843 stated Philippines and indicated a size of 5 poll. Also the lacking periostracal portion of this large *Solena* fits Hanley pl. 12 fig. 42 precisely. There is no doubt that Sowerby fig. 21 b-c is also the species earlier described and depicted by Hanley. It is herein selected **lectotype** of *Solen philippinarum*. The two other, smaller specimens of the same Tacloban lot become paralectotypes.

In all characters, especially also in the condition of the scars *Solen philippinarum* fits Adams' Panamic ***Solena rudis*** as depicted by Keen (1971 sp. 668) precisely. As *philippinarum* has been used after 1899 (e.g. Hidalgo) a nom. obl. procedure is not possible. Unless an ICZN-petition filed to suppress Hanley's earlier "Philippine" name would be successful, *Solena philippinarum* is applied instead of the junior synonym *rudis*. The **type locality** of *philippinarum* is herein corrected to W. Panama.

RE10: ***Solen brevissimus*** Martens, 1865 is a small, unique species from Singapore. Cosel (2002) placed it in ***Solena***, due to morphological affinities. I am somewhat reluctant to follow and to enlarge the compact American *Solena* group of huge, rather heavy species. It is not excluded that an undescribed IND group is present. Phylogenetic data should verify the closest affinities of *brevissimus*.

RE11: Sowerby II (1874 sp. 8) referred to Chenu' illustrations and depicted ***S. delesserti*** from unknown locality. In the synopsis Sowerby II did not state "Sowerby", which would indicate a newly described species. Instead he stated "*delesserti*, Chemn."; Chemn. is an obvious error for Chenu. However, Chenu did not name any *Solen delesserti*. The species closest is pl. 1 fig. 10 ***Solen deshaysii*** (sic). Most likely *delesserti* is a lapsus for *deshaysii*. The two types should be compared. This species was located in the W. Pacific (Cosel) or in the Philippines (HID). Currently, it is listed as unconfirmed Philippine *Ensisolen*.

6.41 PHARIDAE

RF1: **PHARINAE** was created by the Adams brothers in 1856, p. 342. Cosel (1990) proposed inclusion in

CULTELLINAE and as consequence a name change into the older PHARIDAE. In 1993, Cosel treated PHARINAE and CULTELLINAE and separated from these *Siliqua*, *Pharella*, *Orbicularia* and *Sinonovacula*. His views are followed.

Within PHARIDAE various distinct groups occur, which merit further subfamilial distinction:

PHARINAE H. & A. Adams, 1856 for *Pharus*, *Nasopharus* and *Sinupharus* (COS93)

CULTELLINAE Davies, 1935 for *Cultellus*, *Sinucultellus*, *Afrophaxas*, *Phaxas*, *Ensiculus* and *Ensis* (COS93)

SILIQUINAE Bronn, 1862 for *Siliqua* with subgenera *Siliqua*, *Neosiliqua*, ***Poortenia*** herein and ***Neomachaera*** herein (NOMC)

PHARELLINAE Stoliczka, 1870 for *Pharella* and *Orbicularia* (STOL)

NOVACULININAE Ghosh, 1920 for *Novaculina* and *Sinonovacula* (GHO20)

RF3: ***Cultellus***: Clessin depicted ***Cultellus subcylindricus*** Dunker from Salanga. I was unable to trace such a Dunkerian name. Thus, it is considered *Cultellus subcylindricus* Clessin, 1888. Salanga or Talang or Xalang are older names for Phuket on Thailand's West Coast. As ***Cultellus maximus*** is well known from this area and nothing in the OD contradicts, *C. subcylindricus* is considered a juvenile form, adding a further synonym to this large species. The types of Clessin's species, depicted in the Conchylien Cabinet have been destroyed in WWII (Stuttgart Museum). Spengler's ***lacteus*** and Röding's ***nicobaricus*** are clearly referenced to Chemnitz' 6 5 35 *Leguminum maxima*. Lamy (1932) demonstrated that Lamarck's *planus* is *maximus* as well. ***C. orientalis*** Dunker (107 mm, IND, DKR sp. 9) was synonymized by Prashad (1932). However, there are some doubts whether this is really the same species, but the whereabouts of the type (Greifswalder akadem. Museum) is unknown.

Pharella wardi was proposed by Iredale, 1929 for a N. Qld shell. This species was later synonymized by Australian authors with *attenuatus*. *Wardi* does indeed fit Philippine specimens, but not the Japanese *attenuatus*. *Attenuatus* is broader, and anterior shorter. *C. attenuatus*, although originally described from the Philippines, is currently only known from China and Japan. Consequently, its type locality is perceived erroneous. In the Philippines the straighter, larger ***Cultellus hanleyi*** occurs. Whereas Dunker described it from unknown locality, Clessin (1888) placed it in the Philippines. It is well depicted in Springsteen et al. (1986 pl. 86 fig. 11). No significant differences in shape, dentition, or in characteristic internal subdorsal ribbing to Australian specimens from Qld, Yeppon or NT, Darwin could be detected. Thus, *P. wardi* is considered a new synonym of *hanleyi*. Australian specimens reach approximately 90 mm; Philippine specimens may reach more than 100 mm.

The BMNH type of ***C. vitreus*** proved to contain a complete specimen, 39.6 mm and a single valve slightly less than half this size. It appears that Dunker's OD was based on the small single valve. This is a rather fragile species, elongate-ovate, comparatively narrow, with the sides parallel and both ends equally rounded. It is distinct from *attenuatus*. It has been described from Singapore and no other records are known.

Although ***C. subellipticus*** is also known from Singapore it is distinct from *vitreus*. *C. subellipticus* is broader and pointed on the shorter side, it may grow larger.

Thus, 5 IND *Cultellus* are here recognized, 2 barely known.

RF4: ***Phaxas***: Clessin (1889), Cossignani (1992), Cosel (1993) and Repetto (2005) are followed and ***P. adriaticus*** is considered a form of ***pellucidus***, living in the Med. Without clear genetic data a valid species is hard to establish.

Weinkauff, 1867 used earlier ***Cultellus pellucidus var. minor rectior*** for such specimens from Algeria. This was mentioned by Clessin (1889) for this form, but this name was nowhere found applied after 1899 and qualifies as nom. obl.

RF5: At least 10 ***Ensiculus*** have been described in the last 250 years. The IND species described by Linnaeus and the 7 species later described by Dunker, 1862, were illustrated by Clessin (1889). Later Iredale and Preston described an additional species each. Many authors just recognize *Ensiculus cultellus* L. with a range throughout the Indo-Pacific.

However, Cosel (1990) admitted 3-4 species, and Cosel in Hylleberg & Kilburn (2003 fig. 6-8) depicted 3 distinct species from Vietnamese waters only.

Here, at least 4 species are considered valid. The curbed ***marmoratus*** (Hylleberg & Kilburn, 2003 fig. 8), the uniquely pointed, dark ***aspersus*** (also from Vietnam, Hylleberg & Kilburn, 2003 fig. 6), and the white to brown ***australis*** from tropical Australia seem to surpass even the high variability of ***cultellus*** (fig. 7). The very broad ***E. cumingianus*** Dunker, 1862 is at least a strong form as well as the whitish speckled, thin ***concinnus*** from the Philippines.

The BMNH-type of Preston's ***C. maculatus*** from Sri Lanka proved too close to Dunker's *marmoratus*.

Iredale's ***E. hilaris*** is perceived the same as Dunker's earlier *australis*.

Dunker's ***C. philippianus*** and ***C. lividus*** have been synonymized by most authors with *cultellus*.

RF6: Most authors accept 5-7 valid European ***Ensis***. At present 6 species are considered distinct.

The Mediterranean ***E. sicula*** is still somewhat enigmatic. However, very likely it is only *E. ensis*; at least all specimens seen so far from the E. Med could be identified as *ensis*.

Chenu (1843) illustrated on pl. 3 four distinct European *Ensis*; first true Linnean *ensis* (as *Solen ensis minor*), then true Linnean *siliqua* (*as Solen siliqua*). Furthermore, he depicted 2 "varieties" of these Linnean names. His ***Solen siliqua minor*** is nowadays widely accepted in European literature as common ***Ensis minor***. Chenu's fourth species, ***Solen ensis major*** was nowhere encountered. Chenu's precise pictures with a large, slightly curbed shape, the characteristic color and a long muscle scar leave no doubt, that *major* is the earlier name for *Ensis arcuatus*. However, *Ensis major* (Chenu 1843) was not found in modern European literature. It is not mentioned in Tebble (1976), van Urk (1984), Cosel (1990), Poppe & Goto (1993), Bruyne et al. (1994), Severijns (2002), Repetto et al. (2005), nor is it listed in CLEMAM (2006). All these use consistently *E. arcuatus* for this species. Only Clessin (1887 p. 14) mentioned *Ensis major* Chenu erroneously as synonym of *ensis*. *Ensis major* is a forgotten name and therefore here declared nom. obl. based on ICZN Art. 23.9.2. Thus, ***Ensis arcuatus*** (Jeffreys 1865) is a **nomen protectum**.

According to Schumacher, his ***E. magnus*** is neither the curbed *ensis* nor the straight *siliqua*. *E. minor* is a straight form and excluded as well. *E. directus* was introduced into European waters late in the 20th century and is excluded from a 19th century OD. This leaves *magnus* either the same as *E. arcuatus*, or as a valid species. Schumacher gave no locality but a single reference to Chemnitz 6 4 29 (= Faroe Isl.). This has also been referenced by Spengler, 1794 for his huge *Solen ensis* var. a, also from Faroe Isl. Schumacher' as well as Chemnitz' picture show a large, comparatively broad, slightly curbed specimen. Chemnitz' type is depicted in Martynov (2002 fig. 5 K-L). It does not fit *ensis* (as declared by Clessin, 1887) or the more slender *arcuatus*. I therefore follow van Urk (1964) and Poppe and Goto (1993) and consider the type species ***E. magnus*** as valid European species. The consistent difference to *arcuatus* is a comparatively less elongate, broader anterior adductor scar. The shell is comparatively broader, and the lower border usually stronger curbed than in *arcuatus*. Van Urk mentioned this species from Norway to the Netherlands.

Whereas van Urk (1966 and 1984) considered ***phaxoides*** a valid species, rarely found in GB, NL and Belgium, Severijns (2002) could not distinguish *E. phaxoides* from *E. ensis*. However, specimens known from Belgium and the Netherlands do not fit any of the known species, except *magnus*. It is possible that *phaxoides* is the Southern form, and a junior synonym of the type species *magnus*, but more material is necessary to verify.

The well known US ***Ensis minor*** Dall, 1899 is a junior homonym of the well established European *Ensis minor* (Chenu 1843). *Minor* was briefly characterized by Dall, 1899 and placed from "Cape May to Florida and Texas". *Ensis megistus* Pilsbry & McGinty, 1943 was introduced as subspecies of *minor* Dall. Many authors synonymized these two, some kept them separate. Having seen many US lots I was unable to draw a line. Neither biogeography, nor habitat (true "*minor*" is also known from at least 20 m), or size (the largest "*minor*" reported from N.C. is 150 mm, Porter & Houser, 1994), nor morphology holds. Consequently, these two are here considered synonymous and ***Ensis megistus*** is the valid name to represent this well known North American "minor jackknife". The main difference to the northern *S. directus* is the comparatively longer anterior adductor scar.

RF7: The group around ***Siliqua*** with currently 15 species encompasses ovate-elongate forms, globally encountered, in 4 distinct lineages. All these share an easily recognizable internal calcareous enforcement (internal rib) not found in other pharid subfamilies.

Bronn, 1862 used SILIQUANA, encompassing *Tagelus*, *Macha*, *Siliqua*, *Ceratosolen*, *Pharella* and *Cultellus* in parallel to SOLEANANA with *Solen* and *Ensis*. However, SILIQUINAE Bronn, 1862 was accepted by the **NOMC**-authors as a valid subfamilial group. **SILIQUINAE** is herein applied as a valid subfamily within PHARIDAE for Siliqua in the above sense only.

This group is scarcely known and was nowhere found reviewed.

4 distinct lineages are present, which all deserve at least subgeneric status:

- The typical fragile, colored, translucent, shiny, mainly Indo-Pacific group with a very weak yellowish periostracum and a comparatively narrow internal rib. This group is represented by ***Siliqua*** s.s. (*radiata*, *barnardi* nom. nov. herein, *fasciata*, *polita*, *pulchella*, *pulchra* and *tenerior*)
- The uniform white, rather solid, ovate IND ***Neosiliqua*** with a brownish periostracum (*inflexa*, *minima*)
- The preoccupied *Machaera* comprising huge Boreal-Arctic species, larger in size, with a broad internal rib and a strong yellowish periostracum, here renamed as ***Neomachaera*** (*patula*, *costata*, *squama*, *alta*, and possibly *lucida*)
- ***Poortenia*** is here proposed for the uncommon fragile, strongly, regularly commarginally ribbed *S. grayana*, with a minute weak radial interrib sculpture.

Siliqua: Typical is Linnaeus large, widely distributed type ***radiata***. A unique ***Siliqua*** is well known from South Africa. It was named *radiata* by Barnard, 1964 and later *fasciata* by Kilburn, 1974. It is well known today in S. Africa under this latter name (Steyn & Lussi, 1998 sp. 915). However, this small *Siliqua* fits neither the OD's of *radiata*, nor of *fasciata*. True ***fasciata*** is a much smaller, more robust, purplish-white species, not found in Tunisia as originally stated, nor in SAF, but in the South and East China Sea. No other *Siliqua* described fits the SAF species. Barnard (1964) well characterized this species, thus, ***Siliqua*** (***S***) ***barnardi*** nom. nov. *S. radiata* "Linn." Barnard, 1964 non Linnaeus 1758 is here proposed. Natal is confirmed as type locality. The name honours the rich contributions of K. H. Barnard to our knowledge of the S. African bivalve fauna. This species appears confined to the E. SAF and the W. Indian Ocean (Transkei, Natal, Mozambique, Kenya (SPRY as *pulchella*), India (Chennai, BMNH general coll.). It grows twice the size of true *fasciata*, is brownish (pale fawn or fuscous), more fragile and translucent and posteriorly more elongate than *fasciata*. There is only one white ray, extending almost vertically from the umbones, whereas in true *fasciata* usually three rays are visible. It lives deeper than *S. fasciata* and is uncommonly beached. True *fasciata* is well depicted in Hylleberg & Kilburn (2003 pl. 8 fig. 9, Vietnam).

The BMNH type lot of ***Aulus japonicus*** Dunker, 1862 (3 syntypes) proved identical to ***Solen politus*** Wood, 1828, a species well known from the NW. Indian Ocean (e.g. Oliver, 1995 sp. 1115). Smith (1891) identified Aden shells as *japonicus*. Dunker's type locality Japan is erroneous, nothing close occurs there. Consequently, Okutani (2000) only depicted ***S.*** (***S.***) ***pulchella*** from Japanese waters. The type locality of *Aulus japonicus* is herein corrected to **Gulf of Oman**, from where identical specimens have been studied.

Aulus pulcher Gray is a ms. name only for a BMNH-Cuming lot. However, Smith, 1891 p. 429 characterized ***Siliqua pulchra*** as clearly distinct from *japonicus* (= *politus*) and this name is here understood as recognizable and validly proposed. The old BMNH type lot has been refound in the general collection. It contains 3 syntypes labeled *pulcher* Gould on the front. The backside reads "pulcher, Gould ms. apparently; see my paper on Aden Shells E.A.S.“ As characterized, ***Siliqua pulchra*** Smith, 1891 is significantly distinct from *S. polita*. The type locality on the label reads Catanauan, which is Luzon, Philippines. *Pulchra* is a characteristic elongated species, with a vertical, not oblique internal ridge, a purplish spot umbonally, lacking the keel-like umbonal ridge and is more inequilateral compared to *polita*. It is uncommon and only a few specimens from the Philippines have been seen. Sowerby II (1874 Reeve's Icon.) ***Cultellus*** fig. 15a is *pulchra* Smith, whereas fig. 15b is *polita* Wood. From the OD, Hidalgo's ***quadrasi*** from Mindanao, 38 mm fits *pulchra* precisely. It is also not excluded that Kira (1971 pl. 62 fig. 12 "*japonica*") a small fragile species with a purplish spot umbonally is instead referable to *pulchra* and that *pulchra* extends into the East China Sea. However, this eastward extension needs further material.

S. tenerior is a similar brownish species, only known from tropical Australia.

Neosiliqua: In general, 2 IND species are placed in *Neosiliqua*. Clessin (1889), Hidalgo (1904), and Lynge (1909) is followed and ***Solen albida*** Adams & Reeve, 1850 (orig. loc. Korea err.) and *Cultellus albida* Sowerby II, 1874 (Philippines, erroneously as of Dunker) are considered further synonyms of ***S. minima*** Gmelin, 1791 (= *Minutissimus leguminum* Chemnitz). Röding's *lenticula* and Anton's *minutissima* are clearly referenced to Chemnitz' species and fall also in synonymy. *S. minima* is not known from Japan or from the Korean Archipelago. It seems to end its eastern expansion in Chinese waters (Zhongyan, 2004 pl. 152 C).

A larger species was described as ***winteriana*** by Dunker, 1852 from Java. This is ovate, somewhat broader at the end, strongly gaping, with a marked, long and oblique internal enforcement. However, Wood, 1815 p. 131, pl. 32 well described and precisely depicted his *Solen inflexus*, just before *Solen minimus* Gmelin. There is no doubt that ***Siliqua* (*Neosiliqua*) *inflexa*** (Wood, 1815) is the earlier name. It was properly proposed and is not preoccupied (SHE).

Neomachaera: Despite a huge number of available names, it seems that only 4 or 5 American species occur. The type species, SD Dall, 1900 ***Solen costata*** Say, 1822 is preoccupied by *Leguminaria costata* Schumacher, 1817. As recognized by Dall (1899), confirmed by Moore (1969), *Leguminaria* is a synonym of *Siliqua*; the type, MT, *Leguminaria costata* is the same as *Siliqua radiata*. However, Say's *S. costata* is a well introduced American species. For the time being *Siliqua costata* is still applied, anticipating an ICZN-invalidation request of Schumacher's name by American authors. If an invalidation of Schumacher's name fails, then ***Solen nahantensis*** Des Moulin, 1832 is the next available name (DAL992).

Sowerby II, 1874 described ***Cultellus belcheri*** from unknown locality. It was later placed in Java by Clessin, 1888 and a conspecific lot in the BMNH general collection is indeed labeled Java. However, Dall (1899) considered it the same as *costata*. The BMNH *belcheri* type, 52.1 mm has a very broad interrib, a strong yellow periostracum, and the umbones are quite anterior. There is very little doubt that *belcheri* is not an Indo-Pacific *Siliqua*, but instead an American *Neomachaera*. As concluded by Dall, closest is *costata.*

The huge, 132 mm ***Aulus rostratus*** Dunker, 1862 in the BMNH-type collection from Arctic Seas has been studied. Dunker just compared it with *grandis*, and stated it more rostrate. *Rostratus* is undoubtedly an American *Neomachaera*. Despite the huge size it is perceived as large ***S. costata***. ***S. squama*** specimens from New Foundland are heavier, anterior shorter and have a distinct shorter and more confluent pallial sinus. *Squama* is well depicted in Abbott & Dance (1986 pl. 339 sp. 12).

S. alta and ***S. patula***, two large NE. Pacific species have been treated by Coan et al. (2000). ***Solen grandis*** Gmelin, mentioned by Clessin (1888 p. 58) and depicted by Sowerby II (1874 sp. 12, Reeve's Icon.) does not exist. Other than stated by Dall (1899), *Solen grandis* Dunker, 1861 is a huge, valid *Solen* from Japan and China. The type of ***Cultellus grandis*** Sowerby II, 1874 was not found in the BMNH type collection. However, from the 4 large American species involved, it is very close to *alta*.

S. lucida is difficult. From the limited material at hand it seems, that this smaller, colored species has its umbones more inequilateral than *patula* and may therefore be a valid species. Dall (1899)'s view that *lucida* is the counterpart of the Japanese "*S. pulchra*" (= *S. pulchella*) is not shared; neither shape, nor interrib, or periostracum fit.

The type of Sowerby II's ***Cultellus subsulcatus*** was not isolated either and could not be found in the BMNH general collection. From IND nothing similar is known. Dall (1899) considered it the same as *costata*. Specimens named *subsulcatus* in the BMNH general collection from California are instead *lucida*. The comparatively broad shape does not exclude that true *subsulcata* was a juvenile of a larger American species. However, without type, it is best treated as nom. dub.

Poortenia: On a sandy beach in Phuket, W. Thailand 1 articulate and 2 single valves of a then unknown *Siliqua* where found. The specimens displayed a very regular, dense commarginal sculpture with very fine radials in between, a highly unusual feature in this genus of smooth forms. Otherwise, the shells are fragile, ovate-elongate and white with traces of purple. The internal rib, as usual for IND species is comparatively narrow and extends about 2/3 slightly oblique anterior. J. J. ter Poorten then gave me the 3 third complete specimen 32.6 mm, also collected in Phuket Thailand. No name was attached. However, still another old, unresolved IND *Siliqua* described by Dunker, 1862 is available.

Indeed, on a wood board from M. C. two specimen labeled *grayanus* have been found in the BMNH general collection, which well agree with Dunker's OD of ***Aulus grayanus***. The label reads "Ceylon E. L. Layard". They proved conspecific with the Phuket specimen. A few further specimens in the BMNH general collection, collected in the 1930s came from India, Chennai. Thus, ***Siliqua* (*Poortenia*) *grayana*** (Dunker 1862) is known from a few specimens from India, Chennai, Sri Lanka and Andaman Sea, W. Thailand. Some further records have been found in literature, but the identifications could not be verified. The name for this new subgenus within *Siliqua* honours J. J. ter Poorten, an outstanding expert in cardiids and a friend, who also procured the largest *grayana* known. ***Poortenia*** is in commarginal sculpture with a minute weak radial interrib sculpture not confoundable with any other siliquid and monospecific.

RF8: **PHARELLINAE** are another group of lesser known bivalves. As indicated by Cosel (1993) subfamilial status is here applied for this group of elongate, rather large, estuarine IND species. As Ghosh, 1920 based his pharellid conclusions on Bloomer's "*Pharella orientalis* Dunker", which nowadays is considered a true *Cultellus*, this group needs additional anatomical analysis.

Most authors followed Keen in Moore (1969) and considered *S. javanicus* SD Kobelt, 1881 as type species. However, Gray, 1854 p. 24 exemplified *Pharella* by 3 species: *P. javanicus*, *P. michaudi* and *P. acutidens*. Stoliczka, 1871 selected validly and earlier ***P. acutidens*** as **type SD**.

Cosel (1993) considered 3-4 *Pharella* as valid. However, it appears that 6 species are valid. 4 have been studied and the OD of the other 2 is sufficiently distinct.

The best known species ***P. javanica*** is schematically well depicted in Cosel (1990 fig. K). It has 2 narrow teeth of equal length in the right and 3 teeth in the left valve, the central largest and often bifid. In shape it is ovate elongate, the sides almost parallel, rounded at both ends, ventrally incurved. *Javanica* is known from Indonesia, Java, from the Philippines, and recently depicted from Vietnam (HYL03). An eastward extension to Okinawa as stated by HIG99 could not be verified.

P. olivacea has been described from Borneo. It has the same dentition as *javanica*, but is broader and more pointed. Specimens have been studied from N. Borneo fitting the OD and the type picture (REV741 fig. 27) well. The type series in BMNH demonstrated that this is the largest pharellid, reaching almost 100 mm. Hidalgo (1903) reported it from the Philippines. However, a distribution to Amami, as stated by HIG99, could not be verified and no intermediary localities are known.

The same dentition, 2 and 3 teeth is equally found in ***P. ovalis***. This is the broadest species described from Singapore. 3 syntypes are present in BMNH.

P. waltoni is barely known and somewhat tentatively placed here. It has been described as 39 mm species from Bangkok area, freshwater. The type should be in Frankfurt. Brandt described it with the same dentition as found in *ovalis*, but the shape is much shorter, high and ovate centrally pointed.

The type species ***P. acutidens*** is similar in ovate-elongate shape to *javanica*, but has only 2 teeth in either valve and is narrower. Hanley (1842) synonymized *Solen michaudi*, which was described from unknown locality, but with the same shape and the same dentition. Sowerby II (1874) recorded it from Sumatra. Tchang et al. (1964) from S. China, Bernard et al. (1993) from Hainan and Hong Kong, specimens studied came from the Philippines, Mindanao. Gould, 1861 described ***Solecurtus strigosus*** from Hong Kong, Whampoa. From OD and locality this might be a further synonym of *acutidens*. Concluding from dentition, Clessin (1888) confounded *acutidens* with *javanica*.

Finally, the 6th species, acute, pointed in shape, with 2 teeth in the right valve, one smaller, and 2 teeth in the left valve is Hanley's ***P. acuminata***. It shares the same dentition as *acutidens*, but is distinct in shape and possibly restricted to India. It has first been described by Hanley, 1842 p. 17 (Catalogue).

Clessin, 1888 described a further ***Pharella adamsii*** with a particularly concave ventral margin. This species from unknown locality was said to measure 65 mm. However, the dentition was not mentioned. It was described from the dispersed Bülow collection and no type is available. Without type material *P. adamsii* is not identifiable and considered nom. dub.

RF9: ***Novaculina*** and ***Sinonovacula*** were placed differently by various authors, e.g. in PSAMMOBIIDAE, SOLECURTIDAE, PHARIDAE (Sowerby II, 1874; Clessin, 1888; Annandale & Prashad, 1924; Lamy, 1932; Thiele, 1935; Yonge, 1949; Owen, 1958; Moore, 1969; Cosel, 1993), sometimes together, sometimes separate.

As both species have no cruciform muscles tellinoids, especially *Solecurtus* or *Tagelus* are excluded. However, neither anatomy, nor gross morphology, or habitat excludes PHARIDAE.

Furthermore, the similar anatomy, the presences of separated siphons and non-plicate gills and a comparable gross morphology do not exclude either species from NOVACULININAE. Thus, Annandale and Prashad (1924)' arguments are shared and both genera are included in **NOCACULININAE** Ghosh, 1920.

RF10: ***Solen constrictus*** Lamarck 1818 (= type species OD ***Sinonovacula***) is a junior homonym of the also well known *Solen constrictus* Bruguière, 1792 (= type species *Austromacoma*).

According to Lamarck, 1818 his type should be at MNHN, and not at Geneva, but Lamy (1932) did not find it there. Fortunately, this species is quite well known from Japan (e.g. Kira, 1972, pl. 62 fig.10). Cosel (1990 p. 295 fig. 1) excellently depicted the interior and fixed the dentition, large scars and the deep rounded pallial sinus, extending about 2/5 of shell length. As such Lamarck's species is squarish, roughly irregularly sculptured, medially with an oblique groove, with a rather thick brownish periostracum, comparatively heavy and solid and grows more than 92 mm (Ariake Bay, Japan, coll. auth.). However, it needs another name.

Cosel (1993 p. 247) mentioned that ***Solen tenuis*** Wood, 1828 from unknown locality is not the same as *S. tenuis* of Gray, 1834 (= *africanus*), and noted "but probable *Sinonovacula constricta* (Lamarck 1818), a pharid species of China and Japan". However, *tenuis* also resembles *mollis*; the *tenuis* type material, which ought to be in the British Museum, was not found there in 1986 by S. Morris (COS93) and also not in 11/08. In addition, this name has never been used in any solenoid/solecurtid review so far (e.g. Sowerby II, 1874; Clessin, 1889; Cosel, 1990); also Lamy, 1932 with an extended synonymy did not mention it, while discussing Lamarck's *constrictus*. Thus, *Solen tenuis* Wood, 1828 is considered a nom. dub.

The 3 BMNH syntypes of ***Solecurtus mollis*** "Gould" Sowerby, 1874 (BMNH 1985187/1-3) are still present. Dall (1899) identified them as SW. Atlantic (coasts of Brazil and Uruguay) and made *mollis* the type, OD of his ***Clunaculum***. However, Dall's *Clunaculum* OD does not fit the present species with a very short rounded pallial sinus and umbones marked removed from a subanterior position. From S. Brazil indeed an uncommon species is known which shares superficial traits with *mollis*. This species is much better placed in SOLECURTIDAE and discussed there.

Furthermore, the label on the old wood board of true *mollis* reads "Malacca". Shape, dentition, rough, wrinkled periostracum, medial groove and texture do not resemble anything known from the Caribbean. Instead *mollis* is a typical *Sinonovacula*. At first glance it appeared even conspecific with Lamarck's species. Indeed Sowerby II (1874) contrasted *molli*s against *constrictus*. However, the analysis of additional fresh material revealed that two quite similar species occur, at least in Chinese waters. A marked difference has been found in the pallial sinus. In *mollis* the sinus is shallow and very broad emanating form a broader scar. Furthermore, the periostracum in *mollis* is in general lighter, rather yellowish-olive green and *mollis* appears to remain smaller and somewhat more fragile. The board locality Malacca (= Malaysia) may be correct, *mollis* extends eastwards at least to S. Taiwan. It seems that Zhongyan (2004 p. 296) "*constricta"* from China represents instead *mollis*.

It is possible that ***Tagelus obtusatus*** Clessin, 1888 type locality Malacca represents *mollis*, but the OD is too imprecise, the interior not depicted. The type material was from the Bülow collection. According to Dance, the Bülow collection was sold in 1913. The Melvill-Tomlin collection appears to include the freshwater material only. The whereabouts of the solenoids/solecurtoids could not be traced. Thus, *obtusatus* is considered non identifiable and nom. dub.

Lamarck's well known, but preoccupied species is therefore still without name and here renamed. ***Sinonovacula lamarcki*** is proposed as **nom**. **nov**. *Solen constrictus* Lamarck, 1818 non Bruguière, 1792. Lamarck's original type locality "habite les mers de la Chine ou de Japon" is still valid. The MNHN *constrictus* (= *lamarcki*) specimen depicted by Cosel (1990) came from China, Ming-Po.

6.42 HIATELLIDAE

SU1: Except *Hiatella*, this family is quite well known, mainly based on the works of Tryon (1869), Tiba (1988), Scott (1994) and Coan et al. (2000). The number of valid hiatellids may range from 25 up to 40 species, solely depending on how many *Hiatella* may once be recognized.

SU2: ***Hiatella***: Sowerby II (1875) differentiated 14 *Saxicava* (= ***Hiatella***), Lamy (1924) recognized 6 species. Japanese and Chinese authors usually apply *S. orientalis* although *S. macrodon* from Taiwan or *S. flaccida* from Hong Kong are older and not just biogeographically close. Dell (1964) included all S. American forms under *S. solida* from Peru and listed many other hiatellids, but *solida* has been perceived as possible synonym of *arctica* by Coan et al. (2000). Australian authors usually apply *S. australis*, although some specimens are very close to Japanese forms. As stated by Dell (1964), very inflated *australis* are even very similar to inflated *solida*, other specimens from Australia are close to Deshayes' *similis*. European authors sometimes differentiate between a byssally attached *arctica* and a non-byssate, edentate *rugosa* nestling in sponges (e.g. MICAL04). The spinose forms are found at least in MED, SAF, ANT, CAR, and PAN. The largest specimen seen are approximately 50 mm (California and Australia), but 59.7 mm is reported as maximum size.

Overall, more than 60 extant hiatellids and some more varieties (CLEMAM) have been described globally. More than 9 genera have been erected to solely accommodate *Hiatella*.

Coan et al. (2000) listed *arctica* with 27 main synonyms and stated: "Full taxonomic understanding of this genus is a problem that cries out for attention with modern methodologies grounded in sound nomenclature and with type specimens. One might expect that the situation will prove to be genetically complex as well. … There is evidence that there is more than one species in this genus. …. Found throughout the world, possibly, spread in part by human activity."

Still lacking an extended analysis and convincing criteria for more than 1 species, Coan's course is followed. The names applied are listed and special forms found around the globe are depicted under *arctica*.

SU3: Coan et al. (2000) considered a larger, 40 mm ***Cyrtodaria*** ***kurriana*** centered on the Bering Sea and a "smaller, more elongate and not twisted to the right anteriorly" Atlantic and Arctic *C. siliqua* as valid. European authors (e.g. Poppe & Goto, 1993) usually apply *siliqua*; Japanese and Russian authors use *kurriana* in their area.

However, Lubinsky (1980) reported *kurriana* from the Canadian Archipelago and from Greenland, considered it a high Arctic species and *siliqua* as Boreal species, occurring in S. Labrador. Ockelmann (1958) also saw *kurriana* in the Atlantic, with a circumpolar distribution and *siliqua* restricted to NE. US. He stated the length of *kurriana* as 38 mm; whereas *siliqua* reaches more than 90 mm. Dell (1978) and Richling (2000) came to similar conclusions.

Dunker, 1861 described his *kurriana* from Greenland as small species, 35 mm against the much larger *siliqua*. Spengler, 1793 described his *Mya siliqua* from Newfoundland, thus, West of Dunker's *kurriana*, and gave a size of "3-in, 2-lin long, and 1 ¼-in. broad", which equals 82.8 mm length and 32.7 mm height; thus, more than twice the size of *kurriana*. As such a widely distributed, smaller, circumarctic ***C***. ***kurriana*** extending to the Kuriles and to the European Dogger Bank and a large, restricted NE. US, non arctic ***C***. ***siliqua*** live. The former is well depicted in Coan et al. (2000 pl. 104), and herein from Spitsbergen, the latter in Abbott (1974 sp. 6023) or in Sowerby II (1873 as *Glycimeris siliqua*) and herein.

Dunker (1861) further mentioned a ***Cyrtodaria cumingii*** in sched. in the BMNH-Cuming Collection. Although applied by H. & A. Adams, 1856 this is a nom. nud.

SU4: According to R. Petit (pers. com. 3/08) Sowerby I's ***Panopaea australis*** Genera pl. 32, fig. 2 dates as of 1833. The type locality mentioned in the text is NSW.

SU5: Whereas Philippi, 1844's *Arcinella carinata* non Brocchi might indeed be the same as ***Saxicavella*** *angulata*, his *Arcinella laevis* is barely congeneric. As *A. laevis* has been designated type *Arcinella*, SD Gray, 1847 the preoccupied ***Arcinella*** Philippi, 1844 is removed from the ***Saxicavella*** synonymy. *A. laevis* Philippi, 1844 is a small roundish Italian fossil of unknown status and *Arcinella* Philippi is considered gen. dub.

6.43 GASTROCHAENIDAE

ST1: This is an extremely difficult family. Almost no *Gastrochaena* was described based on growth series, most from single finds only, sometimes from unknown locality, and sometimes with an unlikely CAR and IND distribution.

Due to the often deep boring habitat many species are scarce and in most cases the intraspecific variability is barely known. However, in some cases where it is well known a high variability can be stated. For one of the best known species, the European *G. dubia*, which received more than 10 different names, Albano (2003) demonstrated this well.

Another issue is the often subtle difference among congeneric species from various areas. Specimens without locality are very difficult and sometimes impossible to attribute.

Fortunately, Freneix & Roman, Nielsen (1986), La Perna (2006) and Carter in excellent papers treated this difficult family. Following Freneix & Roman (1979) and Carter et al. (2008) the former monogeneric *Gastrochaena* is broken up into 3 genera:

Gastrochaena: smooth anterorsal margin without myophores, short united siphons

Rocellaria: with poorly developed myophores, siphons united

Lamychaena: with strong, elongated myophores, long united siphons, umbones terminal, pyriform shape

More distinct are the 4 further gastrochaenid genera:

Dufoichama: cupped shells, with shelly appendices and small, rounded myophores, very long, largely united siphons

Spengleria: with a marked radially divided sculpture and divided siphons,

Cucurbitula: with a unique flasky mode of life and elongated, widely gaping valves

Eufistulana: with a unique tubular mode of life and anteriorly characteristically sculptured valves

ST2: ***Gastrochaena***: Spengler's type species ***G. cuneiformis*** has been described from the Andaman Sea, Nicobar Isl. It is well depicted and recognizable in Knudsen & Hylleberg (2001). Mörch (1871) stated in his Spengler review the type lost. Lamy (1925) synonymized Deshayes *gigantea* (syntype in Lamprell & Healy, 1998 sp. 570). Carter et al. (2008) selected a neotype from Great Nicobar Isl. and confirmed Lamy's conclusions. As such the type species exceptionally attains 57 mm, but is commonly found in excess of 30 mm. It appears moderately variable in shape and widely distributed. Lamy (1925) and Nielsen (1986) synonymized *G. lamellosa*, *indistincta* and *mauritiana*; all three appear close. ***G. hawaiensis*** from Hawaii was synonymized by most authors with *cuneiformis* and is close, at least morphologically and in size.

Carter et al. (2008) depicted and obviously considered ***macroschisma*** as distinct species, shorter and smaller, also found in the Andaman Sea, as well as the Australian ***brevis***, and the Japanese ***grandis***. The differences in the 2 former species appear subtle, but recognizable. However, the latter name is invalid. Dunker (1882 p. 171) listed and on pl. 14 fig. 10-11 depicted "*Gastrochaena grandis* Desh. (*Chaena*)". As recognized by Lamy (1925) Dunker's species is a *Gastrochaena*, whereas Deshayes, 1855 true *Chaena grandis* is instead a *Eufistulana*. At first glance Dunker's species seems indeed distinct from *cuneiformis*, comparatively shorter and broader. However, after comparing further specimens it appears that the preoccupied ***G. grandis*** shares too many features with *cuneiformis* to be separated. The size is comparable, the sculpture as well, the ventral opening has a very similar shape, and the pallial sinus is not significantly distinct. Forms typically known from Japan have been found off Borneo and Chinese specimen (Zhongyan, 2004 pl. 174 fig. C) approach typical *cuneiformis*. Unless genetic analyses demonstrate otherwise, Lamy (1925) and modern Japanese authors (e.g. Kira, 1972 pl. 63 fig. 14; Okutani, 2000 pl. 511 fig. 1) are followed, who synonymized "*grandis*" with Spengler's widely distributed species.

On the other hand, Nielsen (1986) synonymized ***G. philippinensis*** with *cuneiformis*. Lamy (1925) treated it as distinct, Lamprell & Healy (1998 sp. 571) recognized it as well, whereas Carter et al. (2008) did not mention it. It is likely that *philippinensis* is a valid species, smaller, more rectangular than *cuneiformis* and less pointed anteriorly. The lamellae are as in *cuneiformis*, fine and raised. The ventral opening is smaller, slightly more than half length only. *G. macroschisma* is also small, but higher and shorter, with a larger ventral opening. *G. brevis* is distinct in broader anterior shape.

As true *Gastrochaena*, but distinct from above tropical species appears the comparatively large S. Australian ***G. frondosa*** Cotton, 1934. Due to biogeography, shape, shorter pallial sinus and dentition synonymy with *cuneiformis* is not likely and *frondosa* is recognized as valid species. On the other hand, Smith (1885 p. 28) reported *G. lamellosa* (= *cuneiformis*) from 15 m, off Cape York. Thus, true *G. cuneiformis* seems indeed to occur in tropical Australia.

A unique species is the 12.6 mm ***G. spathulata*** described from the Philippines. A single specimen is present in BMNH. The shape rather fits *Lamychaena*; however, no myophore could be detected. The pallial sinus is extremely deep, extending 2/3 of shell length is and also very narrow rounded at the top. As such it should be easily recognizable, but *G. spathulata* was rarely discussed and no recent records are known.

Another rare and unique species is ***G. denticulata*** with denticulate ridges on the anterior half from the SE. Pacific. It seems to share many features with *G. ovata*, but no growth series was available.

The W. Atlantic species are very difficult as well. The Caribbean counterpart of *cuneiformis* is ***G. difficilis*** Deshayes, 1855. Deshayes stated Western India. The BMNH type lot from M.C. reads St. Thomas (= Virgin Islands). Indeed, Sowerby II (1878 sp. 5) corrected Deshayes error and depicted it from St. Thomas. Carter et al. (2008) accepted *difficilis* as Western Atlantic species, depicted the BMNH syntype and clearly separated it from the distinct Panamic ***G. ovata***.

In addition, there is a composite Deshayes species from two localities which needs resolution, namely ***G. humilis*** Deshayes, 1855. BMNH 197889 was described from the Philippines, Cebu and 1840.10.8.41 from the West Indies, labelled St. Vincent. In each of the two *humilis* lots one specimen is present; these are similar but decidedly not conspecific. Fortunately, Sowerby II (1878 sp. 25) recognized Deshayes' error and selected St Vincent and depicted the Caribbean species. This 15.5 mm specimen from St. Vincent, of which one valve is partly broken, is marked distinct in higher, shorter shape and broader, straighter hinge line from *difficilis*. However, lacking material hinders a Caribbean confirmation. In Caribbean literature no representative was located to date. The depicted, congeneric gastrochaenids are quite easily attributable to *G. difficilis*.

The large portion of gastrochaenids has been described by Deshayes (1855) from the Cumingian collection. However, Deshayes did not depict anything and did not give any sizes. His locations are in some cases not given, in a few erroneous and the BMNH type material is in some species very difficult. As stated by Dunker (1882) and Lamy (1925) some of Deshayes, 1855 species are enigmatic and the following names are considered nom. dub.

G. tenera Deshayes, 1855: The stated type locality is Philippines. Sowerby II (1878 fig. 27) and (1884 fig. 28) twice depicted the same elongated, fragile specimen. However, BMNH, lot 1829, labelled *G. tenera* bears instead the Australian locality Port Curtis. Apart from a piece of coral no *gastrochaenid* is present. The included note states that S. Morris 3/89 could not find the specimen.

G. intersecta Deshayes, 1855: No locality was given, The BMNH lot 197890 is marked "?syntypes" and contains 3 specimens belonging to 2 distinct species. It is possible that Sowerby II (1878 fig. 26) did not depict what Deshayes originally meant. However, a double selection of a type and of a locality is deemed too shaky and *intersecta* is considered a nom. dub.

G. laevigata Deshayes, 1855: Quite similar to *intersecta*, originally no locality was given. The type lot contains 2 distinct species and *laevigata* is also considered a nom. dub.

ST3: ***Rocellaria***: Tryon's uncommon ***Rocellaria stimpsonii*** from N. C. is significantly distinct from *difficilis* in elongated, narrow shape, the umbones almost terminal and a hinge with "small but well marked laminae". Tryon's original genus is perceived correct. *R. stimpsonii* appears congeneric with the type species *Rocellaria*, the E. Atlantic *dubia*. All evidence points that Redfern (2001)'s Bahamas *Gastrochaena* sp. 988 is indeed *stimpsoni*, his sp. 989 is instead *difficilis*.

Castellanos even rarer ***carcellesi*** from Buenos Aires seems to belong here as well.

Carter et al. (2008) pointed that ***G. savignyi*** Pallary, 1926, based on material collected before the opening of Suez Canal into the Red Sea, belongs also to *Rocellaria*. In addition, Deshayes earlier ***G. ruppellii*** was originally described from the Red Sea before the canal opening as well; the 34.2 mm BMNH holotype bears this locality. Based on type material, Smith (1891) considered *ruppellii* identical to *dubia*. Oliver (1992) demonstrated that *ruppellii* was identified by various authors with different Red Sea species. However, the species finally depicted by Oliver (1992 p. 199 fig. 7) as *ruppellii* does not match the type, but is instead the generically distinct *Lamychaena weinkauffi* Sturany, 1899, as concluded by Carter et al. (2008). Finally, Carter et al. (2008) considered *ruppellii* as synonym of *cuneiformis*. However, neither shape of *ruppellii* with the broader anterior part, the rostration ventrally and not dorsally, nor the much rougher and irregular sculpture matches.

Furthermore, specimens very close to ***ruppellii*** are also known from Natal, Durban area. Indeed, Barnard (1964 p. 561) reported from S. Africa in addition to *cuneiformis* (= Steyn & Lussy, 1998 sp. 997) the distinct *G. cf. dubia* with *G. cf. ruppellii* in synonymy. The myophores in the Natal specimens are somewhat longer than in *dubia* but well hidden under the dorsal curb. At present, it seems most likely that only a single *Rocellaria* is present in the W. Indian Ocean, extending from the Red Sea to SAF. This species is similar to *dubia*, but somewhat straighter, and was living in this area before the canal opening. The oldest name may be ***R. ruppellii*** with *G. savignyi* and *G. dubia* Barnard, 1964 non Pennant, 1777 as synonyms. Bouchet & Danrigal (1982) gave 11 mm for *savignyi*, Barnard gives 16 mm for cf. *dubia*, and the largest specimen from Natal studied is 16.5 mm. Certainly, more material is necessary for a confirmation.

ST4: ***Lamychaena***: The IND synonymy is difficult. Nielsen (1986) stated ***inaequistriata*** valid and the Hawaiian ***oahuana*** synonymous. Carter et al. (2008) considered ***inaequistriata*** synonymous to the earlier ***weinkauffi***, but did not comment on *oahuana*. Genetic data is not available.

From the specimens from Arabian waters and the pictures studied (e.g. STUR01 pl- 5 fig. 11; Nielsen, 1986 fig. 5d; Dall, Bartsch & Rehder, 1938 pl. 51 fig. 6-10) for the time being Nielsen (1986), Oliver (1992/1995) and Mienis (2006) is followed. The shape and the pedal opening in *inaequistriata* did not closely approach *weinkauffi*; instead both species seem to occur in the Red Sea. The Hawaiian *oahuana* is in size, habitat and morphology close to *inaequistriata*.

Furthermore, ***Rocellaria cordiformis*** G. & H. Nevill, 1869 from Sri Lanka may be the earlier name for *inaequistriata*. The type at ZSI should be studied.

Deshayes' ***cucullata***, growing at least up to 25 mm, originally described from the West Indies, is undoubtedly a *Lamychaena*. It is perceived as large *hians* with a correct type locality as indicated by Lamy (1925). Peile (1926) reported *cucullata* as the common species from the Bermudas. Neither Deshayes (1855), nor Sowerby II (1878, 1884) recognized *hians*. The *cucullata* syntypes, 25 mm, are present in BMNH, but the large specimen depicted by Sowerby is missing. This latter specimen indicates that *hians* might reach the larger sizes of approximately 35 mm known from *inaequistriata* and *rugulosa*.

Carter et al. (2008) synonymized the larger Panamic ***truncata*** with ***rugulosa*** with page priority. *L. rugulosa* is another large species, reaching almost 36 mm.

ST5: ***Dufoichaena***: Jousseaume in Lamy (1925) placed the characteristic ***G. dentifera*** Dufo, 1840 with additional shelly appendices and rounded, open myophores inside of the beaks in *Dufoichaena*. Carter et al. (2008) well demonstrated these features. Lamy reported *dentifera* from the S. Red Sea, Aden to the Seychelles and to New Caledonia and Polynesia, Peard's Isl. Nielsen (1986) synonymized Deshayes' ***G. interrupta*** from the Philippines. Specimens studied came from Poly, Raiatea, dived 35 m, in coral.

D. pexiphora has been described from the Red Sea, reported from the Andaman Sea and also been dived in 58 m off N. Borneo. The length of the borehole from a dead *Empressostrea* is 35 mm, the siphons fused, only weakly separated at the opening.

ST6 ***Spengleria***: Lamarck, 1818 did not give any references for his *mytiloides*, nor did he indicate any size. The type locality is Mauritius. According to Lamarck his type ought to be at MNHN. However, it was not mentioned by Lamy (1925) nor was it found there or at Geneva in 1986 (NIE86). Thus, the figure in Sowerby II (1878 fig. 12), also depicted by Keen in Moore (1969 N699) and by Lamprell & Healy (1998 sp 575) is here selected as **plesiotype**. This is the rather humped, ovate, small form with a sinuous ventral edge. Typically, it is the specimen well depicted by Soliman (1973 pl. 1 *Rocellaria retzii*) from the Red Sea.

Nielsen (1986) stated *S. plicatilis* (BMNH 1978101) originally described from the Philippines as distinct. However, based on the same BMNH-material, his opinion is not shared. It rather appears that juveniles are usually more humped and sinuous and full adults more elongate and flatter. Small specimens closely resembling Red Sea specimens are known from Japan, Kii (coll. auth.) and there understood as *mytiloides* (Kira, 1972 pl. 63 fig. 13). On the other hand, Okutani (2000 pl. 511 sp. 3) depicted a large 40 mm specimen from Japan as *mytiloides*, with the sinuous ventral edge vanishing. This is virtually the same as depicted by Nielsen from the Andaman Sea as *plicatilis*. *G. retzii* from Reunion has been synonymized with *mytiloides* by Jousseaume, confirmed by Lamy (1925) and Prashad (1932), whereas Nielsen considered it the same as *plicatilis*. Oliver (1992) only accepted one species in the Red Sea and named it *Spengleria plicatilis*, but the specimen depicted on pl. 45 fig. 8 is very close to Lamarck's *mytiloides* plesiotype from Mauritius. Two *Spengleria* are mentioned from Australia, but Lamprell & Healy (1998 sp. 574) only illustrated an Australian valve of a larger specimen. In Sowerby II (1884 fig. 3, 8, 10, Thes. Conch.) the differences among these 2 forms are much less exaggerated than earlier in Sowerby II (1878, Reeve's Icon.). All evidence points that only one species, somewhat variable in shape, especially during its growth, is present. ***S. mytiloides*** is widely distributed from the Red Sea, EAfr, Australia to Japan.

Whereas the Caribbean ***rostrata*** is close to the type species in habitat, mode of life and morphology, this is not the case for ***G. apertissima***.

G. apertissima is a comparatively small species, with an extremely wide pedal gape. Morphologically it shares most traits with *Gastrochaena*. However, as demonstrated by Nielsen (1986) it has its siphons completely free and not united as in *Gastrochaena*. Consequently Nielsen placed it in *Spengleria*, but there it does not fit particularly well and seems to require a new grouping. *G. apertissima* is widely distributed. Specimens have been collected in Dibba, Gulf of Oman, Andaman Sea, W. Thailand, but also in NT, Darwin, coral blocks. There is little doubt that ***Gastrochaena tumidula*** Thiele, 1930 described from Shark Bay, but recorded by Lamprell & Healy (1998 sp. 572) along the whole tropical Australian coast is the same. The largest *apertissima* seen is slightly less than 20 mm.

ST7: ***Cucurbitula cymbium*** has a unique habitat and characteristically quadrangular, widely open valves. In *Fistulana* the valve occupies only about 1/3 of the tube; in *Cucurbitula* the valves occupy about 2/3 of the space. Spengler's OD is translated and the type depicted in KNU01. The largest tubes collected are from E. Malaysia, Kuantan, 27.4 mm; but Sluiter (1890) reported 36 mm from Indonesia. *C. cymbium* is widely distributed throughout the Indo-Pacific. Sluiter, 1890 was not aware of the existence of *cymbium* and described the same species in-depth as ***Gastrochaena aequabilis*** from Krakatau. He gave excellent pictures of the inside and explained growth mechanisms and stages.

From valve morphology, habitat and mode of life the S. Australian ***tasmanica*** appears closely related and is placed as *Cucurbitula*.

It also appears that Folin's unique ***aedificator*** from China is best placed here. Valve morphology and habitat fit this group. It is not excluded that a juvenile was described, and the adult forms grow larger. As far as could be compared, *aedificator* appears distinct from *cymbium*. The type was not located at MNHN in 6/09, but *aedificator* has been well enough described and depicted for recognition.

ST8: At least 7 extant ***Eufistulana*** have been described. Fischer (1866) considered 5 species valid, but gave no differences. Based on Sowerby II (1878, *Fistulana* in Reeve's Icon.) and Sowerby II (1884, *Gastrochaena* in Thes. Conch.) usually 3 species are considered valid.

The earliest named species is Spengler, 1783's ***Gastrochaena mumia*** from India, Coromandel Coast (KNU01 with translation of Spengler's OD). This species appears to occur mainly in the Indian Ocean. From Thailand (presumably Andaman Sea) in 1992 a tube of 275 mm has been reported. The tube is generally narrower, usually smooth with only a few particles attached. The valves have a more or less equal height throughout. Megerle von Mühlfeld, 1811 described and depicted *Fistulana annulata*, which presumably served as base for Gray, 1858's *Chaena annulata*. *Annulata* conforms quite well to *mumia* material seen from Indonesia. Abbott & Dance (1986 pl. 370 fig. 9, just tube) seems to represent this species.

Another species, ***E. grandis*** occurs from the Philippines to Japan. This has a comparatively broader tube, usually covered with sandy, shelly or stony material. The valves are unequal in height, broadest at the joining end. The largest specimen seen is 135 mm (tube), 38.7 mm (valves) from Okinawa. This species is well known from Japanese literature. The sculpture is well depicted by Gray (1858 as *Chaena tesselata*).

A third smaller, rare species ***E. agglutinans*** is scarcely reported. It has been described from the Philippines and also reported from China by Bernard, Cai & Morton (1993). *E. agglutinans* has a comparatively short and more slender tube and very slender valves. The only picture known is still Sowerby II (1878 sp. 2). Recently a specimen from the East China Sea, off China, referable to *agglutinans* could be studied. The ventral tube opening is somewhat more ovate, compared to the rather round opening in *grandis*. The valves are comparatively smaller and narrower and the ventral gap is stronger anteriorly.

6.44 CHAMIDAE

PK1: This is one of the most difficult families in bivalves.

Chamids have been treated by many authors, notably by Chenu (1845-6), Reeve (1846) and by Lamy (1928). As reviewed by Lamy and confirmed by subsequent authors, Reeve in approximately 1/3 of his 55 species overstated intraspecific differences and inflated the number of species, especially so in *pacifica* and *asperella*. Clessin (1888-9) in his usual manner described many "new" species, approximately half are recognizable as synonyms; the other half, generally without locality, is not or not unambiguously recognizable. His type material was destroyed in the Stuttgart Museum during WWII. Consequently half of his new species were by earlier authors or are here declared nom. dub. There is no valid chamid bearing Clessin's name. *Chama oblonga* from the Philippines would, but this name is preoccupied by Linnaeus and this species is currently too little known for a redescription. *Chama reeveana* was certainly a wise decision, but Chenu's holotype of *subspinosa* proved to be the same and the earlier name.

Particularly important for chamids are two collections: MHNG (Lamarck, Chenu) and BMNH (Reeve, Broderip).

Fortunately, in chamids some excellent modern regional reviews are available (Red Sea/IND: DELS; IND: MAA96-05; Australia: HEA93; Florida: BAY43, CAMP). Furthermore, the very difficult Panamic chamids could be discussed with Coan & Valentich-Scott in 2010 and their views (e.g. separation of *coralloides* from *echinata*, synonymy of *echinata* and *garthi*, recognition of *rubropicta* and *tinctoria*, possible synonymy of *corallina* and *sordida* Broderip, and nom. nud. for Deshayes' *inermis*) are followed. They also recognized *C. sordida* auctt. as new species (in press for 2010).

Genetic analysis is, except for Floridan species, largely lacking and would be urgently needed, especially for some IND species.

Generically, Matsukuma (1996) is largely followed. He well characterized the 6 extant genera within CHAMIDAE.

Pseudochama has been controversial since inception. Experience shows that the majority of chamids occur in dextral and sinistral conditions. Bernard (1976)'s statement that "anomalies are nearly all referable to misidentifications" is not shared, although this mix appears much less common in Panamic waters than in the Indo-Pacific. However, most chamids have a predominant condition, mostly dextral; comparatively few have a predominantly sinistral condition. As also Lamarck's type species has been biogeographically localized, *Pseudochama* is here used as weak genus, restricted for species exclusively or largely attached by the right valve and the apex twisted to the left. From a practical view this is convenient. Scientifically it may be questioned as recently well demonstrated by Campbell et al. (2004).

In most chamids marginal crenulations are quite stable. However, at least in *C. brassica/elatensis*, *C. pulchella/similis*, *C. ruderalis/fimbriata*, in *P. gryphoides*, and in *P. radians* in addition to smooth margined, also weakly to strongly crenulate specimens are known.

Here approximately 70 chamids in 6 genera are recognized. Especially in the Caribbean a couple of **undescribed** species occur.

Chama decussata Lamarck, 1819 proved to be non chamid. From dentition and trigonal pallial sinus it appears as gerontic veneroid. Lamarck's MHNG holotype has been precisely captured by Chenu pl. 9 fig. 8, but erroneously placed under fossils.

PK2: ***Chama***: ***C. pacifica*** is undoubtedly the most variable IND chamid as originally recognized by Broderip, 1835 and as excellently elaborated by Delsaerdt (1986). All synonyms of Delsaerdt, notably *C. carditaeformis*, *C. reflexa* and *C. multisquamosa* are here confirmed and a few more are added. In shape *pacifica* is typically ovate (lectotype HIG01 B568; DELS pl. 7 fig.1) internally white and usually almost half rose-red, with finely crenulate margins. Occasionally, narrower, elongated forms as Reeve's *pacifica* occur (REV46sp. 15; DELS pl. 7 fig. 2; CLES880sp. 29 *segmentina*). ***C. carditaeformis*** Reeve, 1847 is a quite typical, whitish form and the BMNH-holotype less spectacular than Reeve's figure. ***C. meyeri*** Jonas, 1846, reddish with white spines, is a widely distributed common form also found in the Red Sea (Oliver, 1992 pl. 25 fig. 8 "*reflexa*"). Large *meyeri* closely approach Reeve's large ***C. divaricata*** from the Philippines. ***C. reflexa*** is a somewhat finer spined form, but internally red with a fine crenulate margin as well. This synonymy has also been accepted by Lamprell & Whitehead (1992). Probably the most difficult synonym of Delsaerdt is ***multisquamosa*** with a fine and regular ribbing. However, Lamprell & Whitehead (1992 sp. 153a *pacifica*) closely approaches typical *multisquamosa* and the BMNH-holotype shows internally the typical *pacifica* features. In addition to Chenu's *delessertii* (see below), two other species are here synonymized. Almost identical in sculpture to *meyeri*, but more vividly red or red-purplish colored is Reeve's ***C. rubea*** (BMNH) from the Philippines. Undoubtedly Chenu's ***purpurata*** is the same, and even the earlier name for this beautiful color form, as stated by Hidalgo. The large syntype of Chenu's ***Chama sinistra*** is missing, but the smaller syntype pl. 4 fig. 9 is available in MHNG. However, this is a normal dextral specimen and most likely a further *pacifica* synonym.

Whereas Quoy & Gaimard's preoccupied *foliacea* belongs to *pacifica*, Gmelin's earlier ***C. foliacea*** is indeterminate and a nom. dub. The same applies to ***C. küsteriana*** Clessin, 1889 based on the indeterminate Chemnitz 7 52 521, as well as ***C. rugosa*** Bruguière, 1792 non Linnaeus, 1771. Linnaeus *rugosa* is indeterminate as well, without locality and type material (DOD52; CAMP; LAM28).

In addition to the larger *pacifica*, a second variable, but smaller species occurs and is equally widely distributed. By various authors, this species was described almost as often as *pacifica*. The earliest name is ***Chama asperella*** Lamarck, 1819. The lectotype is depicted in DELS pl. 1 fig. 1. It has a comparatively rough ribbing ventrally, is basically white, with some rust red and with crenulate margins. Delsaerdt considered the intergrading ***C. pellisphocae*** from the Philippines, ***C. spinosa*** from Marutea and ***C. jukesii*** from N. Australia synonymous. Smith (1885) earlier synonymized **C. *fibula*** and *pellisphocae* with *jukesii*, a view shared. Lamy (1928) recognized that Chemnitz 7 52 518 from Nicobar Isl. is the same. Thus, Röding's ***C. muricata*** based on Chemnitz 518 is the oldest, but fortunately preoccupied name for *asperella*. Here ***C. exigua***, ***obliquata*** and ***planata*** are added as synonyms. Oliver (1992 pl. 26 figs. 5-6 and fig. 7) well depicted *asperella*.

The base shape of *asperella* is ovate as well, but the size much smaller than *pacifica*, mostly between 25 and 35 mm; the spines are generally shorter and more numerous. The base color is white, internally and externally, but often reddish brown streaks, especially umbonally or on the dorsal slope are found, occasionally brown streaks occur inside, and occasionally almost all brown specimens are found. The margins are also crenulate. What probably caused most problems is the sculpture. Very finely spined forms (e.g. ***obliquata***, "***fibula***"-forms), medium spined forms (e.g. ***planata***, ***spinosa***) or rougher spined forms (e.g. ***asperella***) occur, but they intergrade. Having analyzed many 100's of these smaller IND chamids, I was not able to define separate species and consider all the above mentioned names to represent the same species.

As a matter of fact, the types of Reeve's ***aspersa*** and ***fragum*** are lost. What is present under "*fragum*" BMNH1995182 from unknown origin, even Caribbean is possible, does not conform to Reeve's species. What is present under "*aspersa*" BMNH 1995175 from the Philippines is definitely not Reeve's species. Delsaerdt stated these two types lost, he did **not** designate any neotype but he defined both of Reeve's obviously indeterminate figures as iconotypes. As in both cases type material is missing and as both were differently interpreted by various authors, *C. aspersa* Reeve, 1846 and *C. fragum* Reeve, 1847 are here formally declared **nom**. **dub**.

Present, without any doubt, is Reeve's depicted syntype of ***C. planata***, BMNH 1950.11.1.42. Delsaerdt synonymized *planata* with *aspersa*, but this is highly speculative. As in the case of *aspersa*, Reeve, 1846 described *Chama planata* as "margins of the valves smooth". However, both specimens of the depicted *planata* syntype-cluster have finely crenulate margins. This obviously enlarges the doubts on the true identity of *aspersa*. *C. planata* is basically white with reddish brown streaks externally and internally in the upper valve. I fail to distinguish *planata* from *asperella*. Also present is the minute, whitish, crenulate ***C. exigua*** from Singapore. However, it is also too close in sculpture to the non depicted syntype of *planata* to be separated from *asperella*. Also unambiguously available is the depicted, beautifully colored syntypic cluster of Reeve's ***obliquata*** from the Philippines. However, I also here fail to differentiate from *asperella*.

Very similar whitish brown, finely spined *asperella* forms are separated by some authors as ***fibula***. However, the type lot could not be located at BMNH and nothing was depicted by Delsaerdt, 1986. Fortunately, *fibula* was synonymized in 1885 by Smith and he may have seen Reeve's original material. Japanese authors depict such forms instead as Lamarck's ***japonica*** (Okutani, 2000 pl. 470 fig. 4). Higo et al. (1999) listed *fibula* in synonymy of *japonica*. However, Lamy (1917 and 1928) characterized Lamarck's MNHN holotype, as completely abraded 15 mm single upper valve. He stated it as "absolument indéterminable". As before Hanley, Lamy could not place it. Consequently *C. japonica* must be understood as **nom**. **dub**. *Chama japonica* of Japanese authors non Lamarck, 1819 is *asperella*.

Menke, 1843 described ***Chama spondylodes*** from W. Australia. From the OD it is not excluded that an *asperella* form was intended. However, Lamy (1928) could not identify it, the type seems lost (not MfN) and the name was never used. Together with Menke, 1828's ***C. mitrula*** (no loc., no type) *C. spondylodes* is considered a nom. dub. Spry (1964)'s finely crenulate "*aspersa*" from Tanzania is *asperella* as well. Steyn & Lussy (1998 sp. 887) is the wrong picture and does not conform to *Pseudochama cristella*; instead it is perceived as *asperella* which is known from Natal and Transkei. Finally, from the Med CLEMAM reported the immigrated "***aspersa***". An analysis of "*aspersa*" received from P. Ovalis from Greece revealed instead of a smooth, a finely crenulate margin, apart from a comparable small size approximately 20 mm and the typical whitish red brown outer color. This Med immigrant represents instead also the widely distributed variable, small IND *C. asperella*.

Overall, Reeve, as in the case of the larger *pacifica*, was able to describe the same variable species about 7 times.

If this view of a common, variable, small chamid from the Med, to Natal and to Japan should not be shared, then new species with unambiguous and new type material should be described.

Of course, many valid smaller IND chamids exist.

Calcitic specimens from Japan formerly identified as *fragum*, but in texture similar to *pellucida* and *arcana* have been recently redescribed as ***C. cerinorhodon***. These are clearly distinct from *asperella*.

It is further possible that the two specimens from India, depicted in Delsaerdt (1986 pl. 5 fig. 6 as "*fragum*") with "the free valve concentrically fimbriate with tubular scales to the margin; lower valve rudely tubular squamate; the margins crenulate" refer to a valid, **undescribed** species. Quite similar specimens have been studied from the Philippines, Masbate Isl. These approach *asperella*, but seem to have stronger and tubular spines.

Further present in BMNH is the upper valve of Reeve's depicted ***C. linguafelis*** sp. 53, inside marked type from the Philippines BMNH 1950.11.1. 9-10. *Linguafelis* is very close in sculpture to certain *asperella* forms; however, here the margins are indeed smooth as originally described. As stated by Matsukuma in sched. the other complete specimen in the type lot is distinct and with its crenulated margins referable to *asperella*. *C. linguafelis*, currently only known from a single upper valve may turn out to be a valid species.

C. brassica is a large, brightly, often reddish colored, widely distributed species, from the Red Sea to Japan, type HIG01 B562. Delsaerdt, 1986 described a new subspecies from Eilat as ***elatensis***. This is mainly based on crenulate margins, compared to the smooth margined *brassica*. However, some *brassica* from the Philippines or from Japan studied demonstrated weak crenulations as well, very close to specimens analysed from Eilat. As otherwise, sizes, colors, borders and lamellation are that close, *elatensis* is perceived the same. Obviously, as some other chamids *brassica* is found with smooth or crenulate margins. Dekker & Orlin (2000) identified Oliver (1992 pl. 26 fig. 2-3 *brassica*) as *fragum*. However, the large size, the lamellation and the margins are perceived as quite typical *brassica*. Furthermore, Reeve described ***C. praetexta*** from unknown locality. The BMNH holotype revealed that this is instead a smaller, whitish, lamellate *brassica* with smooth margins, but otherwise quite close to typical Red Sea or Indian Ocean forms. Reeve's ***brassica*** lectotype is a rougher, quite large specimen. Very close to *brassica* appears also ***Chama chinensis*** Chenu, 1846 pl. 5 fig. 6 -6c. This name has been validly proposed, is not preoccupied and would be older than Reeve's. However, the type which ought to be at Geneva was not traced as yet.

C. ***ambigua*** from Japan is close to *brassica*, but it is quite consistent in whitish-purple colors, in heavy valves, broad hinge and commarginally arranged lamellae. Lischke, 1870 had 80 mm specimens, the largest studied from Nada has been 70 mm.

C. ***limbula*** is difficult and highly variable. Delsaerdt (1986 pl. 6 fig. 3) depicted the MNHN syntypes. As concluded by Lamy, Delsaerdt and Lamprell & Whitehead, these match Conrad's ***iostoma***, making *limbula* a rather heavy, quite large species often encrusted, usually strongly furrowed, with smooth, purplish margins. Delsaerdt considered Chenu's figs. 5-6 as distinct from *limbula*, whereas Lamy (1928) included them in synonymy. Throughout its range such large, rather ovate, weakly furrowed, strong scaled forms occur; these may have whitish or yellowish-purple margins. Lamprell & Whitehead (1992 sp. 151a) or Clessin's ***bülowiana*** from the Red Sea represent such forms. Consequently, Lamy's view is shared. An enigmatic species is Lamarck's *C*. ***aeruginosa***. The MNHN-type was studied by Lamy (1917) and by Delsaerdt (1986), but no firm conclusion was achieved. Lamy's approach to Reeve's *aspersa* has been rightly questioned by Delsaerdt. Undoubtedly, the specimen depicted as "*aeruginosa"* by Chenu (1846), present in MHNG general collection, is the common *C. pacifica*. However, Lamarck described his species explicitly as smooth margined and no specimen was present in his personal collection. Lamarck originally mentioned 2 localities Timor and Shark Bay, indicating that the Paris Museum once had more than one *aeruginosa*. As in 1917, today only one type is left. This 39.6 mm MNHN specimen fits precisely the OD in rounded shape, reddish in color, the lower valve with foliaceous sculpture and the upper valve with small squamae (lamellate arranged) and smooth margins. Delsaerdt (1986 p. 95 fig. 6) depicted this lectotype from Timor, as selected by Lamy (1917). Comparing to larger IND species, there are not many choices. It must be a species which may occur ovate and reddish, reaching approximately 40 mm, may have a smooth margin and which occurs in Indonesia and in Australia. The best approach to Lamarck's *Chama* No. 8 is found in his *Chama* No. 7, in weakly colored *limbula* as found in Australian waters. Lamarck's *limbula* matches better than Reeve's *brassica*, which is also not known to occur in Australia. Lamarck's *aeruginosa* is therefore perceived as conspecific with his earlier *limbula*.

C. ***plinthota*** Cox, 1927 is a new name for the old ***C. imbricata*** Broderip, 1835 non Lamarck, 1801. Delsaerdt (1986) accepted *C*. ***savignyi*** Jousseaume in Lamy, 1921 as identical, but still applied the junior synonym. However, *Chama savignyi* has been validly proposed, is not preoccupied and there is no doubt that such forms occur in the Red Sea and are identical to *plinthota*. Boshoff, 1965 described his 92 mm ***Chama ratoi*** from Mozambique. This equals large *savignyi*, which was not compared. Boshoff stated dextral and sinistral specimens. Furthermore, Adams & Reeve, 1850 described ***Chama laciniata*** from China, which is preoccupied by a German fossil of Nilsson, 1827 (SHE). Lamy (1928) approached it to *pulchella*. However, it does not match there. It is not excluded that *C. laciniata* was the same as Lamy's *savigny*, but Adams & Reeve's type was in 3/09 neither found in the BMNH type-, nor in the general collection and appears lost. *C. laciniata* is here treated as preoccupied nom. dub. Finally, Lamarck's Geneva type lot of ***Chama croceata*** could be studied. MHNG 1087/4 contains 2 specimens, first, the described larger sinistral specimen, ink marked 16 and labelled "var. droite du Ch. croceata", and secondly, a smaller dextral specimen. Thus, Lamarck had the more common dextral and the less common sinistral variety, as Boshoff (1965). The mentioned sinistral specimen in Animaux sans vertèbres may have misled many authors to look for this common species in *Pseudochama* instead of *Chama*. Chenu pl. 7 fig. 3 and 4 depicted both Lamarckian specimens, but admittedly not very easily recognizable. The characteristic sculpture, white nodules interrupted by orange-brown, the ovate shape, the smooth margins leave no doubt that *Chama croceata* Lamarck, 1819 is the valid earlier name for *Chama savignyi* Lamy, 1927. Indeed, specimens closest to the syntypes have been collected in the Red Sea, here selected as **type locality**. More common however, the colors between the white nodules in *croceata* are purplish-red or dark red.

The type of *C*. ***dunkeri*** Lischke, 1870 from W. Kyushu is depicted in COS981 fig. 26. This is a comparatively large, solid, elongated species with rather short, irregularly spines, orange-red with purple traces, with finely crenulate margins. *C*. ***semipurpurata*** Lischke, 1870 has been described from the same locality, but ovate, purplish white, otherwise with a close sculpture, size and crenulation. These two species have been scarcely treated in Japanese and Chinese literature. Most authors who depicted *dunkeri* omitted *semipurpurata* and vice versa. Okutani (2000) did not mention either, Okutani (1991 p. 305) depicted a whitish-red *dunkeri* only, Kira and Habe in their Western Pacific volumes depicted only a reddish *C. dunkeri*, Habe & Kosuge (1992 pl. 54 fig. 11) figured a quite similar specimen as *semipurpurata*, but no *dunkeri*. Only Taki (1951 pl. 26) depicted 2 specimens, sp. 1 as elongate, purplish-white *semipurpurata* from the type locality and sp. 2 as ovate reddish-white *dunkeri* from Kochi. However, Taki's *semipurpurata* matches instead the *dunkeri* shape and both do not perfectly fit the *dunkeri* type in color. Most likely *C. semipurpurata* is a color/shape form of *dunkeri*. *Dunkeri* itself is perceived as uncommon, but valid species. Compared to *pacifica* the spining is shorter and internally specimens are white or only the dorsal border is colored, whereas in *pacifica* typically half is deep red-purplish or rose red colored. Zhongyan's *dunkeri* seems to be this species, whereas his "*semipurpurata*" (ZHO pl. 143D) is too large and has the typical internal color of *pacifica*.

The preoccupied ***Chama oblonga*** Clessin, 1889 described from the Philippines and accepted as valid by Hidalgo, 1903 shares some features with *savignyi*, but has a crenulated margin. It also seems to surpass the variability of *pacifica*. The large size by far surpasses *pellisphocae* (= *asperella*), where approached by Lamy (1928). Two specimens studied from subtidal reefs off Mactan Isl. slightly surpassed 60 mm. However, Clessin's name is a junior Linnean homonym. This species needs a new name, but also more material for a **redescription**.

Chama lobata Broderip, 1835 was described from the Caribbean. Reeve (1847) corrected the type locality to

China. Without doubt, ***Chama cancellata*** Philippi, 1836 from China is a synonym. Philippi's, not Wiegman's species has been precisely depicted on pl. 8 fig. 1a-c and is virtually identical to the *lobata* syntype in MAA96 figs. 16a-b, as stated by MÖR53 p. 37.

In ***C. pulchella*** (syn. *similis*) Reeve (1846), Healy et al. (1993) and Beu (2006) are followed against Odhner (1917) and Matsukuma et al. (1997). The chamid condition is more common and I fail to recognize two species.

Chama isaacooki is a small, rather quadrate, densely spined, whitish and purplish-red species. It has been described from N. Australia and has also been found off Sarawak, N. Borneo in the S. China Sea and in the Philippines, Olango Isl. It may well be expected in Indonesian waters.

Chama cerion is a characteristic, small honeycomb sculptured species. It is widely distributed and is also well depicted in Jarrett (2000 sp. 585) from the Seychelles.

Chama oomedusae a smaller, yellowish white, inflated deep-sea species with very numerous fine lamellae has also been identified from the Philippines, Aliguay Isl. and from New Ireland. These specimens came from 100 and 150 m, enlarging the known range in depth and biogeography.

From **SAU** only ***C. ruderalis*** is known. Despite the original pseudochamid condition, Lamprell & Whitehead reported in 50% a chamid position. The majority of the specimens analysed had a chamid position as well. Beu (2006) depicted the MHNG lectotype, included some NZ fossils and placed it in *Chama*. Cotton (1961) restricted the type locality to Gulf St. Vincent. In SWA *ruderalis* extends at least to Mindarie, N. of Perth. The NSW *ruderalis* var. b Lamarck, 1819 is identical to the preoccupied *fimbriata* Reeve and depicted in Delsaerdt (1986 p. 118). Consequently, Lamprell & Whitehead (1992) included NSW in the distribution range. *Ruderalis* is a comparatively small, ovate, and whitish to pinkish species. It appears extreme in variability, even for a chamid, commarginally lamellate, smooth margined (BEU06 fig. 17 C, E) to rather spinose with crenulated margins (REV46 sp. 41; HEA93 fig. 10).

Paulay (1996) reported *Chama lazarus*, *pacifica* and *brassica* found under ship bottoms in **Hawaii**, Pearl Harbor. As depicted by Severns, 2000 p. 242 *C. lazarus* seems established, *pacifica* appears likely considering his many records, whereas *brassica* needs confirmation. In addition, *limbula* (syn. *iostoma*) and *asperella* (syn. *hendersoni*) are well known from Hawaii.

Bernard (1976) treated the **E. Pacific** chamids, Skoglund (2000) summarized the changes since, but many more changes evolved (Coan pers. com. 5/09). Bernard described the Northern ***C. arcana*** and separated it from the Southern ***C. pellucida***. As indicated by Lamy (1928) Chenu's preoccupied *C. speciosa* might have been the same as *pellucida*, whereas Chenu's "*pellucida*" seems instead very close to *arcana*. However, no types could be isolated at MHNG and *C. speciosa* is best considered a preoccupied nom. dub.

For once, Clessin, 1889 gave a locality for a newly described species, namely Panama for ***C. flavida***. However, from there nothing close is known. As the type is lost *C. flavida* is best treated as nom. dub. ***C. squamuligera***, where Bernard approached *flavida*, remains much smaller, is white-cream and has a much finer sculpture. The Caribbean *lactuca* is the cognate. Dextral and occasionally sinistral *squamuligera* occur.

The identity of Clessin's ***C. compacta*** from unknown locality with any Panamic species is unconfirmed. It may well have been a Red Sea or a Caribbean species. As the type is lost, it is treated as nom. dub.

It may be that Chenu (1846) erroneously copied Broderip's *echinata* figure into his pl. 6 fig. 4. However, earlier on pl. 1 fig. 4 he gave the name ***C. delessertii*** to a distinct species. The depicted specimen, the holotype, is unambiguously present in Geneva (MHNG 23442) and has been well illustrated in Cailliez & Finet (1997). There is no doubt that this is the species Chenu had in mind. As recognized by Lamy (1928 p. 331) *delessertii* is Indo-Pacific, representing *C. multisquamosa* forms from the Philippines. Consequently, *C. delessertii* is a further synonym of *C. pacifica*. Lamprell & Whitehead (1992 fig. 153a) depicted a quite similar specimen from tropical Australia. Bernard (1976)'s synonymy and type locality for *delessertii* Puerto Portrero do not match. Chenu pl. 6 fig. 4 is understood as an erroneous reference.

The **CAR** chamids appear more numerous than usually accepted. Bayer (1943) based on a large collection and Campbell et al. (2004) treated the Floridan chamids. According to Campbell's genetic results and their discussion, ***C. congregata*** is fossil only and instead at least 2 recent **undescribed** species occur. From the material at hand this view is shared. This complex of rather small, ovate "*congregata*" specimens needs more work and material throughout the Caribbean.

As stated in the introduction, the Port Alfred origin of Turton's 5 mm, "Lucky Log" ***Chama problematica*** and ***Chama perplexa*** is highly doubtful. The first is chamid, the second with reservation. Both are considered nom. dub.

Many chamids were based on peculiar umbonal elongations of the valves, a feature found in various species. These names, e.g. ***C. bicornis*** Linnaeus, 1758, ***C. unicornis*** Bruguière, 1792, ***C. fusca*** Gmelin, 1791 or ***C. lamellata*** Röding, 1798 are without fixation of type material indeterminate and nom. dub. as indicated by Lamy (1917 and 1928) and Delsaerdt (1986).

PK3: ***Pseudochama***: Here placed are the species exclusively or mostly found sinistral, with the apex twisted to the left.

The JAP ***retroversa***, the MED/WAF ***gryphina***, the Caribbean ***radians***, the Red Sea ***rianae*** and ***corbierei*** and 8 **E. Pacific** species are widely accepted as pseudochamids. In addition, the IND ***subspinosa*** and the SAF ***aenigmatica*** belong here, both confused with Lamarck's ***cristella***.

The Geneva holotype of ***P. radians*** (MHNG 1087/3) conforming to Chenu pl. 4 fig. 7 has been illustrated by Campbell et al. (2004) and was studied in Geneva. Specimens very close are found in the WInd, e.g. Abaco, Virgin Isl., Central to South America, Honduras to Brazil. As stated by Campbell et al., there is no doubt that Reeve's smooth margined ***C. ferruginea*** and ***appressa*** from Honduras represent typical *radians*. Clessin's ***rotunda*** is the same. As synonymized by Lamy (1928) and Delsaerdt (1986) there is also no doubt, that Chemnitz 9 116 992 from St. Croix represent larger *radians*. The **type locality** of *radians* has been designated as Virgin Islands, St Croix by Delsaerdt (1986). Lamy's Aden *radians* are instead *rianae* as newly described by Delsaerdt, 1986. Lamarck (1819 p. 96) stated that *radians* can not be Bruguière's ***Chama sinistrosa*** from the Indo-Pacific, albeit using the same Chemnitz figure as reference. This may or may not be true, likely Lamarck's statement was false. However, *C. sinistrosa* has been used in the last 200 years for different species in various regions, for Caribbean forms (DIL), for IND species (LAM28) and even for European fossils (Brocchi, 1814), no type is available and *sinistrosa* is here considered a **nom**. **dub**.

The Caribbean ***P. radians*** is a comparatively large, ovate, sinistral species brownish white outside, whitish to deep brown inside with smooth to weakly crenulate margins. It is weakly to strongly lamellate often with two clear ridges in the upper valve. Lamarck's large 52.4 mm holotype has smooth margins. On the other hand, many of the BMNH material studied and own Caribbean material had weakly crenulate margins, especially dorsally, smooth ventrally. Adult specimens are often larger than 50 mm. *O. radians* seems to occur common and shallow in the Southern part of its distribution and rare in deep water in Texas (Andrews, 1977) or North Carolina (Porter & Houser, 1994). Most *radians* seen had the pseudochamid condition of Lamarck's type, occasionally dextral specimens occur.

On the other hand, Campbell et al. (2004 pl. 8) depicted Floridan "*radians"*. This common Floridan species is generally much smaller, thicker and more solid, often whitish with a purplish border inside and has strongly crenulate margins; the sculpture is generally stronger and specimens occur very shallow. Such specimens are widely distributed in the Caribbean and also found in Jamaica and Aruba. Indeed no typical *radians* was ever seen from Florida. Based on a large collection Bayer (1943) did not accept *radians* from Florida. He identified these small specimens as ***P. variegata*** (Reeve 1847). Lamy (1928) recognized *variegata* also as valid and gave further localities. Consequently, Reeve's BMNH *variegata* holotype has been analyzed, but instead of the expected densely crenulate margins, Reeve's species from Honduras has a smooth margin as often found in *radians*. Therefore, Campbell et al. is followed and *variegata* is considered an unusual *radians* form. Thus, all evidence point that a closely related but smaller, obviously **unnamed** pseudochamid is present, very common in Florida. A modern analysis with true *radians* is necessary to verify and to describe this species.

Lamarck's type species ***Chama cristella*** proved as the most difficult chamid encountered. Lamarck's MHNG 1087/6 holotype has been depicted by Chenu pl. 5 fig. 4 and photographed by CAMP fig. 11. Campbell et al. (2004) stated Lamarck's type and consequently the type species of *Pseudochama* as still unrecognized, its distribution unknown, though assumed Indo-Pacific. The MHNG label indeed reads "Ocean Indien" as originally described.

Consequently, Reeve (1847), Lynge (1909), Odhner (1917 and 1919) and Lamy (1928) saw *P. cristella* in Indonesia (Java, Maluku), or in NW. Australia, or in the Gulf of Thailand. All these authors synonymized Clessin's *reeveana*, which is a nom. nov. for *C. cristella* Reeve, 1846 (Java) non Lamarck, 1819. However, the many specimens studied from these areas are quite distinct from true *cristella* in shape and sculpture and quite uniformly orange or orange red colored, usually with small whitish spines. Odhner (1919 p. 81) stated for "*cristella*" a "predominant radiating sculpture, consisting of small scales of the same nature as in *Ch. reflexa*". This does not match the type species of *Pseudochama* with lamellae, but fits precisely ***P. reeveana***. Clessin was correct to rename Reeve's species. The beautiful type lot of *reeveana* from Batavia is present in BMNH with many syntypes in the general collection. However, Chenu earlier pl. 4 fig. 6 depicted ***C. subspinosa***. The MHNG holotype proved, as well curated, indeed conspecific and ***Pseudochama subspinosa*** (Chenu 1846) is the valid and earlier name for one of the most colorful small chamids from the central Indo-Pacific. Here Indonesia, Java is designated as **type locality** for *subspinosa*. Campbell et al. (2004) illustrated *P. subspinosa* well on fig. 12 "cf. *cristella*".

Another trial to identify true *P. cristella* started in SAF, by Kilburn & Rippey (1982). Specimens from SAF are indeed somewhat closer in shape and internal coloring to *cristella* than is *subspinosa*, but these are reddish colored externally and the characteristic interrupted lamellae of *cristella* are not present. This uncommon SAF species remains with less than 30 mm also much smaller than the *cristella* holotype with 36.2 mm. The SAF specimens otherwise conform in broad shape and color well to Turton, 1932's small pseudochamid ***aenigmatica*** beach collected in Port Alfred. This is the valid name for this reddish SAF species.

Thus, *P. cristella* was still without identity. Finally, Campbell et al. (2004 p. 390) concluded *cristella* "appears to be very close, if not conspecific with ***Pseudochama similis***". However, the BMNH type lots of *pulchella* and *similis* and many tropical Australian specimens have been studied; they do not match Lamarck's species.

In addition, also worn sinistral *lazarus* or Dodge's proposal of a *gryphin*a synonymy had, after careful study, to be dismissed.

The Geneva holotype still in front of me, it seemed very unlikely, that after 250 years of collecting such a large pseudochamid should only be known from a single specimen. I then compared it again with Lamarck's other pseudochamid, *radians*. As *cristella*, also *radians* has been equally mislabeled "Indian Ocean". *P. radians* shows a very similar lamellate sculpture on the upper valves and a very close structural pattern on the lower valve, and both are also very similar in color. Nonetheless, these two are distinct in shape and size; in addition, *radians* has smooth margins whereas *cristella* has dorsally weakly crenulate and only ventrally smooth margins. However, considering the variability seen in *radians*, and comparing further *radians* specimens, especially from Bahamas and Virgin Islands, it transpired that these two are conspecific and represent extreme forms of the same variable Caribbean species. Against page priority the type species *Pseudochama*, SD Gardner, 1926 *P. cristella* is here selected to represent this well known Caribbean species. The type locality of ***Pseudochama cristella*** (Lamarck, 1819) is corrected to the *P. radians* type locality Virgin Islands, St Croix. There also the closest matching specimen has been found.

The true identity of Odhner (1919)'s anatomically analysed *Pseudochama* "*retroversa*" from Labuan, NW. Borneo is unknown. No locality outside Japan and Taiwan is as yet reliably reported for ***retroversa***. On the other hand, the very large ventral scar and the ventrally smooth margin would well conform to specimens studied from Honshu, Chiba Pref. Thus, it can not be excluded that *retroversa* has a much wider distribution.

Chama cornuta Dillwyn, 1817 has been validly proposed and is not preoccupied (SHE). It has never been invalidated by ICZN. Despite confusing references Dillwyn recognizably described ***Pseudochama gryphina*** earlier than Lamarck, 1819. However, this name was not found applied in any European literature, after or before 1899. It was not recognized by Reeve (1846), not even listed by Lamy (1928) other than of Chemnitz, Poppe & Goto (1993), CLEMAM (2006), or by any modern European author consulted; neither was it found in chamid literature. All these authors, including the many references after 1899 listed by Lamy (1928) used *gryphina* for this well known East Atlantic *Pseudochama*. Based on ICZN, Art 23.9.2 here *Chama cornuta* Dillwyn, 1817 is declared nom. obl. and *Chama gryphina* Lamarck, 1819 as **nomen protectum**.

Another unresolved species is Chenu's ***Chama virens***. The characteristic type lot, consisting of two attached specimens is unambiguously present in MHNG. *C. virens* proved to further represent *Pseudochama gryphina*, likely originally from Italian waters.

The BMNH type series of ***Chama janus*** Reeve, 1847 has been compared to the MHNG syntypes of the earlier ***Chama picta*** Chenu, 1846. As curated in Geneva, there is no doubt that Chenu's type lot is unambiguous, still contains the depicted pl. 4 sp. 3 and the upper valve 4b and that Reeve's *janus* is a junior synonym. The **type locality** of ***Pseudochama picta*** (Chenu, 1846) is here designated as Galapagos Isl.

PK4: ***Arcinella***: The Caribbean species are very difficult and perceived unresolved. Unfortunately, Nicol's widely accepted conclusions seem rather superficial and based on very little material studied from South America and Brazil.

Based on Nicol (1952), conventionally a smaller white specimen approximately 40 mm north of Florida Keys down to 6 ribs is ***cornuta***, a larger whitish specimen from South of Florida Keys to Venezuela up to 53 mm with up to 35 ribs is ***arcinella***. One year later Nicol, 1953 described a densely ribbed, brownish specimen up to 61 mm from S. Brazil as ***brasiliana***, but obviously did not study *Arcinella* material between Trinidad and Rio.

Comparatively clear is the many ribbed, purplish brown, internally white ***A. brasiliana*** though with an expanded distribution. It has been described from S. Brazil, Santa Catarina, but it ranges far into the Caribbean, from RS, through the type locality, ES, Bahia, Alagoas, Pernambuco, at least to Tobago. As such it can not completely be excluded that large fossil specimens with many ribs and comparatively high and broad lunule depicted by Nicol (1952) from West Indies or by Gibson-Smith (1979) from Venezuela may be closer to *brasiliana* than to the *arcinella*-complex.

The largest size reported for any extant Caribbean *Arcinella* is not from the West Indies but instead from W. Florida 73.6 mm. From there all white to yellowish-white *cornuta* with 6-18 ribs are known (BAY431; NIC521). From Brazil, Bahia all white *Arcinella* 30-48 mm with 12-25 ribs are known as well. Hanley, 1885's not traced *Arcinella bonanni* was said to have come from Brazil and had only 8 ribs. All white specimens with about 12 ribs are without locality barely attributable; the white inside reddish "*A. arcinella"* depicted by BRASIL from Bahia could easily have been collected in Florida.

From Colombia and Venezuela small yellowish white "*arcinella"* with 12-31 ribs but only up to 35 mm are known, whereas the maximum size for *arcinella* from the West Indies is 53.3 mm and similar specimens from Brazil reach more than 70 mm. Femorale.com has interesting specimens under *brasiliana*, *cornuta* and *arcinella* from Panama to Brazil, e.g. a very low ribbed whitish-rose "*arcinella*" from Colombia and a white, many ribbed, 60 mm "*brasiliana*" from Brazil.

I am not convinced that the conventional distribution range of *cornuta* vs. *arcinella*, e.g. north or south of Florida Keys holds. Furthermore, it is possible that more than 1 species is hidden within *arcinella*. Finally, it is not excluded that in Brazil 3 distinct *Arcinella* occur.

No genetic analysis is available. The highest variability seen in extant *Arcinella* is from Brazil. It is therefore likely that the center of *Arcinella* is instead Brazil and not Florida as assumed by Nicol (1952). The *Arcinella*-complex certainly needs much more work and extended material throughout the whole area, especially from S. America.

For the time being three Caribbean species-complexes are differentiated:

The ***A. cornuta***-complex with whitish large specimens with 6-18 ribs, and a comparatively broad lunule, possibly ranging from N.C. to Brazil, reaching more than 73 mm in Florida.

The ***A. arcinella***-complex with yellowish-white or whitish-rose specimens with 10-35 ribs and a comparatively narrow lunule, ranging at least from the West Indies to Central Brazil, reaching more than 70 mm in Brazil.

The ***A. brasiliana***-complex brownish-rose, with more than 18 dense ribs and a very broad lunule, ranging from the West Indies, at least from Tobago to S. Brazil, reaching more than 61 mm in Brazil.

PK5: ***Amphichama***: Poutiers, 1981 described a small ***Pseudochama scutulina*** from the Philippines. This species has subsequently been uncommonly found in Philippine and South China Sea waters from 20-150 m. Matsukuma (1996) placed *scutulina* in *Amphichaena* due to similarities to the type species *argentata*.

Bayer, 1943 described ***Pseudochama inezae*** from Florida. Based on 50% dextral and sinistral specimens found, Campbell et al. (2004) placed it in *Chama*. However, *inezae* is a very untypical chamid and does not approach *lazarus*. It appears that the affinities and the correct placement of *inezae* needs more work. Its ovate, lamellate, smooth margined form shares many traits with *Amphichama argentata* and *inezae* is tentatively placed here. It clearly grows larger than the two other *Amphichama* and attains at least 59.6 mm in E. Florida.

PK6: ***Eopseuma***: The type species ***E. pusilla*** is only known from 5 small, 2.1-7.5 mm specimens, 4 sinistral and 1 dextral, from the Macassar Strait W. of Borneo and from E. of Borneo (ODH19; ODH55). A 7.5 mm specimen was sexually mature. Assuming this as young adult specimen, a maximum size of about 15-20 mm could be possible. As far as is known, *E. pusilla* was not refound since. On the other hand, from off N. Borneo, dived in a coral reef area, in a far offshore reef, 12-14 m a unique species was found, which could not be attributed anywhere. Despite many dives there, only one specimen has been found. It is dextral, shares the biogeography, the orbicular-ventricose shape, the marginal crenulation and the regular sculpture of short vaulted spines (where abraded) of *E. pusilla*. It is whitish rose with a dark dorsal streak. The size of 14.7 mm could indicate a large adult size. The hinge configuration is closer to *E. phyllotrapezia* than to *C. lazarus*. It is tentatively associated with *pusilla*. If this should prove correct, then *pusilla* could grow twice the size currently known. Furthermore, the sculpture would be significantly different to the original description. The abraded portion only shows Odhner's sculpture. These vaulted spines are the base portion of comparatively long tubular spines, broadened at the top and directed ventrally. These form a dense, quite regular brick-like, rose roof about 3 mm above the surface of the valves. This unique sculpture was not seen in any chamid to date, also not in the two other *Eopseuma* species.

6.45 CARDIIDAE

QQ1: Cardiids are among the best known bivalves. To a large extent this is the merit of the late Jacques Vidal. His papers are extensively used here. In addition, J. J. ter Poorten (2005) published his Outline, condensing the current status. Many personal discussions with Jan Johan enlarged and deepened my understanding of cardiids. Furthermore, many findings of Schneider (1995, 1998, 2002) (e.g. placement of *Dinocardium* within CARDIINAE, subfamily LYMNOCARDIINAE encompassing *Cerastoderma*, *Adacna*, *Didacna* and *Monodacna*; subfamily LAEVICARDIINAE, but not PROTOCARDIINAE) have been integrated. Some views are not shared, as specific attributions (e.g. within *Afrocardium*), or the integration of tridacnids with cardiids.

Following Vidal, a division of CARDIINAE into CARDIINAE s.s., ORTHOCARDIINAE and TRACHYCARDIINAE appears somewhat premature. Especially the positioning of *Maoricardium*, *Papyridea*, and the relations between *Europicardium* and *Dallocardia* seems to merit additional efforts. In addition, *Dallocardia* might be less close to *Trachycardium* than assumed. *Afrocardium* on the other hand, seems quite distinct form CARDIINAE, but not very close to *Europicardium*. Furthermore, the true affinities of *"Ctenocardia" victor* are open as well.

At supraspecific and specific level, some issues are unresolved. Vidal (2000) considered the European *Laevicardium* (e.g. *oblongum* group) close to *Clinocardium*, but not close to the Indo-Pacific forms. The placement of the unique, brooding Arctic *Goethemia* was unresolved. A review of FRAGIINAE is needed; especially the position of *C. robillardi*, *C. translata* and *A. guppyi* is not satisfactory and none are perceived very close to extant type species. The number of valid *Corculum* and *Lunulicardia* is open. Also the IND *Nemocardium* contains many more species than usually listed. The number of valid extant lymnocardiids ranges from about 15 (here) to 26 for the Caspian Sea alone (RUSSIA); more than 75 names have been created for extant lymnocardiids.

Here, I am deeply indebted to R. E. Petit (pers. com. 10/08), who gave the difficult dates for Sowerby II's *Cardium* (Conch. Illustr.).

QQ2: Keen (1980) mentioned the type species of *Sphaerocardium* (= *Acanthocardia*) ***Cardium paucicostatum*** Sowerby II, 1841 as preoccupied by a fossil so named by Deshayes, 1838. However, R. E. Petit confirmed Sowerby's *paucicostatum* date as of **1834**. Thus, no new name is necessary.

Cardium ciliare was described by Linnaeus, 1758. Hanley (1855) isolated two unmarked valves as Linnaeus' species; Dodge (1952) considered *ciliare* as valid species and as "fairly common Mediterranean shell".

Of the 5 extant European *Acanthocardia* species Linnaeus, 1758, p. 679 described *C. aculeatum*, C. *echinatum*, afterwards *C. ciliare* and, finally, C. *tuberculatum* (syn. *C. rusticum*). *A. spinosa* is an uncommon, large, deeper water form with 30 or more ribs. For his *ciliare* Linnaeus gave "M. Mediterraneo", he also stated "simillima duobus praecedentibus". The two single valves present in the Linnean Society Collection have 19 and 17 ribs respectively, with 31.7 and 29.5 mm size. Hinge, sculpture and fragile texture approach *paucicostata* in some respects, but are not far from certain *echinata* forms either. However, both valves are unmarked and heavy doubts persisted, whether these represent indeed Linnaeus true *ciliare*. In Sweden no type material is present. Consequently, *Cardium ciliare* is treated as nom. dub.

QQ3: ***Acanthocardia echinata*** is without doubt the most variable *Acanthocardi*a species between Greenland and Israel. Due to different size, shape, number of ribs, inflation and weight, it was specifically or varietally named over 15 times. However, large series do not allow separation of *mucronata* or *deshayesii* as valid species (Vidal, 2000; Poorten, 2005 pers. com.). The number of ribs varies from about 18 to 23 (= *deshayesii*), but the typical structure, central row of spathulate nodules, broad ribs and very wavy interrib undulations are found in these forms as well.

QQ4: The number of accepted ***Maoricardium*** species varies from 2 (Vidal, 2000) to 5 (VOS911). Both authors agree that *M. pseudolima* is a valid, large species confined to the W. Indian Ocean.

Shells from China, the supposed type locality of *setosum*, are barely distinguishable from specimens from Taiwan (= *mansitii*), the Andaman Sea or from Australia (= *fraseri*). They all appear more or less rounded, inflated, with rectangular ribs, covered with rows of small papillae with periostracal hairs, often with a colored lunule. I currently fail to recognize clear criteria to separate *mansitii* or *fraseri* from *setosum*.

M. pseudolatum differs, at first glance, in elongated, less inflated shape. However, neither ribs number, serration of intercostal area, inside visibility of ribs, color, nor lunule offer special features.

It appears that Vidal's opinion stands. Thus, in addition to the huge ***pseudolima***, only a highly variable ***setosum*** is currently recognized.

QQ5: The number of ***Afrocardium*** species varies from 2 (Vidal, 2000), 9 (Schneider, 2002) to 10 (Fischer-Piette, 1973). It appears that, at most, 3 species are present.

Undoubtedly, *A. exochum* occurs from the Red Sea to Japan, where it is usually named *thielei* (Okutani, 2000 pl. 472 sp. 16) or earlier *infantule* Nomura and Zinbo. This is a rather uniform, quite uncommon species, very small, round, usually whitish-yellow in color.

The more common *A. richardi*, described from the Red Sea has twice that size, is quadrate to elongate and highly variable in color, all white, red, yellow, purplish and in shades between. In Australia this species is called *skeeti*, in Japan *ebaranum*, in the Indian Ocean *rubescens* or *crenelloides*. Reeve's *carditaeformis* (type in HIG01 B808) is the same.

The type species *shepstonense* from Natal is close, but seems to surpass even the high variability of *richardi*. It is more rounded ovate in shape, more solid, the umbones smaller and more central and less variable in color. It is currently separated, but genetic confirmation is needed.

QQ6: As defined by Vidal (1999), ***Vasticardium*** is considered a useful genus for large, relatively rough, strongly ribbed IND cardiids, e.g. "*assimile-*", "*flavum*", "*luteomarginatum*", "*orbita-*","*elongatum-*" and "*rubicundum*"-groups. On the other hand, many of Vidal's subspecies are here considered valid species, with clear characteristics and restricted biogeography (e.g. all members of the *orbita-*, *rubicundum-* and *luteomarginatum-gr*oup as well as the Australian *dupuchense*). Some others, especially in the *elongatum-* group, are considered too strongly intergrading to be specifically separated.

Cardium lacunosum is perceived too close to *assimile* and *Vasticardium subassimile* is most likely a strongly ribbed form of the same species.

It appears that the uncommon ***C. sewelli*** and ***A. capricorne*** do not match *Vasticardium* and these may represent an **undescribed** genus.

QQ7: Vidal (1993) characterized ***Vasticardium elongatum*** as highly variable species. His own remarks and illustrations, especially on p. 54 and further collecting throughout the IND led to the conclusion that these "subspecies" have neither a clear biogeography, nor stable distinctive characters. Too many intermediaries occur. Some typical extremes are depicted to demonstrate the high variability of *elongatum*.

V. elongatum s.s. is the most common form widely distributed, typically brownish, with a purplish margin.

V. enode is a broader form, characteristically yellowish-orange colored inside. Voskuil & Onverwagt (1991) depicted the BMNH lectotype of Sowerby's *enode* from Sri Lanka, whereas Vidal (1993) did not find an *enode* type and selected unnecessarily a MNHN neotype from Vanuatu. However, forms similar to the lectotype are found in the Andaman Sea and the Philippines.

Extreme ***V. coralense*** are often very large, pale and inside umbonally yellowish. It is a form typically found in New Caledonia, but certain specimens from the Andaman Sea are virtually indistinguishable.

Typical ***V. indioceanum*** is a vividly colored form, white-yellowish-red, typically found in EAfr. However, specimens from the South China Sea, Thailand (= *okinawaense*) are extremely close and some specimens are not attributable.

Easily separable at first glance appears ***V. wilsoni*** from N. Australia. However, specimens from the South China Sea are in shape, less so in color almost identical (e.g. HYL03 pl. 3, Vietnam; ZHO pl. 145 m, Hainan to Japan.).

V. okinawaense is the form typically found from the Gulf of Thailand to mainland Japan (type HIG01 B785). There is no doubt, that Vidal, 1993 named this form again as *cipangense* from Japan. However, the fact that even Vidal considered *okinawaense* as synonym of *elongatum* and *cipangense* distinct thereof, whereas Okutani, 2000 pl. 472 sp. 2 depicted the same form as *enode* clearly supports above synonymization of these *elongatum* forms.

It appears that *elongatum* is a young species in an early phase of speciation.

QQ8: Vidal (1998) stated, that the "***mindanense***" lot of Reeve is composed of 3 specimen and 2 species - one *Trachycardium egmontianum* and two *Vasticardium "rubicundum* ". Vidal (1998) selected the "*rubicundum"* specimen of *Cardium mindanense* Reeve, 1844 as lectotype. Earlier, Voskuil & Onverwagt (1992) selected and depicted the larger *egmontianum* (BMNH 1978.124) as "holotype", which is the same as originally depicted by Reeve (1844 sp. 19). Thus, *mindanense* would be the earlier name for the well known U.S. *Trachycardium egmontianum* with an erroneous type locality and a misleading name.

The situation is further complicated as Vidal synonymized *kengaluorum* and *compunctum* with *rubicundum*. Though related, these are here considered as three biogeographically, in color and in rib structure distinct species. Reeve's two *mindanense* specimens from Mindanao (Vidal, 1998 fig. 18-19) are undoubtedly the same as *kengaluorum*. This is the only species which fits in color, biogeography and rib structure, and just this one is easily confounded with *egmontianum*.

Thus, if the ICZN case 3341 of Lee & Petit is accepted (i.e. that Vidal, 1998's type designation is valid), then the earlier name for ***kengaluorum*** is *V. mindanense* and as such correctly depicted by Springsteen & Leobrera (1992 pl. 87 fig. 2).

V. rubicundum is a characteristic species, quite consistent in ribbing and color and never seen as yet outside a very restricted area along the SE. African coast from where originally described.

QQ9: Undoubtedly the species figured by Reeve (1845 sp. 87), BMNH 1996514 *foveolatum* (= HIG01 B789), is the same as ***A. punctolineata*** Healy & Lamprell, 1992. However, Sowerby's original description does not fit Reeve's interpretation. Neither size, nor "much flatter, with a greater number of ribs than *muricatum"* describe the uncommon *foveolatum* of Reeve. It may well be, that *foveolatum* of Sowerby is the earlier name for *cygnorum* as stated by Wilson and Stevenson. Indeed, Iredale & McMichael (1962) synonymized *cygnorum* with *foveolatum*. However, *foveolatum* has been variously interpreted, Sowerby's type could not be isolated and no neotype was selected. Thus, true ***foveolatum*** is best treated as nom. dub.

QQ10: Like *A. impolita* and *A. simplex*, also *A. maculosa* is a common, highly variable species. As specimens from Oman or Andaman Sea may be inside pink, as the rib number in the nominal species ranges from 44-60, as smooth ribbed species, inside white are also known from the Red Sea, and as neither habitat nor size offer special features ***howense*** is considered as synonymous form. The large Japanese ***arenicola*** (up to 55 mm) with relatively few and strong ribs is recognized as valid species by virtually all Japanese authors (e.g. Okutani, 2000; Higo et al., 1999). However, Vidal depicted the type from the Philippines and well demonstrated that the Japanese form falls into *maculosa* as well; the Japanese specimens are typically larger end of range forms.

QQ11: ***Lunulicardia*** has been defined as "deep lunule distorting the hinge" (Keen, 1980 p. 9). Obviously, this must be enlarged to accommodate *C. hemicardium*, which has a flat lunule. The distinct lunule led Vidal (2000) to adopt Spengler's *Hemicardium* for the later. However, Keen (1980) had earlier demonstrated that Spengler's usage was not at a generic, but at a group level and is not applicable for *hemicardium*. On the other hand, *Hemicardium* Schweigger, 1820 was considered a synonym of *Corculum* (HABE).

Lunulicardia is composed of 2 species-complexes: ***retusa*** and ***hemicardium***.

L. hemicardium has a flat lunule, but otherwise closely resembles *retusa*. In addition to the typical form, 2 extremes, the finely ribbed, posteriorly less expanded ***tumoriferum*** from Western Australia and the glossy ***guichardi*** from New Caledonia are depicted. However, specimens from E. Australia connect these varieties with the nominate form. Most modern authors only consider one species valid.

Specimens in the ***retusa*-complex** have an excavated lunule. Linnaeus' Indian Ocean ***retusa*** is comparatively small, smooth, with rather glossy ribs, strongly serrate interribs and a comparatively shallow lunule. It is usually white, but specimens with yellowish or reddish spots occur. In addition to this typical form, at least 3 extremes are found. As recently demonstrated by Mienis (2008) the differences in the *retusa*-complex appear stronger, more stable and without intermediaries, compared to the *hemicardium*-complex. As such various species are separable.

Most distinct from the type species is a large, yellowish, strongly keeled form, restricted to the Red Sea. This species grows at least 48 mm, is translucent with opaque spots on the dorsal slope, sharing these traits with *Corculum cardissa*; the lunule is largest. This species has been recognized as undescribed and recently named ***L. orlini*** by Mienis, 2008.

YARO and MIE08 depicted the type of ***L. auricula*** (Niebuhr 1775). This species is with its broader lunule, more solid texture and with a less angled adult shape, quite distinct from *orlini*. Compared to *retusa*, *L. auricula* is more solid, rougher, with deeper lunule, more inflated, often with strong nodules on the ribs. Sowerby II, 1834 described ***subretusa*** from unknown locality. Specimens closely approaching are typically found from E. Thailand to Japan, *subretusa* shares the same distinguishing marks towards *retusa* as *auricula*. At present *subretusa* is perceived too close to the earlier *auricula* to be separated.

Lamprell & Whitehead (1992 sp. 207 *retusa*) represents Linnaeus' nominate form, but Lamprell & Healy (1998's sp. 739 "*auricula*") from N. Qld is distinct. It shares some traits with *auricula*, but seems to represent the 4th, as yet **undescribed** species in the *retusa*-complex. Such comparatively small, strongly noduled forms are also known from the Philippines, Olango.

QQ12: The number of valid ***Corculum*** ranges from 1 through 2, 3, 6 (HABE), 8 to 10 species (8 of Bartsch and 2 afterwards described). Most authors state *Corculum* monospecific. A critical, in-depth review was not encountered. Modern methods have not been applied for specific distinction.

Neither shape, nor marginal sculpture is constant and unambiguously applicable for distinction within *Corculum*. Convexity is somewhat better. Finally, the surface sculpture proved to be most important, well discernible when valves are held against a very bright light. Especially the arrangement or absence of opaque dots and streaks proved quite stable among different species. Carter & Schneider (1997) treated this microstructure. Unfortunately, they did not inquire about differences among various species and only analyzed the type species.

Chemnitz well differentiated and depicted 4 of the 7 species here recognized.

C. cardissa is unanimously understood as large, white species, with a crenulated margin, equally convex anterior and posterior. Hold against light the unique, almost translucent sculpture, with many irregular opaque white splashes and often commarginally arranged red dots, is well visible. This structure is precisely depicted in Born (1780 var. b) (= Chemnitz 6 14 143-4; REV431 sp. 15d/e). The "albo-lutescente, maculis albis" of Deshayes' *productum* seem to characterize this species as well. The color may occasionally be orange or light yellowish; the margins are occasionally completely smooth. As concluded by Hanley (1844), a growth series demonstrates, that *C. dionaeum* is a juvenile form of *C. cardissa*.

C. kirai is characterized by red or purplish rose commarginal streaks, usually along the margins and centrally. The margins are usually weakly dentate. The irregular opaque structure is very close to *cardissa*, the commarginal ribbing as well, the same shapes are found in *kirai* and in *cardissa*. Without genetic support, *C. kirai* appears as color form of *cardissa*.

On the other hand, ***C. impressum*** (syn. *humanum*, *junoniae*) is recognized as distinct species. This is an old name, well depicted by Chemnitz 6 14 145-6 and also recognized as "bien distincte" by Lamy (1942). It is a common shallow water species, quite constantly anteriorly dotted red on a white or yellow background, posteriorly generally uniform white or yellow, margins generally weakly crenulated. It is well depicted in Born (1780 var. a), REV431 sp. 15a or Springsteen & Leobrera (1986 pl. 87 fig. 15). The shell is translucent. However, the opaque spots are much more regular than in *cardissa* and located exactly where the red dots are visible on the outside. It is a smaller species than *cardissa* with generally smoother ribs.

C. roseum is also an old Chemnitzian name, latinized by Gmelin, 1791. It is a rare, but uniform and easily recognizable species. It is well depicted in Chemnitz 6 14 147-8 or REV431 sp. 15b/f. Recent figures have not been encountered. It seems to live deeper. The escutcheon is rose red, the lunule white, and the border yellowish and smooth. The posterior surface is solid, smooth-waxy and very different to *impressum* and *cardissa*. All specimens seen so far originated from Philippine waters.

C. monstrosum Gmelin, 1791 is another early recognized species, well depicted by Chemnitz 6 14 149-150 or

REV431 fig. 15c, also Springsteen and Leobrera (1992 fig. 18 and fig. 19). Spengler's type of *replicatum* seems to represent this species as well. F. Cailliaud (1859) remarked "*Cardium monstrosum* ... prouve qu'il ne constitue qu'une monstruosité et non une espèce". This view is false. Although a strongly curbed shape is occasionally seen in most *Corculum* species, this peculiar shape is indeed most often found in true *monstrosum*. The shape of *monstrosum* though often distorted is generally anteriorly dished. All specimens seen are quite uniformly yellowish white, with characteristic long darker streaks posteriorly and red dots anteriorly. The opaque lines and spots seen against light reflect exactly the outside sculpture and differ significantly from *cardissa* and *impressum*. *C*. *levigatum* Bartsch, 1947 is the same.

C*. *aselae Bartsch, 1847 is the most common species, especially in Philippine waters, found in many strong colors (yellow, red, orange, brown, white, in shades or uniform). It is a comparatively small species, equally convex, margins usually smooth, sometimes crenate. Both sides have the same or at least a similar color, opaque dots are scarce or absent. Usually the anterior side is slightly or strongly dished. This species was obviously not recognized by earlier authors. Shikama (1964 pl. 44 fig. 3) is this species. However, his fig. 4 "*cardissa*" the yellow specimen, apparently without opaque dots from the Philippines, is an *aselae* as well. *Cardissa*, generally whitish, occurs also in weak yellow colors, but never as intense as found in *aselae* and the opaque dots in *cardissa* are strongly expressed.

C*. *obesum is characterized by an anterior strongly produced, generally white form. The posterior side is slightly dished, sometimes strongly expanded, and sometimes almost flat. The umbonal part is quite acute and the shell regularly, broadly ridged. Most specimens seen have no or very weak marginal dentition. Juveniles are much higher than broad, full adults are almost round. Also here the surface structure is superficially smooth and less translucent, opaque spots are virtually absent. The type of ***C*. *aequale*** is depicted in Fischer-Piette (1973 pl. 12 fig. 2). Fischer-Piette placed *aequale*, due to its special ribbing, in *Fragum*. Most subsequent authors identified it as *Corculum*. The unique BMNH holotype from unknown locality has been studied. Although it shares many features with *obesum*, I must admit that an identical specimen has not been encountered as yet. *Aequale* is currently interpreted as somewhat humped *obesum*, thus, as earlier name. However, some doubt remains. This species is not common.

In Philippine waters, known from Sogod and Mactan an obviously rare, **undescribed** *Corculum* occurs, reaching exceptionally 48 mm.

C*. *inexpectatum described form 800 m off Three Kings Isl., NZ is not well known. As at least some, if not all *Corculum* harbor *Zooxanthellae*, this species cannot be a true *Corculum*. Indeed, J. H. Leal recently removed it from cardiids and placed in poromyids.

Thus, 7 true IND *Corculum* are considered recognizable.

QQ13: Typical ***C*. *fornicata*** is found from Okinawa, Philippines to New Caledonia, with the largest specimens reaching almost 40 mm in New Caledonia. In the Red Sea a smaller, finer ribbed form is found. Specimens from Natal and Mozambique are in between these two extremes, usually quite small, less than 15 mm and often yellowish purplish in color. Whether all these forms are indeed only referable to one species, is open.

QQ14: In N.C.-NE. Florida a special ***C*. *media***, shaped with a clear posterior truncation occurs. It somewhat approaches the fossil *C*. *columba*. However, Brazilian specimens occasionally show these same truncations. Porter and Houser (1994) identified this form from N. C. without doubt as *media*. This course is followed and *media* is considered a quite variable and widely distributed Caribbean species.

QQ15: ***C*. *virgo*** is considered another highly variable species found in three extremes. Typical *C*. *virgo* is a small white form, densely, finely ribbed with 38-40 short spined ribs, rather fragile, squarish, white and inside pinkish red. It is known from the Philippine, probably also living in the Andaman Sea (var. *brevispinosa* Preston).

C*. *perornata is a larger form with 27-30 strong ribs. It is elongate, predominantly white, often flushed red inside and well known from Australia.

The type species of *Ctenocardia* SD Dall, 1900 *Cardium hystrix* (= ***C*. *symbolica***) is a yellowish-red colored form, widely distributed. The rib number is in between the two above mentioned extremes.

QQ17: Vidal (2005) published a remarkable paper on the European ***Laevicardium***. He accepted much more species than admitted conventionally. Then strongly doubting, I had in spring, 2005 the opportunity to meet Jacques Vidal and his *Laevicardium* species in MNHN, Paris. I am now convinced that recognizing 5 distinct E. Atlantic *Laevicardium* is much more appropriate than coercing all forms into 2 "species", as applied by most European authors. Whereas juveniles may be very close, the 5 adult forms are significantly distinct. Nonetheless, the 5 species here also recognized should be verified by modern methods.

Three species are quite common, shallow living – *crassum*, *oblongum*, *senegalense*, whereas *L*. *gibba* and *L*. *castanea* are deeper living and uncommonly encountered. *Castanea* is typically brownish inside; *gibba* has smoother ribs than *crassum* and stays smaller.

The small, colorful, fragile Mediterranean specimens are difficult to attribute. Together with most authors these are considered juvenile glossy Med specimens of *crassum* instead of *senegalense*, which is understood restricted to WAF only.

Obviously, more cardiids are panatlantic (CAR and WAF) than usually mentioned. In addition to the CAR ***sybariticum*** (Gulf of Guinea, Principe, MNHN), also ***pictum*** is known from Sao Tomé.

Furthermore, in addition to the well known *Papyridea soleniformis* also *P*. *lata* is rarely encountered in WAF waters.

QQ18: The conventional opinion that just one highly variable large ***Laevicardium*** lives from Cape Hatteras to Brazil is not shared. Instead, 3 larger species are recognizable:

The smallest occurs in Brazilian waters. ***L*. *brasilianum*** is biogeographically and morphologically (size, form, sculpture and brown mark on the escutcheon) easily separable (= CLE44, fig. 5-7).

A second species is medium in size, glossy, colorful, externally and internally, usually trigonal-oblique, and has ridges on the escutcheon of the left valve. These ridges are neither found in *brasilianum*, nor in *pristis*. This is *laevigatum* of Born and Lamarck, but not of Linnaeus. Hanley (1855 pl. 1 fig. 8) well depicted Linnaeus' *laevigatum* type. Linnaeus' species was misunderstood by Clench & Smith (1944). As concluded by Vidal (1999) *laevigatum* is not a *Laevicardium*, but a *Fulvia*. As stated by Chemnitz, Reeve (1844), Dall & Simpson (1901), Lamy (1942) and, finally, by Vidal (1999), based on Linnaeus' type material, the correct name for this common Caribbean species is ***Cardium serratum*** Linnaeus, 1758 (= CLE44, fig. 3). *C. serratum* is very common in the West Indies.

L. pristis, the largest species, is well known from Florida and the Bahamas, but also known from Colombia and Venezuela. It has been first named by Bory de Saint-Vincent, 1827 in Enc. Meth. p. 155 based on the earlier published, but unnamed pl. 299 fig. 3. It shows this characteristic inflated species with the fine radial sculpture well. *Pristis* is generally all white, often brownish speckled and strongly inflated. Usually the sides are distinctly tawny colored. The escutcheon is smooth and the ligament is quite long (= CLE44, fig. 1-2). Occasionally this species is strongly radially lined and was as such also named *L. glabratum* (= CLE44 fig. 4) or *multilineatum* (= DIA94 fig. 167).

Photos of all type specimens have been studied. Juveniles of *pristis* are rounded ovate, whereas juveniles of *serratum* are elongate.

QQ19: ***Fulvia*** is a very difficult genus. Whereas I still suffer under the impression that *Fulvia* might be over-named, the experts recognize subtle differences among the almost 20 IND species.

The most common and widest distributed species is ***Fulvia australis***. It is extremely variable in form (quadrate elongate to round), in texture (thin, very fragile to thick, quite solid) and in color (almost white, cream-yellowish, deep orange, often marbled with purplish-brown pattern). Apart from others, also *F. fragiformis* Vidal, 1994 is here considered a synonymous color form; *boholensis* is at least very close.

Cardium laevigatum Linnaeus, 1758 was depicted by Hanley (1855) and correctly identified by him as Chemnitz' *C. papyraceum* (= *Fulvia papyracea* (Bruguière 1789). 3 syntypes are available, and Vidal (1999 p. 327) selected a lectotype. Linnaeus' name was long erroneously applied by US authors for an unrelated Caribbean *Laevicardium*. *Fulvia laevigata* (Linnaeus 1758) is instead a rather uncommon IND species; synonyms are *papyracea* and *voskuili*.

QQ20: ***Nemocardium***: Juvenile "***bechei***" from Japan, Philippines and Australia are close and easily confounded. However, adults show significant differences in shape, color and periostracum as recognized by Poorten (pers. com.). As described by Iredale, 1927 the rose, quite elongate, and deeper living Australian ***N. probatum*** is perceived as distinct from the Philippine ***N. bechei***. Fully adult Japanese differ from Philippine specimens in a particularly dark periostracum, rose instead of orange colors and comparatively high shape and represent an **undescribed** species. Furthermore, it is more likely that the deeper water, 15.4 mm Kermadec species (POW58) represents an **undescribed** *Nemocardium* than *bechei* (Otago) or *probatum* (POW58). This complex is under study in the Netherlands.

QQ21: **GOETHEMIINAE**: Ockelmann (1958) discussed and depicted the barely known *Cardium elegantulum* "Beck" Møller, 1842. This is one of the very few cardiids confined to the cold waters of the Northern hemisphere. It is a small species, barely surpassing 13 mm and lives in rather deeper water. In addition, it features a unique reproduction trait in cardiids. The large majority of cardiids are known as monoecious, a few as dioecious. As far as is known, the shallow water cardiids are reproduced by planktotrophic larvae. However, *elegantulum* is distinct, brooding and viviparous. Ockelmann gives the details.

Ockelmann (1958) placed this unique species in *Cerastoderma*, followed by Abbott (1974 p. 488). However, Lambiotte, 1979 considered it distinct and erected *Goethemia*. *Goethemia* has been recognized by subsequent authors, but variously placed; e.g. near *Parvicardium* (CLEMAM), between *Clinocardium* and *Laevicardium* in group 2 (Vidal, 2000) or unplaced (Schneider, 1998; Poorten, 2005).

Schneider (1998) studied *Goethemia* phylogenetically. He stated morphological affinities to *Cerastoderma* in oval, cerastiform shell shape and confirmed as such Ockelmann's earlier perception. However, the genetic data show a marked distinct lineage, which do not allow inclusion of *Goethemia* in the compact group of lymnocardiinids. Furthermore, *Goethemi*a has a significantly distinct habitat and mode of life compared to the predominantly shallow water, estuarine to freshwater lymnocardiids.

Based on a special mode of reproduction, distinct phylogeny and habitat here GOETHEMIINAE is proposed to accommodate this unique Arctic species. GOETHEMIINAE is placed near LYMNOCARDIINAE.

QQ22: **LYMNOCARDIINAE**, composed of often shallow, brackish water species, are among the most difficult in cardiids. Recommended are still Ostroumoff (1905) and Lamy (1946), whereas most modern authors, e.g. Keen, Vidal, and Schneider circumnavigated this thorny subfamily. It has to be expected that the lacking genetic data is as complex as the variability encountered in reality.

A first issue is the number of valid species. From the more than 700 species within 73 genera mentioned by Nevesskaja et al. (2001), at least 75 names are available for extant *Cerastoderma*, *Adacna*, *Monodacna* and *Didacna*. Whether specimens from the Black Sea and the Azov Sea are still the same or now distinct from their Caspian Sea cognates is one issue. The other topic is the extent of intraspecific variability. Ostroumoff (1905) demonstrated a high variability in important species, whereas Birstein et al. (1968) attributed separate names to many of these forms. Herein, a conservative approach is applied, less than 15 extant lymnocardiids are recognized. Accepting, on the other hand, minor morphological differences and biogeographical separation, then this number can easily be doubled.

A second issue is the number of extant genera. Whereas *Cerastoderma*, *Monodacna*, *Didacna* and *Adacna* have clearly attributed type species, *Hypanis* is variously understood. Following Lamy (1946) Hypanis "Pander" Ménétriés, 1832 is a nom. nud. Afterwards *Hypanis* was applied by Boisduval, 1833 for an Insect genus. Thus, ***Hypanis*** Eichwald, 1838 is preoccupied and was not accepted by Lamy. In addition, the type species of *Hypanis* Eichwald, 1838 by monotypy is the fossil *Cardium plicatum* Eichwald, 1838. This species is distinct from *Glycymeris plicata* described validly also by Eichwald, but already in 1829 from the Caspian Sea. The extant *G. plicata* was classified as *Adacna* by Eichwald in 1838 and is here also classified so. The interpretation of *Adacna* and *Hypanis* by Nevesskaja et al. (2001) does not oppose an inclusion of *plicata* in *Adacna*. *Plicata* is close to *laeviuscula*, the type species of *Adacna*. Both share an edentate hinge, a deep sinus, a whitish color and the differences in ribbing are only gradual.

As far as can be assessed, four genera *Cerastoderma*, *Monodacna*, *Didacna* and *Adacna* suffice by far to accommodate the few extant lymnocardiids. A renaming of the unavailable *Hypanis* for extant species is not deemed necessary.

The first species of Pallas, 1771 ***Cardium trigonoides*** is widely understood as type species of *Didacna* living in the Caspian Sea. Pallas' second species ***Mya edentula*** has been interpreted variously during the last 200 years (e.g. as *M. caspia*, as *M. colorata*, or as *Adacna plicata*). Unless the type material could be found, this name is understood as nom. dub.

6.46 TRIDACNIDAE

QS1: Some workers treated tridacnids as their superfamily (Keen in Moore, 1969, even distant from CARDIOIDEA; Russian authors, e.g. Starobogatov, 1992), some as valid family (IRE37). Most modern analyses (e.g. Schneider, 1998; Giribet et al., 2002; Matsumoto, 2003) demonstrate a close relation to cardiids, either to *Fragum* or to *Nemocardium* (*Keenaea*). Consequently, modern workers attribute this group subfamilial status within CARDIIDAE.

Definitely, a superfamily is no longer justifiable. However, the restricted biogeography, the special habitat and mode of life, an anatomy, in some features marked distinct from cardiids, a special morphology, the fact, that nobody ever confounded cardiids with tridacnids, together with their unique size and weight still justifies a familial treatment within CARDIOIDEA.

As stated in the introductory notes, I do not share the reducing view that taxonomy is a mere function of phylogeny.

QS2: ***Tridacna***: Taking into account the characteristic features of each species and the small number of tridacnids, a differentiation of various subgenera within *Tridacna* adds little benefit.

Iredale (1937) started and proposed 5 genera for the then recognized 5 *Tridacna* species. He created for the most variable tridacnid, *maxima*, even two distinct genera. Whether *Persikima* is genetically indeed significantly distinct from *Tridacna* s.s. is open. In addition, the often applied subgenus *Chametrachea* Mörch, 1853 has to cede the earlier usage by Herrmannsen, 1846 (SHE). However, Herrmannsen's monotypic usage of *Chama aspera* Rumph. can be interpreted as *T. crocea*, which then would equal Mörch, SD Iredale, 1937.

More important than a forced grouping appear the real differences in habitats, modes of life and detailed specific characters as recently excellently elaborated by Roa-Quiaoit (2005).

Crucial are ***Tricdachnes imbricata*** Röding, 1798 from IND and ***Tridacna squamosina*** Sturany, 1899 from the Red Sea. As indicated by Mörch (1853) the former is likely the earlier name for Lamarck's *squamosa*. However, here an analysis of Bolten's types at Gotha is pending to verify.

Together with A. Eschner, NHMW, the 7 syntypes of Sturany's *squamosina* from the Red Sea could be studied. This is the same as Roa-Quiaoit (2005 *Tridacna* sp.), respectively the recently described ***T. costata*** from Aqaba. The findings together with the type material will be published separately.

6.47 DONACIDAE

RK1: The last global view dates from Bertin (1881). However, from Bertin's newly introduced 10 names, only *D. erythraeensis* is perceived as valid species. More in-depth Römer (1869-70) treated donacids. Also important are Reeve's monograph (1854-55), Bernardi's monograph on *Galatea* and *Fischeria* (1860) and Pilsbry & Bequaert (1927) on WAF donacids. Furthermore, Tryon (1869) listed 110 donacids. In modern times, especially Coan (1983) and Adamkewicz & Harasewych (1996) have to be mentioned. Subba Rao & Dey (1986) treated the Indian donacids; however, some specific and many of their subgeneric attributions are not shared. Overall, global donacids are a neglected family, and the WAF genera/species are virtually unknown to science.

Here, 4 genera with approximately 100 species are recognized, the large majority is placed in ***Donax***.

Within *Donax* neither habitat, nor biogeography, or anatomy seems to present clear features for generic distinction. Thus, all species are kept within a single genus, as concluded by Keen in Moore (1969). Salas (1987) considered ***Capsella*** as generically distinct. However, this view was followed by few European authors. Furthermore, *Latona* and *Plebidonax* have smooth margins as well, and other subgenera, e.g. *Hecuba*, *Amphichaena* or *Tridonax* offer morphologically more distinct type species. ***Hecuba*** was generically differentiated by some authors. However, other subgenera with a special sculpture or shape, e.g. *Deltachion*, *Pulcherridonax* and especially *Carinadonax* could then also be discerned. Subba Rao & Dey (1986) kept *Hecuba* in *Donax* and this course is followed. ***Amphichaena***, even included in PSAMMOBIIDAE by Keen in Moore (1969), has been analyzed by Coan (1983) and declared a subgenus of *Donax*.

Morphology (especially surface sculpture, but also pallial sinus, hinge and marginal dentition) are important for subgeneric distinction. As stated by Coan (1983), the number of subgenera in *Donax* is insufficient. Usually, the monospecific European genera are too widely applied. Other authors used *Latona*, *Paradonax* or *Plebidonax* too widely (e.g. SUB86). As fossil subgenera are virtually absent, in addition to the 14 available, here, 6 new subgenera are proposed to accommodate the various groups found within the currently more than 80 true *Donax* globally.

Donax: Solid, trigonal-elongate cuneiform, posteriorly inflated and usually truncate; radial sculpture without interrib punctuations, posterior with weak to strong commarginal ribs; denticulate margin, posterior denticles often irregular and larger; broad and large pallial sinus; strong bifid cardinal in right valve, weak to absent laterals; adults often with two ovate siphonal openings posteriorly (*D. serra*, *D. hanleyanus*, and occasionally in *D. rugosus*). As such *Donax* is restricted to approximately 9 Atlantic and W. Indian Ocean species; all except *D. serra*, *D. rugosus* and *hanleyanus* are rather small. *D. townsendi* and the very similar, trigonal *D. saxulum* fit in some respects and are tentatively here included.

Capsella: Elongate-cuneate and posteriorly extended; polished, completely smooth with growth lines only, smooth ventral margin; true laterals lacking; similar in form to *Tentidonax* and often confused with it. However, in *Capsella* the characteristic oblique ridges of *Tentidonax* are lacking on the posterior part; monospecific MED.

Serrula: Mörch's composition was confusing, but Stoliczka, 1871 selected the European *D. trunculus* as type, SD. Consequently *Serrula* is restricted to 2 large species up to 48 mm; parallelogram in shape without carina; similar to *Capsella* glossy, smooth, faint microscopic radial sculpture only, without interrib punctuations or commarginal lines; but strongly denticulate on the ventral and completely smooth on the posterior margin; true laterals lacking; 2 species known MED, WAF.

Cuneus: Similar to *Serrula* in form, elongate; glossy, but with radiate striae and wrinkled commarginal lines on the posterior part giving a weak to strong cancellate sculpture, finely denticulate margins, also posteriorly; right valve with weak laterals; usually 3 species are listed, but probably monospecific; Med and adjacent Atlantic only.

Paradonax: Similar to *Capsella* in shape, elongate with low umbones, but slightly gaping at both ends; glossy smooth with weak radial striae, mainly centrally, without punctuation; strong marginal dentition; small laterals in left valve; 2 extant PAN species.

Machaerodonax: Fragile, compressed, very elongate, acute-rostrate posteriorly, sides almost parallel; smooth, posteriorly densely obliquely not radially ribbed; weak and fine marginal dentition, absent anteriorly; laterals in right distinct from cardinals; gaping at both ends; 4 uncommon species WAF, IND.

Tentidonax: Small, fragile; close to *Machaerodonax* in posterior oblique ridges, but without carina, ovate rounded shape, generally small; weak laterals; approximately 8 species in WAF, IND and adjacent regions.

Chion: Radial structure with interrib punctuations; thick shelled; posterior structure divided with oblique, wrinkled ribs centrally; virtually monospecific Caribbean. However, the 6 Panamic "*Chion*" though lacking the typical posterior sculpture, share the interrib punctuations. Following Coan (1983) these are including in *Chion*. This makes *Chion* an exclusively American genus with 7 extant species. The Japanese *semigranosus* is lacking these punctuations and fits *Deltachion*.

Grammatodonax: Unique, with 10-30 strong, oblique ridges; trigonal, solid; margins crenulate; monospecific, EAfr.

Latona: Comparatively large, often strongly colored and highly variable in color and shape; posteriorly densely wrinkled, some also crossed by radial striae giving a granulate impression; anterior part superficially smooth, but microscopic finely radial striated; margin superficially smooth, but often with dense microscopic radial striations; strong laterals in right valve; approximately 10 IND species.

Plebidonax: Large, close to *Latona*, but with radial structure only, predominant on posterior half; margins virtually smooth; massive bifid cardinal in RV, anterior laterals wanting; monospecific S. Australia.

Hecuba: Large, inflated, keeled form, juveniles usually with spines on the keel, posteriorly strongly rostrate, strong radial sculpture commarginally ridged; margins very finely striate. *Hecuba* is monospecific, widely distributed form Arabia to Taiwan.

Deltachion: Small, keeled forms, anterior superficially smooth with weak radial sculpture only, often with spines resulting from strong commarginal ridges crossing the keel, finely cancellate posteriorly; truncate to moderately expanded posteriorly, margins denticulate; two somewhat distant laterals in right valve; approximately 5 species IND and adjacent waters.

Amphichaena: Thin, fragile, gaping at both ends, radial structure, prominent at both ends, without punctuation; pallial sinus comparatively short; internal ventral margin crenulate, smoother towards the center; weak periostracum; monospecific PAN

Assimilidonax subgen. nov., type herein: *Donax assimilis* Hanley, 1845.

a) right valve slightly overlapping left posteroventrally

b) strong laterals in left valve

c) solid, generally high-trigonal in shape; large 25-48 mm

d) radial sculpture with strong growth lines, but without interrib punctuation

e) fine marginal dentition, non gaping.

Coan (1983) recognized this characteristic group without naming it. This new subgenus within *Donax* encompasses *D. assimilis*, *D. asper*, *D. dentifer* (all PAN), *D. striatus* (CAR) and *D. sordidus* (SAF). Members have formerly been included in *Hecuba*, *Chion*, *Donax* s.l. or in *Donax* s.s. Derivatio nominis: After the type *Donax assimilis*.

Carinadonax subgen. nov., type herein *Donax carinatus*.

a) Similar to *Machaerodonax*, also with carina and acutely rostrate, but more inflated and more solid.

b) Radial sculpture only, strong and well visible on the posterior part, not oblique as in *Machaerodonax*

c) Large, more than 40 mm

d) Right valve, hinge with divergent cardinals and very close laterals, similar to *Hecuba*

e) Strong marginal dentition, also on the anterior part.

This new subgenus within Donax is only known from PAN and includes two uncommon species, *D. carinatus* and *D. transversus*.

D. carinatus had earlier been included in *Donax* or *Hecuba*. *D. transversus* was included in *Machaerodonax* ever since. Coan (1983) redefined *Machaerodonax* to accommodate *carinatus* and *transversus*, in addition to the type SD *scalpellum*. Cosel (1995) considered *Machaerodonax* as originally well defined and included *acutangulus*, *scalpellum*, his newly described *phariformis* and *transversus*, but not *carinatus*.

Having studied all above species and additionally Hanley's uncommon *Machaerodonax impar* from the Persian Gulf following are the results: *D. transversus* is closely related to *carinatus*, but both are significantly distinct from true *Machaerodonax scalpellum*, *acutangulus*, *phariformis*, and *impar*. The main differences among these two groups are: Posterior surface sculpture (radial vs. oblique in *Machaerodonax*), hinge (strong, close vs. weak, distant laterals, especially anterior in right valve) and marginal dentition (strong, regular vs. very weak, lacking at least anteriorly and sometimes completely). Apart from disjunct biogeography, *Carinadonax* is also more inflated, more solid, less gaping and grows larger. Derivatio nominis: After the type *Donax carinatus*

Dentilatona subgen. nov., type herein *Donax incarnatus* Gmelin, 1791

a) similar to *Latona* in rounded cuneate shape, glossy, without keel and rostration

b) dentition as in *Latona*, right valve with two cardinals and two strong laterals

c) sculpture like *Latona*, posteriorly commarginally wrinkled ridges, crossed by weak to stronger radials, anterior superficially smooth, with microscopic radial lines

d) but denticulate margin

e) and generally smaller in size, 10-20 mm

This new subgenus within *Donax* encompasses IND species *D. incarnatus*, *D. siliqua* and *D. saigonensis*.

D. lubricus is here included as well, although the lateral dentition is weaker and the shell growing larger. *Dentilatona* species were formerly placed in *Serrula* or in *Latona*. Derivatio nominis: *Latona*, with denticulate margin.

Paraserrula subgen. nov., type herein: *Donax variabilis* Say, 1822

a) similar to *Serrula*, also parallelogram form, but

b) generally smaller, usually 10-20 mm

c) marginal dentition also on posterior margin

d) clear laterals present, distant from cardinals

e) strong, radial sculpture, most expressed posteriorly

This new subgenus within *Donax* encompasses American species: *D. variabilis*, *D. fossor*, *D. texasianus*, *D. vellicatus*, *D. gemmulus*, and *D. gouldii*. These species were formerly placed in *Donax s.l.* or in *Serrula*. However, posterior marginal dentition, hinge with laterals and strong radial sculpture differ. According to a DNA-analysis of Adamkewicz et al. (1996) *D. variabilis* and *fossor* are quite close, *texasianus* somewhat less, but all three are clearly distinct form *striatus* and from *denticulatus*.

In addition, tentatively two IND species are placed here *D. introradiatus* and *D. grasi* sp. nov. herein. These approach large, comparatively fragile *fossor*, and might, once better known, represent an additional IND lineage. Derivatio nominis: Confounded with *Serrula*

Pulcherridonax subgen. nov., type herein: *Donax clathratus* Reeve, 1854

a) Unique in strong radial imbricate ribs in adults

b) trigonal-cuneate; small 10-15 mm

c) unique in ventral margin with true denticles

d) strong laterals in left valve, matching pits in right valve

e) tightly closed

This new subgenus within *Donax* is unique regarding ribs, denticles and together with *Paradonax* in lateral dentition in the left valve. Formerly it has been included within *Donax* or *Serrula*. *Pulcherridonax* is monospecific, known from the Red Sea and the NW. Indian Ocean. Derivatio nominis: One of the most beautifully sculptured donacids.

Tridonax subgen. nov., type herein: *Donax denisi* Fischer-Piette, 1942

a) Unique in three distinct sculptural elements: densely granulate posteriorly, densely commarginally-undulate medially and anteriorly, interrupted by a small completely smooth area anterior

b) unique in strongly plicate posterior margin, 2 up to 6 plicae in larger specimens

c) high trigonal-cuneate; more than 30 mm

d) pallial sinus moderate in height and rounded, passing midline, largely confluent

e) tightly closed

Fischer-Piette, 1942 described a fabulous *Donax denisi*, a unique specimen from unknown locality, purplish-white with marked diverse sculptural elements and a strongly plicate posteroventral margin. *Denisi* has not been recognized since. Going through a large *Donax* collection and many types from various museums nothing remotely close was ever encountered. Longtime *denisi* was considered an outworldly freak.

However, recently 2 complete specimens from Port Moresby, Papua New Guinea dredged in the 1950s, could be acquired, originally from a collector living in this nowadays almost inaccessible area. The comparatively large, purplish-white specimens proved to fit the *denisi* MNHN holotype in color, shape, sculpture, plication and pallial sinus precisely. Derivatio nominis: Three distinct sculptural elements.

There are a couple of further enigmas, e.g. ***D. nuxfagus***, ***saxulum*** or ***cumingii*** with unconfirmed or unknown locations. Some other species are barely known, e.g. ***souverbianus*** (New Caledonia) and ***szemiani*** (Indonesia). The true identity of 3 Spenglerian species ***Tellina solida***, ***faba***, and ***flavescens*** is unresolved; the type of *flavescens* is missing, the other two are still present, but were not studied as yet. The same applies to ***Donax stramineus*** Gmelin, 1791; the type may be at Gotha.

Donax sexradiata Wood, 1828 was placed by several authors in various locations and families. The type was not found in BMNH 11/08. The original picture does not allow a firm identification. *D. sexradiata* is a nom. dub. As in many other cases of Wood (1828), it is most likely that Lamarck's respective *Tellina* (= *Heterodonax*) was meant, erroneously placed by Wood in *Donax*. Overall, approximately half of Wood (1828) "new names" were copied from older authors without reference, sometimes misspelled and often placed in other genera. Many of these names, although recognized by Sherborn, are not valid.

For another 10 not identifiable *Donax* the type material is missing. These were declared **nom**. **dub**. by earlier authors or herein.

More than 5 truly forgotten *Donax* of Bory de Saint-Vincent, 1827 were once properly proposed, but not even listed by Sherborn and also not treated by any subsequent author.

RK2: ***Tentidonax***. The type species ***veruinus*** (= *nitida Reeve* non Lamarck, 1805) is known from Australia to the S. China Sea (= *nitidus* Robba et al., 2002).

In the Indian Ocean two superficially similar *Tentidonax* are found: ***D***. ***aperittus*** (= *nitidus* Oliver, 1992, 1995) which attains about 10 mm, and is known from Aden, Arabian and W. Indian Ocean.

In S. Africa ***D***. ***bertini*** extending to Tanzania (= *veruinus* Spry, 1964) and Mauritius (= *aperittus var*. *elongata* Viader, 1951) is found. *D. bertini* grows more than twice the size of *aperittus*, is more acute and more elongate, in color purple fawn or white, with much finer posterior ridges. Specimens from Tombeau Bay, Mauritius have been studied and proved indistinguishable from *bertini*, but quite different from *aperittus*. Thus, the preoccupied ***D***. ***aperittus var***. ***elongata*** Viader, 1951 non Lamarck, 1818 is here synonymized with *bertini*.

RK3: Willan in Beesley et al. (1998) is followed, who accepted only one valid ***Deltachion*** from Southern Australia. Wells and Bryce (1988), although based on ***electilis***, gave SWA to Qld as *Deltachion* range, which includes Smith's earlier ***brazieri*** from NSW. *D. brazieri* is highly variable in shape. Within the same population narrow to elongate trigonal specimens are found. The swelling of the ventral edge, noted by Cotton as main difference to *brazieri* is weakly also found in NSW-specimens. End of range specimens from Geraldton (= *electilis*) are weaker sculptured and less angled. However, fragility, dentition, pallial sinus are the same as in strongly sculptured NSW specimens. Smith's BMNH *brazieri* type series from NSW encompasses small, mainly purplish, heavily sculptured specimens close in shape to Lamprell & Whitehead (1992 sp. 383b). In addition, in the BMNH type collection 4 single valves of the unresolved ***D***. ***meta*** Reeve, 1855 have been studied. These bear no locality, the largest is 20.1 mm. The trigonal shape, the angular truncation, the swelling of the ventral edge, the solid texture, the large and broad pallial sinus, sculpture and marginal dentition leave no doubt that this ***meta*** lot represents a *Deltachion* from S. Australia; it most closely resembles the specimen depicted by Cotton (1961 p. 315 *Deltachion electilis*) from SA, Normanville. However, subsequently heavy doubts occurred. First, Reeve explicitly mentioned only one odd valve, whereas the BMNH *meta* lot contains instead 4 conspecific valves. Second, the valve fitting Reeve's OD best in size and in yellow interior, inside also penciled *meta* is a left valve with a huge *Natica* hole umbonally, whereas Reeve depicted a right valve without hole. The only possible conclusion is that none represents Reeve's original specimen. Although Reeve's *meta* may have been this species, the missing holotype together with the well introduced *brazieri* recommend to classify *Donax meta* Reeve, 1855 as **nom**. **dub**.

RK4: At first glace indeed two closely related *Tentidonax* seem to occur in SAF waters. Typical ***D***. ***burnupi*** is similar to *D. oweni* from WAF, whereas typical ***D***. ***longissimus*** is more ovate in shape and the posterior portion has more and weaker oblique striae, in older specimens almost perceivable a growth lines only. Obviously, however, Steyn and Lussi considered these the same and their depicted form sp. 941 is indeed quite in between these two extremes. As such, *longissimus* is synonymized with the earlier *burnupi*. *Burnupi* is by far the largest *Tentidonax*. The Australian type species reaches barely more than 10 mm.

The peculiar *D. burnupi* record of Cosel (1995) from Mauritania could not be verified. It is also not listed in Ardovini & Cossignani (2004).

RK5: Whereas in *trifasciatus* the rough commarginal striae are limited to the posterior part, in the closely related *faba* these ridges extend usually as far as midshell. ***D***. ***faba*** is generally elongated, larger and not glossy.

Faba fits well the species depicted by Lamprell & Whitehead (1992 fig. 381). Instead their fig. 380 with the text of 381 represents *D. columbella*. Lamarck's type is in Paris, the MHNG var. b contains 2 purplish specimens. The type locality King Georg Sound is slightly too far southwest, but *columbella* is commonly found around Perth's sandy beaches and also seems to occur to SWA, Albany. As concluded by Lamprell & Whitehead, Menke's ***D***. ***sulcarius*** from West Australia (2 syntypes in ROE700 pl. 16 fig. 7-8) are perceived the same. Without any doubt ***D***. ***splendens*** Dunker, 1858 (MfN, ZMB108.799) described from Swan River (= Perth) is also this species. The type has been studied and fits specimens collected around Perth exactly. Also Römer's sp. 57 *Donax lineolatus* from West Australia seems identical. True ***D***. ***lineolatus*** Bory de Saint-Vincent, 1827 n. & f. is based on Enc. Meth. Pl. 262 fig. 8a-c. Bory's species might represent a *Chion*, but it is perceived as specifically indeterminate and as nom. dub.

The pallial sinus in *columbella* is much deeper and broader than in *faba*. It is generally larger and flatter than *faba* and usually *whitish*; occasionally purplish and reddish specimens occur. The surface in fresh specimens is glossy and the commarginal ridges confined to the posterior part.

A more trigonal, smaller, solid form, strongly truncate posteriorly, with ridges covering the whole anterior portion has been named ***tinctus*** by Gould and accepted as valid by Bertin and by Lynge (1909). Gould, 1850 gave originally no locality. *Tinctus* is distributed at least from the Andaman to the South China Sea, including Philippines.

RK6: The small specimen depicted in Diaz & Puyana (1994) from Caribbean Colombia as ***Donax cf***. ***vagus*** appears close to *D. gemmulus*. *D. vagus* seems to represent a fossil form only. Adult *texasianus* are also close in shape, but juveniles are less high and broader. Nonetheless, this issue merits further investigations, as *gemmulus* has otherwise not been reported from the Caribbean, but is known from S. Brazil southwards.

RK7: ***Donax grasi*** sp. nov. herein

Introduction: From a research trip to Sumatra, Bangkahulu Province B. Gras sent 18 loose, out of 90 beach collected valves of an unknown *Donax*. At the same time K. van Laethem sent a lot of 5 unknown articulate *Donax* specimens, self collected, found on sandy beaches in various locations in S. Java. B. Gras had earlier collected the same species in Bali, Kuta Beach, live in sand.

Neither in Reeve, Sowerby II, Römer, nor Bertin was an identical species found. This species, in Indonesia locally common, is here described as new.

Diagnosis: An elongated, thin *Donax*, close to *Paraserrula* in shape, gaping at both ends, purplish-white with a thin yellowish periostracum, somewhat iridescent, with a deep pallial sinus, passing midline.

Description: The shell is unusual fragile for this family; small, less than 20 mm. The shape is elongate, with dorsal and ventral margin almost parallel; anterior strongly expanded with a rounded end, posteriorly short and subtruncate; equivalve, but marked inequilateral, with rather low umbones in the posterior quarter. An indentation, emanating from the umbones, becomes trigonal towards the ventral margin and slightly turns the posterior ventral border.

The surface is superficially smooth with rather weak, irregular growth lines and a somewhat iridescent sheen in fresh specimens; under the lens very fine, hair-like radials emanating umbonally are visible. There is not, as usual in donacids a marked sculptural difference in the larger anterior and the shorter posterior part. The periostracum is very thin, yellowish. The outside coloring is quite uniform in all specimens seen, purplish white anterior half, a broad white radial streak and a dark purplish posterior part.

Inside a very deep pallial sinus is present, passing midline, covering in height almost half of the valve. The pallial sinus is moderately ascending, at least half is confluent. The internal color is dark purplish brown at both ends, with a broad white streak radiating from the umbones to the ventral margin. The margins are finely crenulated, the crenulations fading at the posterior and at the anterior end.

The hinge line is weak, the right valve with a thin but prominent anterior lateral and a shorter, posterior lateral; both laterals moderately remote from the small split cardinal.

The valves are quite strongly gaping posteriorly, less so anteriorly. The ligament is small, posterior to the umbones only.

Maximum dimensions (length x height x diameter) 18.1 mm x 7.8 mm x 4.7 mm.

Soft parts were not available.

Derivatio nominis: This new donacid is named after Bavius Gras, who collected it in Sumatra. In addition, Bavius is a highly appreciated specialist in this family and I herewith thank him for his valuable opinions and contributions.

Type locality: Indonesia, SW. Sumatra, Bangkahulu Prov., Pasir Panjang, 3° 48' 26.8" S, 102° 15' 38.6" E; 29.1.2008; sandy beach, a few rocks.

Type material:

Holotype: MNHN, Paris type collection, 1 left and 1 right valve from the type locality, leg. B. Gras, coll. 29.1. 2008

paratype 1: MNHN, Paris type collection, 2 left and 2 right valves from the type locality, leg. B. Gras, coll. 29.1. 2008

paratype 2: MNHN, Paris type coll. 2 p.v., S. Java, Pelabuhan Ratu, Sukabumi, leg. K. van Laethem, coll. 19.11.2006

paratype 3: coll. auth. RK101, 12 s.v., data as paratype 1

paratype 4: coll. auth. RK1011, 3 p.v., data as paratype 2

paratype 5: ZMA Moll. 4.09.036, Amsterdam type collection, 4 left and 4 right valves, data as paratype 1

paratype 6: ZMA Moll. 4.09.037, Amsterdam type collection, 2 p.v., data as paratype 2

paratype 7: ZMA Moll. 4.09.038, Amsterdam type collection, 14 p.v., Bali, Kuta Beach, leg. B. Gras, coll. 25. 1. 2007

Further specimens are in the collections of B. Gras and W. Regter, both The Netherlands and K. van Laethem, Belgium.

Distribution: This new species is only known from Indonesia, Sumatra, Bali and S. Java.

Habitat: *D. grasi* is found intertidal in sand, probably also in shallow water. It is locally common.

Discussion and comparison: ***Amphichaena*** with strongly gaping, thin valves has a marked distinct shape with almost central umbones and a much shorter pallial sinus, also the hinge dentition does not match.

The new species is in many features close to the American ***Paraserrula***, notably *D. fossor* from New Jersey. It has a similar shape and sculpture. However, the new species is more fragile in texture and is even more gaping. Lacking a comparable IND-group, *D. grasi* is tentatively included in *Paraserrula*.

From the known IND species two merit comparison:

Donax introradiatus is barely known. The BMNH type is close to *grasi* in comparatively fragile texture, in color and sculpture. However, the shape is higher, less elongate, the radial sculpture is much stronger and the marginal dentition stronger as well. *D. introradiatus* is distinct, but perceived congeneric with *grasi*.

A second, enigmatic species ***Serrula aenea*** Mörch, 1853 shares some features. It was originally described as elongate, iridescent, 7.25 mm, doubtfully from India, Tranquebar. However, from there nothing similar is known. The interpretations of subsequent authors diverge largely. Reeve (1854) and Sowerby II (1866) did not have the same species in mind as extensively discussed by Römer (1869). Fortunately, in MNHN, a syntypic lot with 6 specimens 5.8-7.3 mm is present. It is labeled "don [= gift] Mörch, 1869" and conforms to the OD. However, the more elongated shape, the more solid texture, the lacking strong gap and the smaller size remove *aenea* from *grasi*. Instead *S. aenea* appears close and most likely conspecific with the NE. American *D. fossor*.

Otherwise, the Indian species are quite well known. Subba Rao & Dey (1986) did not depict anything close to *grasi*. Their ***aperittus*** and ***spiculum*** are also small, but distinct; the former grows smaller, barely more than 10 mm, is more compressed and has a distinct sculpture. The latter is more solid, truncate and has a distinct sculpture as well.

RK9: ***Donax incarnatus*** is a quite common species widely distributed along the northern IND, but not reported from the Philippines as yet. The surface sculpture with a wrinkled posterior and a superficially smooth, but under the lens finely cancellate structure and the crenulate margin are typical for *Dentilatona*. A specimen fitting Chemnitz' figure from the Spengler's coll. is depicted in Lynge (1909 pl. 4 fig. 12-13). *D. incarnatus* is a rather small species; the maximum size seen from India is 22.6 mm. The two laterals are long and strong, the form is usually trigonal, the color varies from orange, yellow (= *flavida*), purple whitish (= *dysoni*), often with commarginal darker lines. The BMNH types of ***D. dysoni*** and ***D. flavidus*** are perceived the same. *Dysoni* and also Preston's ***trigonalis*** have been synonymized by Rao & Dey (1986). Gould's white, solid ***pallidulus*** might be this species, but the type USNM 17942 should be reanalyzed for confirmation.

Swennen et al. (2001 sp. 162) depicted an enigmatic species from the Gulf of Thailand as "*dysoni*". This does not fit the *dysoni* type, but their fragile, whitish specimen appears close to the BMNH holotype of *Donax introradiatus* Reeve, 1855 described without locality and not recognized since. Römer's *D. introradiatus* from Yokohama is instead *semigranosus* Dunker. Reeve's type is larger and slightly higher, internally white, with the name giving two purple rays compared to Swennen's specimen. However, Swennen only found a single valve and it is not excluded that larger specimens are fitting Reeve's type precisely. ***D. introradiatus*** is tentatively placed in the Gulf of Thailand, awaiting further finds.

RK10: Barnard (1964) demonstrated that ***elegans*** is the adult form of ***aemulus***. He also synonymized ***productus*** which seems indeed based on a juvenile specimen. On the other hand, his *aemulus* is perceived as indistinguishable from ***D. lubricus*** Hanley, 1845 under which name this species has been depicted from SAF by Steyn and Lussi (1998 sp. 943).

Barnard's additional synonymization of ***D. simplex*** Sowerby III is not shared. *D. simplex*, as also understood by Steyn & Lussi (1998 sp. 946), grows much smaller and is significantly less high, the umbones more central and less prominent

RK11: Within ***Donax madagascariensis*** the number of oblique ribs varies from about 10 (specimens from Kenya coll. auth.; also Oliver, 1992 pl. 12 fig. 3; Turton, 1932 sp. 1788) to more than 30 (specimens from Natal, coll. auth.; also Römer, 1970 pl. 11 fig. 10). Reeve's *madagascariensis* is intermediate with approximately 20 ribs. Boshoff (1965) observed the same within Mozambique specimens. Neither internal whitish to purplish coloration, marginal crenulation, hinge, nor radial structure in rib interstices offer any clear diagnostic for two different species, as proposed by Römer (1870). Following Tryon (1869) and most subsequent authors ***Grammatodonax*** is understood monospecific with a highly variable species widely distributed in the W. Indian Ocean. *Heteroruga* is the same.

RK12: Guzman et al. (1998) revived ***D. peruvianus*** Deshayes, 1855, synonymized Coan's *D. marincovichi*, but depicted an elongate *obesulus*. However, Coan (1983 p. 292)'s analysis and comparison of the variable, inflated ***obesulus*** and his new, more compressed, elongate ***marincovichi*** are convincing. Paredes & Cardoso (2001) set the issue right. Furthermore, at least in the specimens seen, the pallial sinus in *obesulus* is slightly shorter, more ascending, as depicted by Guzman et al. (1998 sp. 93), whereas in *marincovichi* it is slightly deeper, more horizontal, well visible also in Römer's fig. 20. The largest *marincovichi* seen is 32.5 mm (Sechura Bay). As the typical punctuations of *Chion* are lacking, Coan placed it s.l. Nonetheless, it appears closer related to *Chion* than to *Paraserrula*. A genetic analysis could help to clarify its best affinities.

RK13: ***Donax pulchellus*** was described as common in the West Indies by Hanley, 1843 and from there depicted by Reeve, Römer and Bertin. However, in 1856 Hanley questioned the CAR locality. Indeed, no species similar occurs in the Caribbean. By most authors *pulchellus* has been identified as WAF species.

However, Subba Rao & Day (1986) placed it in India and synonymized ***spiculum***. They depicted Hanley's and Reeve's types. A reappraisal of the types based on Indian and WAF material lead to distinct results. Their fig. 18-19 (type *spiculum*) represents the Indian form; their fig. 14-15 (type *pulchella*) represents the form typically found in WAF. These two species are indeed quite similar. However, *D. spiculum* is comparatively higher, generally more truncate, and as such slightly shorter and has a marked stronger anterior lateral. *Spiculum* also grows slightly larger, reaching 16.2 mm (Kerala). The radial striation is comparable and both are considered well placed in *Donax* s.s.

Donax dussumieri Bertin from Malabar, S. India is perceived as identical to *spiculum*, whereas Récluz ***D. powisianus*** has early been synonymized by Hanley (1856) with his *pulchellus*.

Easily confused with *pulchellus* is ***D. pusillus*** described by Philippi, 1849 from Senegal and also known from Congo. This uncommon species is much more inflated posteriorly and regularly cuneate, almost flat at the anterior end, broadly truncate posteriorly and very small rounded anteriorly.

RK14: Hanley, 1843 described ***Donax semisulcatus***. From the sculpture this is a *Deltachion*, anterior half smooth, posterior half sulcate or ridged, posterior portion finely granulate. The color was originally described as glossy white. The BMNH type lot shows a white shell under a light yellowish periostracum, inside white with traces of purple. Hanley described it from trigonal juveniles, 12.6 mm and did not give any locality. Reeve mentioned East Africa, which is on the BMNH label. Hidalgo reported it from the Philippines. Odhner (1919) reported it from Madagascar. However, no material from these locations fitting *semisulcatus* was as yet seen. The only location known which delivers most closely resembling specimens is Sumatra, Bengkulu Pref. The largest specimen from Sumatra is 18.8 mm and is somewhat more elongate. Thus, the exact distribution as well as the extent of variability in *semisulcatus* has still to be worked out. This species appears to live rather subtidal, than intertidal, as only single valves have been found beached.

RK15: Subba Rao & Dey (1986) identified a very common Indian species as ***Donax*** (***Latona***) ***lubricus***. They characterized as "it closely resembles *D. incarnatus* but can be differentiated from it in the shell being longer than high".

However, the species identified by SAF authors as *lubricus* is distinct. It grows almost twice the size of the Indian, is broader in shape and the pallial sinus is flatter, less ascending than in the Indian species. Furthermore, the lateral dentition in *lubricus* is markedly weaker than in the Indian species.

Römer, 1870 precisely described ***Donax siliqua*** from unknown locality. This appears to fit the specimens analysed from India (Goa, Vypin, Kerala) well in size, elongated and compressed shape, colors usually internally purplish, sculpture, ascending pallial sinus and especially also in marginal dentition "ziemlich starke Kerben, welche an der Hinterseite hinauf sich in feine Zähnchen umwandeln". *Donax siliqua* is well known from India, but also listed from Sri Lanka and Myanmar (SUB86). Römer gave 24 mm, the largest analysed is 23 mm, but usually *siliqua* measures less than 20 mm. The SAF *D. lubricus* reaches almost 35 mm.

RK16: Hanley (1855) isolated and depicted Linnaeus' ***Tellina trifasciata***. Box 41 of the Linnean Society, London contains this complete, 19.6 mm specimen. The specimen is not ink-marked. *D. trifasciata* was approached to Lamarck's "*Donax vittata*".

The specimen identified by Hanley fits precisely Linnaeus' quite characteristic OD in size, ovate-elongate shape, and 3 blood-red streaks emanating from the umbones on a pale color. It is understood as Linnaeus' holotype. *Trifasciatus* is unmistakably a *Donax* not a *Tellina*. It was originally described from European waters. Instead it is a locally common S. Red Sea and Indian Ocean species. In addition, it seems to have been introduced recently into Linnaeus original type locality. Most Indian Ocean *faba* records are, in fact, describing this species. *Trifasciatus* is quite constant in rounded trigonal form, but the color is highly variable. The radial stripes may be two, three or four; they may be red, but also purplish, brown or blue, the shell all white, rose or cream. *Trifasciatus* is a *Latona* with a smooth margin, which might have seduced Linnaeus to classify it as *Tellina*, wrinkled posteriorly, with a faint cancellate sculpture under a superficially glossy smooth surface, a strong dentition with a large bifid cardinal in the right valve.

This common, usually rather small species was described by Forsskål as ***D. biradiata*** form the Red Sea (type in Yaron et al., 1986 sp. 43/44), by Reeve again as *D. trifasciatus* without reference to Linnaeus, Sowerby II (1866) used *D. abbreviatus* of Lamarck, whereas the latter name is a nom. dub. (LA183). Römer, 1870 described the purplish-blue colored form, yellow internally as ***D. lepidus***. Finally, as depicted by Oliver (1992) from MNHN-material ***D. veneriformis*** Lamarck, 1818 is this species, whereas *D. veneriformis* Oliver (1995 sp. 1154) from Arabia is very close to *tinctus*. The largest t*rifasciatus* seen are 20.8 mm, but ***Donax triradiata*** Deshayes, 1830, which proved to be conspecific, measured gigantic 29.6 mm. Unfortunately, the MNHN *triradiata* type lot bears no locality.

The famous ***D. vittata*** Lamarck, 1818 non Da Costa, 1778 was considered synonymous by Hanley (1855). As Lamarck gave originally Great Britain, Linnaeus' *trifasciatus* was placed there by earlier authors. The *vittata* holotype is in Geneva, MHNG 1083/78. Indeed, this specimen has also smooth margins, has on the left valve 3 reddish-brown radial streaks. However, the shape is distinct lower and more elongate, the commarginal sculpture is rougher and more extended towards the centre and, finally, the more elongate and less ascending pallial sinus clearly demonstrate that Lamarck's *vittata* is instead an unusually colored and misplaced *Donax faba*. Instead, Lamarck's *veneriformis* is conspecific with Linnaeus' *trifasciatus*.

RK17: Dunker, 1853 described two enigmatic *Donax* from Angola, Loanda. Both were never mentioned by modern WAF authors (e.g. Nicklès; Cosel; Ardovini et al.), nor have they, to my knowledge, been positively identified by anybody else from Angola. ***D. deshayesii*** (MfN, ZMB108.634) is without doubt a **true *Latona***, a subgenus not known from the Atlantic. It is reddish brown with a purple umbo, posterior radially striated and commarginally wrinkled, anterior superficially shiny smooth, margin smooth, interior dark purplish, teeth whitish. Römer's picture and description fits Dunker's holotype quite well. As assumed by authors (e.g. LYN09; SUB86; HIG99), *deshayesii* is not distinguishable from *Latona cuneata* and considered a synonym with an erroneous type locality.

D. cumingii (MfN, ZMB108.677) is a true *Serrula*, smooth with a serrulate ventral margin, very close to *D. trunculus*. However, the particular color, form and the fine, almost translucent valves have not been encountered among the large European material studied. Other than in *deshayesii*, Dunker obviously originally had a couple of specimens, now lost; he also mentioned completely white specimens. For the time being, *cumingii* is considered an uncommon valid WAF *Serrula*. Definitely, further collecting is needed to verify this record.

RK18: Coan (1983) located ***vellicatus*** in the Caribbean and accepted Morrison's synonymy of ***higuerotensis***. Without doubt the BMNH type of *vellicatus* is in shape and pallial sinus identical to the species described as ***D. mediamericana*** by Pilsbry, 1920 from Guatemala. A synonymy of *mediamericanus* with *striatus* is erroneous, as stated by Petuch (1998). *Higuerotensis* is well depicted by Weisbord (1964 pl. 53) from Venezuela. It appears at first glance distinct from *vellicatu*s, more elongate with a more confluent pallial sinus. On the other hand, Petuch figure of *mediamericanus* from Nicaragua is more elongate than Pilsbry's type as well. As such it also approaches Deshayes' *striatella*. Deshayes, 1855 (May) described one month earlier than Reeve, a white ***Donax striatella*** from "Australia", not recognized from there, but preoccupied by *Donax striatella* Nyst, 1845 (SHE). Indeed no Australian species is close to the 30.2 mm BMNH-holotype and the locality is apparently erroneous. The type lot was in sched. (likely by Smith) identified as the Panamic *carinatus*. However, the strong hinge with marked laterals and the rather solid texture do not fit. Römer (1870) considered *D. striatellus* the same as *variabilis*. However, the size exceeds this common US-species and the shape does not match, but *D. striatellus* seems indeed Caribbean and to fall in the *vellicatus* complex.

Furthermore, Nowell-Usticke described his ***intermedius*** from Trinidad. This species does not fit *striatus* or *variabilis*, as originally compared but appears intermediate between the extreme *vellicatus* and the extreme *higuerotensis* forms. Finally, Diaz & Puyana (1994 sp. 254) depicted a ***vellicatus*** from Columbia which shares traits of both extremes as well.

Until this complex is better known and clear criteria for distinct species can be established, it seems more prudent to follow Morrison's and Coan's view and to consider *vellicatus* as highly variable species along and off S. America. Consequently, the preoccupied *striatellus*, but also *higuerotensis*, *mediamericanus* and *intermedius* are treated as synonyms.

RK19: Whereas Poli (1795) and Hidalgo (1867) recognized two distinct MED ***Cuneus***, most modern authors differentiate 3 species ***vittatus***, ***venustus*** and ***semistriatus***. However, large series of approximately 1000 specimens from Brittany to Greece show marked intermediations; Salas (1987) reported similar findings. Most likely the separation of 3 species is artificial and *Cuneus* is monospecific as well.

However, as no molecular analysis is as yet known, a synonymization into only one, highly variable *D. vittatus* is premature. For the time being the conventional view is presented.

Donax atlantica Hidalgo, 1867 belongs also here and is the same as what is usually named *vittatus*.

The unique ***D. nuxfagus*** Preston, 1908 described from a single specimen from the Andaman Isl. and not refound since (SUB86) should be reexamined. Some traits approach *vittatus* specimens.

RK21: ***Galatea*** are quite uncommon in collections, but locally, as most donacids, exceedingly abundant and locally frequently eaten. More than 35 names are available for this endemic WAF group. Many were synonymized by Bertini (1860), some more by Germain (1918). One of the last overviews has been given by Pilsbry & Bequaert (1927); they listed 17 valid *Galatea*. Pilsbry & Bequaert mainly studied Congo River material. Ardovini et al. (2004) listed 6 *Galatea* from WAF but without any pictures or any explanation and important papers on *Galatea* are not in their bibliography. At present approximately 10 species are perceived recognizable.

During a stage at the Volta river mouth, SE. Ghana the opportunity arose to study hundreds of ***G. paradoxa*** specimen, freshly live taken for the markets from muddy sandy grounds in about 10 m in mixed fresh-saltwater. In addition, large heaps with virtually millions of eaten and discarded specimens, all from the Volta River delta, could be studied. This gave us the possibility to better understand the extent of variability within *G. paradoxa*.

Typical *G. paradoxa*, as depicted by Born, purplish streaked on white underneath a glossy olive periostracum, internally purplish white, was, by far, the most common form in the Volta River mouth.

Occasionally, ***G. concamerata*** forms have been found. As stated by Bernardi (1860) the internal calcitic lamella is only an exaggeration of a normal trait and occurs in various degrees. In addition, typical *paradoxa* color forms have been found with exactly this lamella, thus, *concamerata* is without any doubt synonymous.

G. kochii has an elongated shape with an acutely pointed umbo, specimens fitting and many intermediaries have been found. ***G. truncata*** has also a very acute umbo, but is somewhat more inflated, further it has a very thick hinge without umbonal cavity. ***G. lubakii*** is similar to *kochii*, but somewhat more rounded and inflated. As closely similar specimens have been found, these three are all considered varieties in shape.

G. heukelomii is the reddish color variety, uniform or with olive streaks. Bernardi (1860) stated the dentition as very close to *radiata*, but restricted *paradoxa* to typical colors. *G. heukelomii* is less common, but still found in large numbers. Intermediaries connect deep red forms without any purple in almost all shades to typical olive-blue *paradoxa*. A distinction between *paradoxa* and ***hermaphrodita***, as proposed by Pilsbry & Bequaert (1927) was, as far as is known, followed by nobody and could not be verified. The width of the hinge plate is variable, as is the existence of an umbonal cavity. The type of Lamarck's ***radiata*** is depicted in Germain (1918).

In addition to Volta River, *G. paradoxa* is known from Sierra Leone, Liberia, Nigeria (Niger Delta), and Cameroon, Wouri and Sanaga River. There are many hints that *paradoxa* is also found further North in Gambia River. All *paradoxa* seen from "Senegal", "Africa", Ghana, Nigeria, Cameroon are quite robust, the Ghanan lived within 3 km off sea, and thus, freshwater mixed with marine during tidal periods. Clench, 1929 described ***G. schwabi*** from Cameroon, Sanaga River, 45 km up stream. Whereas form, color and size well agree with *paradoxa*, this specimen differed by extreme thinness and much smaller hinge plate. As *G. paradoxa* is known to live in the Sanaga River, *schwabi* may well a thinner, weak-hinged completely freshwater form.

Above comparison led also to the conclusion that forms not found, exceed the variability of *paradoxa* and are valid species. This is especially true for the Gabon rivers ***G. bernardii*** and for the Congo River ***G. congica***, **G. *tenuicula*** and likely also for ***G. nux***. Thus, "*G. radiata*" records from Congo and Angola rivers refer to distinct species, as stated by Pilsbry & Bequaert and Dartevelle (1935).

G. bernardii is a remarkable species and grows larger than 130 mm. It is trigonal, heavy, rostrate, often purplish, also white, and even rosy under a massive blackish, rough periostracum. It is somewhat undulated, irregular in form, often distorted. As indicated by Bernardi (1860), and inferring from the specimens seen, it is hard to accept ***G. cumingii*** as distinct. Both have been described from close river system in Gabon, about 100 miles apart, Gabon river (*cumingii*) respectively Ogowe river mouth (*bernardii*). The preoccupied ***G. triangularis*** Sowerby II is also barely distinct and may even be the same as the earlier ***triangularis*** Bernardi, 1860. "*Cumingii"* reported from Angola (e.g. Brito Capello, 1878) appears instead to represent elongated *quanzae* forms.

G. congica has been well characterized by Pilsbry & Bequaert (1927), based on large numbers found in Congo/Zaire River. They stated a high variability in form during its growth, with juveniles higher than long (*rubrotincta*) and adults longer than high. ***G. tuckeyi***, ***duponti*** and ***rubrotincta*** have been synonymized with *congica*. They newly described ***G. nux***, which appears related to *congica*, but has been recognized by Dartevelle (1935).

For the Angola specimen from Bengo, Quanza, Pungo and Dande River a multitude of names is available. In addition to the ones already mentioned by Bernardi (1860), i.e. ***G. rubicunda***, ***G. laeta*** and ***G. bengoensis***, many varieties and new species have been introduced by Brito Capello, 1878: *Galateia* ***quanzae*** (Angola, Quanza and Bengo river, 122 mm), ***aguiarii*** (Angola, Quanza river, 86 mm), ***bocagii*** (Angola, Quanza River, 94 mm), and ***pseudoradiata*** (Angola, Quanza River, 79 mm). The opinions regarding validity are split (e.g. BEM061, GER18, PIL27, ARC04).

Venus chemnitzii (*syn. aegyptiaca*) seems to fit well in these Angolan forms. This old, unique Chemnitzian specimen was originally described from Egypt and first latinized by Philippi, 1850. However, none of the many reports on Egypt/African freshwater specimens revealed any hint that a *Galatea* occurs there. The type locality was obviously erroneous. Bernardi analyzed a close resemblance to *rubicunda*. In addition, *rubicunda* is considered by some authors synonymous to *laeta*. *G. laeta* itself is by some authors considered synonymous to *bengoensis* (see PIL27). However, Bernardi objected. Obviously, a comparison of types does in *Galatea* lead nowhere, only large field collection, ideally supported by modern methods can clarify.

The huge ***G. quanzae*** appears somewhat similar to *bernardii*, but occurs much further South in Angolan rivers.

Lacking large quantities of Angolan material, I have no firm opinion. At present ***G. bengoensis***, ***G. quanzae*** (syn. *G. cumingii* auctt.), ***G. laeta*** (syn. *G. chemnitzii*) and ***G. rubicunda*** are perceived recognizable. *G. aguiarii* and *bocagii* might fall into the *laeta* variability.

G. biangulata seems at first glance to represent an exaggerated *paradoxa*, this time with a posterior ridge. Indeed, Germain (1918) synonymized it with *paradoxa*. However, Pilsbry & Bequaert (1927) stated having seen specimens from Pungo River, Angola, and considered it valid. Ardovini et al. (2004) obviously recognized it as distinct as well. Here, Pilsbry & Bequaert is followed. *G. pseudoradiata* of Brito Capello appears quite similar in shape and should be compared.

G. cailliaudii, a large form, similar to *tenuicula*, but with a special hinge and a unique rough, somewhat rugose interior seems not have been recognized since its OD. No exact locality in WAF is known. As it could not be synonymized with any other form, it is likely also a valid species.

This leaves approximately 10 *Galatea* species which occur in the many river systems from Gambia to Bengo and Quanza River. Definitely, much more work, especially in Angola Rivers is necessary to clarify the picture of this fascinating and exceedingly beautiful group of the largest donacids known.

RK22: Having seen many WAF ***Iphigenia*** from the Gulf of Guinea I doubt, that more than one highly variable species is present. Pilsbry & Bequaert (1927) doubted as well, but did not finalize.

Based on one typical *laevigata* and 4 more elongated specimens Römer, 1869 created ***I. rostrata*** from Nigeria. Bertin, 1881, based on a single, fragile, white specimen, from unknown locality, created ***I. fragilis***.

At the mouth of the Volta River, in saltwater, mixed with freshwater, large quantities of *Iphigenia* have been found. Some are comparatively high (1.4) as Römer's, 1870 *laevigata*, others are quite elongate (1.6), even more so than Römer's *rostrata*. Many are purplish, some whitish with purple umbones, a few white and comparatively fragile (as Bertin's *fragilis*) and very few are orange-yellow. Apart from size also the thickness of the valves varied. From Gabon, the indicated locality of *laevigata* (Römer) also *rostrata* extremes are known. In Sierra Leone also *laevigata* extremes are found. Neither color, nor hinge, nor sinuosity as further used by Nicklès (1950) hold. Finally, it is not perceivable, why the Caribbean species, living in similar habitats, is allowed a high variability and the WAF not.

Whereas Bertin listed 8 *Iphigenia* species, here 3 *Iphigenia* in 3 biogeographic regions are considered valid.

I. fragilis and *I. rostrata* are the same as ***I. laevigata***, *I. media* is the same as ***I. brasiliensis*** and *I. ambigua* is identical to ***I. altior***.

Occasionally the name ***Iphigenia ventricosa*** Deshayes is encountered (REV68, ADAMH58). However, no OD and no type were found. *Ventricosa* appears as nom. nud.

Deshayes, 1855 described a further *Iphigenia* ***I. psammobialis*** from unknown locality. No type was seen, but if this was indeed a true *Iphigenia*, then it is a junior synonym.

RK23: ***Profischeria*** is an uncommon and virtually unknown group. It is a nom. nov. for the preoccupied *Fischeria*. Römer (1870) and Bertin (1881) considered *Iphigenia* as valid genus, without including *Profischeria*. P. Fischer (1887) also defined *Fischeria* as valid genus close to *Galatea*. Germain (1918) regarded *Fischeria* as related to *Galatea*, but only superficially similar to *Iphigenia*, whereas Pilsbry & Bequaert (1927) considered it synonymous to *Iphigenia*. Keen in Moore (1969) presented a confusing analysis and synonymized *Profischeria* with *Iphigenia*.

Profischeria is confined to Western and Central Africa. *Iphigeni*a is virtually cosmopolitan, living in the Atlantic and in the Pacific. All evidence points that *Profischeri*a is found in freshwater, often 30-1400 km off coast, whereas *Iphigenia* needs at least low salinity, but occurs almost marine as well. Regarding habitat, *Profischeria* is indeed closer to *Galatea* than to *Iphigenia*. *Profischeria* grows to about 35 mm, or less than half the size of *Iphigenia*. All three *Iphigenia* species reach a maximum size of more than 80 mm. The shell of *Profischeria* is rather thin and fragile, moderately to strongly inflated. The dentition is slightly different; left valve with 2 cardinals, whereas the oblique anterior, other than in *Iphigenia*, is larger, no lateral teeth evident; right valve with a strong, bifid posterior cardinal and a small, often knobby anterior cardinal, and two long laterals, about halfway to the ventral margin, whereas in *Iphigenia* the posterior lateral is usually lacking or when present very weak. The pallial sinus in *Profischeria* is tongue like, rounded, slightly surpassing midline, and less detached from the pallial line than in *Iphigenia*. The periostracum is less glossy, thicker than in *Iphigenia* and the umbones often heavily eroded. In color *Profischeria* are more uniform, usually glossy white or purplish white internally and outside white under a dark to straw periostracum. There is no doubt that *Profischeria* is a valid genus, quite easily differentiated from *Iphigenia*. However, no genetic analyses are known.

Specimens of ***P. delessertii*** from Ivory Coast, about 200 miles east of the type locality have been studied.

Fischeria messageri and *approximans* Preston, 1909 from Senegal River, Podor, 150 km off coast, are perceived too close to *delessertii*. Obviously, this was also the opinion of Germain (1918), who reported *delessertii* from Senegal. Preston did not compare them with *delessertii*.

Fischeria curta Dunker, 1867 described and depicted from WAF is strongly inflated, with very prominent umbones, with a finer periostracum and a broader, shorter pallial sinus. It has been rediscovered in Congo River by Pilsbry & Bequaert (1927) and *G. globosa* Preston was synonymized. The syntype of ***Fischeria tumida*** Martens, 1876 (MfN 23622), described from a single valve, has been studied. The label gives Congo, collected or donated by Mechow, but not Loango Coast as assumed by Pilsbry & Bequaert (1927). Thus, it is obviously from the same river system. As shape, prominent broad umbones, pallial sinus and inflation are too close to *curta*, *tumida* is here synonymized.

Fischeria congo Pilsbry & Bequaert, 1927 also from Congo River, 35 km off coast has been described as very thin, with a weak hinge plate and less triangular compared to *delessertii*.

Fischeria truncata Martens, 1877 (MfN 26385) described from several valves from Cameroon, Mungo river is a comparatively high form, slightly purplish inside and especially so at the umbones. The periostracum is light brown. The pallial sinus is close to *delessertii*, clearly surpassing midline. The illustration in Nicklès (1950 *truncata*) fits the type quite well. He gave Liberia to Belgian Congo as distributional range. However, as this was the only species mentioned, locations of various species may have been confused.

Fischeria centralis Germain, 1904 described from 1400 km off coast appears quite large, compressed and more solid.

I have seen too little material to have a firm opinion regarding the number of valid species. As in general in donacids, also here OD's and holo-/syntype are of very limited value and only large numbers are decisive. However, concluding from the OD's, the types and other material seen, it appears most likely that approximately 5 *Profischeria*, closely adapted to their specific riverine habitats occur between Senegal and Congo River and riverine far off coast within the African continent.

6.48 PSAMMOBIIDAE

RL1: Willan, since 1980, especially (1993), made a very considerable contribution to a much better understanding of this difficult family. Here, largely Willan's views are followed. Unfortunately, many of his findings are not as yet widely known, and some errors are still perpetuated in modern literature.

In addition, Reeve's 6 monographs (1856-7) and Bertin (1880) have been included, apart from various OD's, some type specimens and two excellent papers by Coan (2000 and 2002) on Eastern Pacific psammobiids.

Following Willan (1993) subfamilies are not used, the weak distance between *Soletellina* and *Gari* (*Psammotaena*) would not support a division.

RL2: ***G.*** (***Crassulobia***) ***crassula*** is a very difficult species as juvenile. Whereas in adults the strong calcification interiorly and on the nymphs makes it easily recognizable, juveniles are often confounded with ***G.*** (***P.***) ***minor***. However, Willan (1993) has demonstrated, that *G. minor*, together with the very similar *dautzenbergi* and *sordida* are juvenile *elongata*. It appears that most *P. minor* records in literature are instead juvenile *crassula*. This species has a much larger distribution than often assumed. It is also known from Phuket, Andaman Sea and Japan, Honshu, Tokyo Bay, Chiba Prefecture (coll. auth.).

Juvenile *crassula* are trigonal ovate, often radially colored on a purplish, rarely bluish or even reddish shell, often with a yellow-greenish periostracum, comparatively high, less gaping and more fragile than *elongata*. The ventral margin is more rounded. Especially the elongated pallial sinus is decisive, largely confluent with the pallial line, thus, not half detached, ascending as in *elongata*. *Crassula* is found in low salinity areas, river mouth on sandbanks, often in abundant quantities.

RL3: A specimen from Okinawa, Nahia, from 10-15 m agrees well with Reeve's BMNH holotype of ***Capsella candida*** - whitish, comparatively solid and with an unusual inflated shape. Whereas the type is now all white, the Okinawa specimen shows traces of purple.

However, the surface sculpture and the pallial sinus are identical to *elongata*. As stated by Willan (1993) *candida* is considered a further synonym, enriching this highly variable species even further.

Closest to Lamarck's lectotype (Willan, 1993 figs. 246-7) are specimens from the Indian Ocean. More common however, are the purplish forms often found in Philippine waters, which display an enormous variability.

RL4: Willan (1992) noted ***Psammobia virgata*** Lamarck, 1818 as valid name for the well known European ***Psammobia intermedia*** Deshayes, 1855. This has been consistently neglected by European authors. As mentioned by Lamarck, 1818 the type is in his personal cabinet, thus MNHG, but not Paris as purported by Bertin (1880). Willan (1992) selected a lectotype MHNG 1083/10/1 out of the two syntypes and depicted Lamarck's species. ***Psammobia costata*** Hanley, 1843 is another synonym, also earlier than *intermedia* and also with an erroneous type locality. The oldest name for this species, though invalid, is *Le Gatan* of Adanson, 1757 (type in FIP42). Lamarck's *virgata* was erroneously described from the Indian Ocean. *G. virgata* is a unique *Gari*, having as adult strong irregular commarginal ribs, whereas juveniles are almost smooth. This species is quite uncommon in European waters, but locally commonly found in WAF, snorkeled off Senegal, Dakar area in 5-10 m, coarse sandy bottoms.

RL4a: Barnard (1964) synonymized Turton, 1932's *Psammotellina capensis* var. *livida*, *P. lara* and *P. pyrrha* with ***Soletellina capensis***. From the material at hand, *Psammotellina thetis* and *proxima* Turton, 1932, from the same locality, are perceived as further synonyms. *Capensis* is not only highly variable in color, purple to white, but also in shape, ovate to ovate-elongate.

Psammotellina prolongata Turton, 1932 appears instead to represent a juvenile *Donax burnupi*. The 1.5 mm ***Psammotellina neptuni*** Turton, 1932 seems to represent a *Donax* as well, possibly a juvenile *lubricus*.

The true identity of ***Psammotellina nympha*** and ***innotabilis*** is unknown. The type material was not studied.

RL5: Following Mörch (1853 p. 9) and Lynge (1909), then true ***Solenotellina chinensis*** Mörch, 1853, based on Chemnitz 11 198 1933, is the same as Reeve's *S. truncata* and *planulata*. Abbott & Dance (1986 pl. 348

fig. 1 *planulata*) represents this huge and heavy Chinese *Soletellina*. Their *chinensis* fig. 2 is instead *elongata*. However, *G. elongata* is common, whereas true *chinensis* appears quite uncommon, only few specimens from China and Taiwan were seen so far.

Capsa chinensis Deshayes, 1855 (type HIG01 B1064) is a *Gari* and according to Bernard, Cai and Morton (1995) the same as later described as ***Sanguinolaria castanea*** Scarlato, 1965. Lischke's *moesta* appears also to represent this species. *G. chinensis* is close to ***virescens*** (type HIG01 B1056). However, from the type photos and the material studied, these two are distinct. Zhongyan (2004) depicted both from China. *Virescens* is smaller, narrower-elongate, with a strongly rounded, broader and shorter pallial sinus. It seems that *virescens* of Japanese authors represents instead *chinensis* and true *virescens* occurs in S. China, Philippines and westwards, but not in Japan or East China. *Capsa tenuis* from the Philippines seems to be *virescens* as well.

Following most authors, Mörch's earlier *Solenotellina chinensis* is placed in *Soletellina*, but Deshayes' *Capsa* (*Capsella*) *chinensis* in *G*. (*Psammotaena*).

Furthermore, the BMNH types of *C. layardi* and *P. skinneri* have been studied. Both were described from Sri Lanka. These two are perceived conspecific. ***Layardi*** is a valid Indian Ocean *Psammotaena*, similar to *virescens* and *chinensis*, but larger and with a broader pallial sinus. To date *layardi* is only reliably known from Sri Lanka, i.e. Galle area, but a further distribution can not be excluded.

Similar is the MNHN holotype of ***micans*** from Sumatra, but here, the interior color is purplish and the pallial sinus is more extended. In pallial sinus *micans* is closer to *virescens* than to *chinensis*, but is perceived as distinct. However, no fresh material was as yet seen.

Definitely, this group of 20-35 mm *Psammotaena* from the central IND is barely known to science and needs much more material for a firm picture.

RL6: The type ***Hiatula***, SD Stoliczka, 1871 is *Solen diphos*, whereas the type ***Hiatula***, SD Winckworth, 1935 is *Mya truncata*. Based on prevailing usage, Willan intends to submit a request to ICZN for suppression of Stoliczka's type designation, making *Hiatula* an objective synonym of *Mya*. Anticipating success of this action, Willan (1993) is followed.

S. diphos, through its *radiata* synonymy representing *Soletellina* typically, was originally described from India.

Specimens beach collected in Goa, W. India are depicted. *Diphos* is uncommon, but quite widely distributed and at least known to N. Borneo and the Philippines. Characteristic for this huge species is a very elongated acutely pointed shape and a deep purplish color. ***S. acuminata*** described from the Philippines is perceived the same; a large specimen form there is illustrated. Virtually all *diphos* records in modern literature affect Reeve's much more common ***S. adamsii***. Honda, Willan et al. (2001) recently clarified this issue.

Sanguinolaria acuta Cai & Zhuang, 1964 was described from Guangdong and Fujian and compared to *diphos*. However, their *diphos* is instead Reeve's true *adamsii*, but Cai & Zhuang's *acuta* is a valid Chinese *Soletellina*.

RL7: ***S. lunulata*** has been described from Sri Lanka and the Philippines. However, as far as is known, it has never been found in the Philippines. It appears to be an Indian Ocean species only.

An exceedingly rare species has been described by Bertin, 1880 as ***Hiatula ovalis*** from unknown locality. It is a typical *Soletellina*, similar but much larger than *tumens*, smaller and shorter than *chinensis*. The unique holotype is present in MNHN, measuring 66.5 mm. Recently a specimen has been trawled in the Taiwan Strait off China in 40 m from sandy bottom. It measures 63.8 mm and fits the holotype precisely in shape, color, pallial sinus and the quite wide gape at both ends. The **type locality** for *ovalis* is here clarified East China Sea, off China, Taiwan Strait.

RL8: Undoubtedly, ***Psammotella ruppeliana*** represents the common, quite large Red Sea *Soletellina*. As stated by Oliver (1995) this species is highly variable in color (rose, reddish, purplish, all white), in consistency (very fragile to comparatively solid) and also in shape (more or less elongate), but always quite strongly gaping, with a dehiscent periostracum, the pallial sinus elongate, confluent. Also Dekker & Orlin (2000) recognized just one large *Soletellina* in the Red Sea.

However, this is a very old species. It was collected by Forsskål and Niebuhr in the Arabian expedition and served as base for Chemnitz and Spengler. Hanley (1843) applied *Psammotaea rosea* Gmelin for this Red Sea species. Mörch (1871) stated ***Solen roseus*** Gmelin, 1791 and *Solen tellinata* Spengler, 1794 the same, both from the Red Sea and both based on Chemnitz's *Solen ruber*, e mari rubro 6 7 55. Sturany (1899) used the name *roseus* as well and further synonymized Deshayes' *P. oblonga*. Lamy (1918) recognized this synonymy, but applied the invalid *Soletellina rubra* Chemnitz for this species. Morris & Morris (1993) named it *Hiatula rosea* without any further comment. *Soletellina rubra* (Schröter, 1788) was applied by Repetto (2005) for specimens immigrated into the E. Med; however, this name is invalid.

Gmelin's name is the oldest and ***Soletellina rosea*** (Gmelin 1791) is the correct name for this well known species.

RL9: From the material at hand 4 ***Nuttallia*** are valid. 2 live in Japanese, 1 in California, and 1 species in both locations.

The species named *N. olivacea* from the Yellow Sea, first by Grabau & King (1928), followed by Chinese authors is instead ***N. ezonis***. It is most similar to the Californian type species *nuttallii*; but *ezonis* is more fragile, more elongate and the valves marked unequal compared to *olivacea* Jay (= ***obscurata*** Reeve).

Coan et al. (2000) characterized the Californian species.

Psammotellina ambigua is perceived as very close to *Soletellina*. ***Psammosphaerita*** (syn. *Nanhaia*) is considered to represent a distinct genus. Both groups had been associated with *Nuttallia* by authors.

RL10: Coan (2002) separated ***Psammotella*** generically from ***Sanguinolaria***, whereas Willan (1993) considered *Sanguinolaria* "a coherent group".

More distinct from *Sanguinolaria* s.s. than *Psammotella* is *Psammosphaerita*.

Psammosphaerita psammosphaerita shares many traits with *Nanhaia tchangsii*, which does not fit well into the compact *Nuttallia* group.

Here *Psammotella* is maintained as subgenus of *Sanguinolaria*, following Willan. However, ***Psammosphaerita*** is generically separated and *Nanhaia* synonymized. Thus, *Psammosphaerita* builds a small group of translucent, ovate, rather small species. The pallial sinus is broad, mostly confluent, extending to midline. Both species are whitish with purplish streaks. The periostracum is yellowish and thin. Both species share an intertidal habitat.

Coan (2002) treated the difficult Panamic *Sanguinolaria*. Following his view *purpurea* is considered a special color variety of *tellinoides*, usually more fragile in texture and likely living in a particular microhabitat.

The 2 Caribbean species do not pose any problems.

In WAF an uncommon *Sanguinolaria* occurs, named ***S. africana*** by Cosel, 1989. However, as indicated by Coan (2002), earlier Spengler, 1798 described ***Tellina achatina***. Mörch (1871) recognized it as close to *S. sanguinolenta* and Martens (1880) compared *Sanguinolaria achatina* from Guinea with his *aureocincta*. According to Hylleberg (2001) Spengler's Guinea material originated from Christiansborg, Ghana. A couple of specimens precisely fitting Spengler's OD have been found 2005 in Ghana. There quite fragile, thin specimens are found, whereas in Senegal also more solid specimens occur. The fourth cardinal is indeed very thin, easily overlooked. Cosel's *africana* is a junior synonym.

Deshayes, white ***S. vitrea*** (= REV573 sp.1) was described without locality and has been an enigma ever since. The two conspecific BMNH syntypic valves, 36.1 and 38.5 mm have been studied. They do not conform to any Atlantic species seen in shape, color and pallial sinus. The labeled locality St. Thomas was added later and is erroneous. On the other hand, 3 specimens bought at two occasions from Madagascar, Tulear area, shallow water indicate that a true *Sanguinolaria* uncommonly occurs in the SW. Indian Ocean. One of these specimens is all white, one rather rosy and the third in between. The maximum size is 33.6 mm. A close comparison with the *vitrea* syntypes in size, shape, and pallial sinus left no doubt that these are conspecific and that *vitrea* is instead an uncommon Indian Ocean species. Furthermore, Kilburn (1977) depicted ***S. aureocincta*** described from Mozambique, 43.3 mm, not recognized since. However, the other East African species described by Martens in the same paper (e.g. *ochracea* or *semilaevis*) are precisely localized. Thus, I see no reason to doubt Martens' location. Martens, 1880 compared his *aureocincta* with *achatina* and stated them distinct. Indeed, they are not referable to the same species. *Achatina* grows much larger, is more pointed, has a stronger posteroventral ridge and is less glossy. Evidence points that *aureocincta* is instead a large *vitrea*. Certainly, more material of this uncommon species would allow firmer conclusions. Overall, *vitrea* is closer to the Panamic *ovalis* and to the Caribbean *sanguinolenta* than to the WAF *achatina* and the Panamic *tellinoides*. Compared to *sanguinolenta* the pallial sinus in *vitrea* is more acute-pointed and triangular at the top, descending more steeply at the anterior end, similar sized *vitrea* are shorter and higher in shape and slightly more inflated. Both share similar colors.

In addition to *vitrea*, a second *Sanguinolaria*, ***S. hendersoni*** Melvill & Standen, 1898 occurs in Indian waters. This rare species is only known from a few specimens. The specimen illustrated from the Maldives, 20.3 mm is very fragile, in shape somewhat similar to *tenuis*, but orange-rose umbonally white ventrally.

Thus, 9 ***Sanguinolaria*** are globally recognized.

RL11: ***Heterodonax***: The earliest type designation SD Stoliczka, 1871 p. xvii who selected *D. ovalinus* Desh. (= *pacificus*) is invalid, as *ovalinus* was not included in Mörch's list. Thus, Kobelt's *bimaculatus* stands.

Heterodonax are in older books included in *Donax* and care must be taken to keep these apart. *Donax trifasciatus* is indeed very close to certain *Heterodonax*.

Römer (1870) clearly indicated that *H. bimaculatus* may have laterals. Indeed all *Heterodonax*, well visible in *bimaculatus* and *ludwigii* have a weak lateral dentition, better expressed in juveniles. Abbott (1974 p. 511)'s statement "2 cardinals and 2 laterals in each valve" is correct. Weakest and virtually vanished are these two laterals in larger *pacificus*. *Heterodonax* are generally rounded, the umbones more central, no sculpture, only growth lines, smooth ventral margin, weak, often obsolete laterals, and a small nymph. It appears that in PAN, CAR, WAF and the SW. Indian Ocean, just one highly variable species occurs. Consequently, 4 species are recognized.

Fischer-Piette's ***Heterodonax messageri***, originally described from Tahiti was not, whether before or afterward, recognized from there. The all white, 19.7 mm MNHN holotype has clear laterals. These exclude *pacifica*, size excludes *parvus* and shape and color exclude *ludwigii*. I see no arguments against a misplaced Caribbean *bimaculatus*. Haiti would have been the far better choice than Tahiti.

D*. (*H*.) *crassus Bertin, 1881 was originally described from unknown locality. The MNHN holotype now bears "Asie". However, from Asia nothing similar is known and I fail to perceive this blue-purplish 23 mm specimen other than a large Caribbean *bimaculatus*.

H. seychellarum Bertin, 1881 is, as recognized by Boss (1969), distinct in shape and pallial sinus from *ludwigii*. *Seychellarum* is labelled as of Dufo, and as from the Seychelles. However, as far as is known, it has never been refound there or nearby. Also Jarrett (2000) did not mention any *Heterodonax* from the Seychelles. However, two of the four old labels in the box of the 3 MNHN syntypes bear the name *ovalina*. The size of 24 mm, shape, colors, pallial sinus and especially dentition indeed approach *seychellarum* very closely to the E. Pacific *pacificus* (syn. *ovalinus*, according to Coan et al., 2000). Despite its surprising original locality *seychellarum* is understood as most likely misplaced and conspecific with *pacificus*.

Thus, from the various IND species described, only one is reliably known to live there. ***H. ludwigii*** occurs along SE. Africa. The BMNH holotype of Sowerby III's ***Soletellina brevis*** from Zanzibar proved to represent also this species. Reeve's ***Donax obscura***, 1855 is preoccupied by Deshayes, 1830 which is *D. cuneatus* (LYN09, ROE700). Shape, color, minute and close striation of Reeve's *obscura* strongly resemble *H. ludwigii*, but its type was not located as yet in the BMNH and this synonymy is therefore only tentative.

Instead of 8 *Heterodonax* as proposed by Fischer-Piette (1942) only 4 are here considered valid, as also concluded by Cosel (1989).

6.49 SEMELIDAE

RN1: This is a large and neglected family. In addition to the named SEMELINAE, ERVILIINAE and SCROBICULARIINAE, many more groups appear discernible. However, until relations among the at least 15 genera are more transparent, the use of subfamilies seems premature.

For large ***Semele***, which account for only one third of the family members, Reeve's monograph (1853) is still important. Lamy (1914) covers most genera, but comparatively few species. A sharp analysis of the E. Pacific semelids has been presented by Coan (1988). This is important, as almost half of *Semele* occur in the E. Pacific, mainly in Panamic waters. Earlier Boss (1972) treated the small number of Caribbean semelids, but he synonymized far too many valid IND species with *proficua* and recognized neither *radiata* nor *martini*, both valid W. Atlantic species. Scattered literature covers other species and aspects. For *Iacra* Dekker (2001) and for *Semelina* Coan (2003) are important.

Crucial in semelid taxonomy are Sowerby I (1833) and Adams (1854). Sowerby I started in 1833 a catalogue, never finished. Following Sherborn and Boss (1972) these names (as well as Sowerby I, 1841) are treated n.n., validly introduced later by Reeve (1853). However, in the same year Sowerby I published an article in PZSL (for 1832) validly describing a couple of Panamic semelids, plus the IND *australis*. This Sowerby I, 1833 is valid.

A. Adams described 20 *Semele* in a paper which was produced in 1853, but only published in 1854. Based on Adams' ideas, Reeve described and depicted these species and used, except in *modesta*, the same localities, but often a different wording. As Reeve's work was published in 1853, his type localities and his wording are decisive. Most of Reeve's types are still present in BMNH. Unfortunately, today in many specimens the original bright colors are bleached and often only whitish specimens are present. A further complicating issue is that many species, notably of Reeve, Adams & Reeve and Angas, were described without or with erroneous type localities.

Semele displays an enormous variability in surface sculpture, shape, thickness and color. The large number of globally approximately 55 true semelids invites for subgeneric distinction. Coan (1988) started with a grouping. He differentiated *Semele*, *Amphidesma*, *Elegantula* and 4 other groups. Indeed, the type species of *Elegantula*, *Amphidesma*, and *Semele* are distinct and the *S. barbarae*-, *S. laevis*-, *S. jamesi*- and the *S. guaymasensis*-groups display without doubt special features. His tentative grouping of *Semele* s.s., however, is perceived too large considering the relatively small, rather fragile type species. Especially *S. decisa*, *S. sowerbyi*, *S. zalosa*, but also *S. corrugata* and *S. solida*, display a special sculpture and large sizes and are here separated. *S. rubropicta* appears unique in elongated and rather light shells with a unique sculpture. *S. formosa* is quite similar in size, color, sculpture and hinge to the IND-group around *S. exarata*. In the IND, *S. australis* is unique. A strong, as yet unnamed IND group consists of *S. carnicolor* and 7 further whitish, frilled lamellate, mostly larger and uncommon species.

Once this genus is better known, in addition to *Semele* s.s., *Amphidesma* and *Elegantula* 9 additional subgenera are perceived as justified. However, currently no phylogenetic data is present. For the time being 1 genus is applied and the perceived groups are added in numbers:

S1 ***Semele***	*proficua*, *bicolor*, *brambleyae*, *capensis*, *compta*, *cordiformis*, *hedlandi*, *lenticularis*, *radiata*	9
S2 unnamed	*decisa*, *californica*, *corrugata*, *flavescens*, *martini*, *pilsbryi*, *solida*, *sowerbyi*, *tortuosa*, *zalosa*	10
S3 unnamed	*rubropicta*	1
S4 ***Amphidesma***	*purpurascens*, *casali*, *craneana*, *elliptica*, *lamyi*, *natalensis*, *pallida*, *venusta*	8
S5 unnamed	*exarata*, *duplicata*, *formosa*, *gruneri*, *jucunda*, *modesta*	6
S6 ***Elegantula***	*striata*, *rupicola*, *rupium*	3
S7 unnamed	*carnicolor*, *amabilis*, *casta*, *crenulata*, *lamellosa*, *phryne*, *scabra*, *zebuensis*	8
S8 unnamed	*hanleyi*, *bellastriata*, *pulchra*, *verrucosa*	4
S9 unnamed	*barbarae*, *jovis*, *rosea*	3
S10 unnamed	*laevis*	1
S11 unnamed	*jamesi*	1
S12 unnamed	*australis*	1

Semele ada A. Adams & Angas, 1864 from SA proved to be a lucinid, similar to ***Notomyrtea***.

Amphidesma decora Reeve, 1853 was synonymized by Boss (1972) with *Semele proficua* and a type locality St. Thomas, Virgin Islands designated. However, the 3 BMNH-syntypes, well conforming to Reeve's OD, bear the label Tasmania and were early identified in sched. (likely by E. A. Smith) as the preoccupied *Tellina decussata* Lam. (= ***Pseudarcopagia*** *victoriae* (Gatliff & Gabriel, 1914). As such *decora* is the older name for the type species of the tellinid *Pseudarcopagia*.

RN2: ***Australis*-group**: The type of ***S. australis*** is depicted in HIG01 B1012. Lamy (1914) could not differentiate *A. obscura*. Oliver et al. (2004) depicted *borbonica* from Rodrigues Isl. Habe (1971 pl. 61 sp. 10) depicted *tita* from Amami Isl., whereas Higo et al. (1999) considered *tita* the same as *obscura* extending to Honshu. Lamprell & Whitehead (1992) depicted *australis* from Australia. Dall, Bartsch & Rehder (1938) described *S. tita* from Hawaii as closely resembling *australis*, but subsequently, Kay (1979) synonymized *tita* with *australis*.

Having, in addition to all OD's, also studied specimens from Mauritius, Borneo, Marquesas and Hawaii I am convinced that *Amphidesma obscura* and *borbonica* from Reunion, as well as *Semele tita* from Hawaii are the same species as the earliest *S. australis* from Marutea.

This is a quite small, fragile, rather inflated semelid. It has a very fine, dense commarginal sculpture without any radials. It is cream-white, glossy white inside, occasionally rayed with faint rose-orange streaks or with yellow patches internally. The lunule is deep. The pallial sinus is steep, rounded, extending to midline. *S. australis* is somewhat variable in elongation and coloration, which seduced

Deshayes in Maillard, 1863 to describe it twice from the same locality. As most semelids, it is not common. The maximum size seen is 23.7 mm from Hawaii, but 28 mm are reported from Australia. It is unique and not closely resembling any other semelid known and therefore placed separately in group 12.

RN3: ***Semele***-group: Usually, only 1 larger semelid is accepted in the W. Atlantic, namely ***S. proficua***, ranging from N.C.-Bra. However, hidden behind the type species is a second species with subtle, but consistent differences, which occurs from Florida to Brazil. This is ***A. radiata*** Say, 1826. Say, 1822 (*orbiculata*) and 1826 (*radiata*) described both and gave differences. The ANSP *radiata* type lot 53283 consists of two syntypes, which, however, represent two distinct species. The smaller, whitish, elongated species, penciled "type" is in fact *radiata*. It is here selected as lectotype. The larger, ovate specimen is instead *proficua*, or Say's *orbiculata*. The locality for both specimens on the label reads Florida. Indeed, both species occur there (coll. auth.). *Radiata* is otherwise well known from the West Indies (Humfrey, 1975 from Jamaica; Nowell-Usticke, 1959 from Virgin Isl.; Reeve, 1853 *Amphidesma subtruncata* from Nevis). In addition, *radiata* has been found in Honduras, in Roatan, in Martinique and in Brazil. Compared to the type species *proficua*, *radiata* is generally ovate-elongate instead of ovate; the surface sculpture is regular, stronger than in *proficua*. In color it is both outside and inside radially marked with irregular red lines. *Proficua* is usually umbonally inside and outside yellowish or reddish suffused, radial streaks are lacking. *S. radiata* is also thinner, more fragile and less inflated. The maximum *radiata* size seen is 34 mm, whereas *proficua* reaches at least 48 mm (Puerto Rico).

As stated by Winckworth (1943) and Boss (1972) the IND ***S. cordiformis*** Holten, 1802 (syn. *A. sinensis* Reeve, 1853) is close to the CAR type species *S. proficua*, but recognizably distinct. *S. cordiformis* is a quite variable species in convexity and colors, but not in sculpture. Internally it is usually mottled with red or yellowish red. Often weak reddish radials occur and the umbones may be reddish. It is widely distributed from the Red Sea, Suez to Natal to mainland Japan. Oliver (1992) synonymized the preoccupied *A. radiata* of Reeve and *S. shoplandi* Melvill, 1896, both described from the Red Sea area. Specimens depicted as *S. radiata* from Natal and Mozambique (Steyn & Lussi, 1998 sp. 960; Barnard, 1964; Boshoff, 1965) have been studied and are conspecific. ***Semele aphrodite*** Angas, 1879 was originally described from China Seas, the BMNH label reads Japanese Seas. *Aphrodite* is perceived identical to *cordiformis* and both localities match the known distribution of *cordiformis*.

Lamprell & Whitehead (1992 sp. 424) depicted a similar species from N. Australia as *S*. "*sinensis* Adams, 1853". However, ***A. sinensis*** (Reeve 1853) from China is the same as *cordiformis*, whereas the Australian species is distinct. True *cordiformis* is not known from Australia. Specimens studied from Broome and found in Darwin are more ovate, more inflated, stronger commarginally sculptured, especially ventrally, internally white or yellowish, but not mottled as in *cordiformis*, also the red radial streaks commonly found in *cordiformis* are lacking. Instead of rose or reddish, the umbones are faintly yellowish in color. The pallial sinus is deep, steep and somewhat more pointed. At first ***A. pulchella*** was perceived close. However, Reeve's two BMNH-syntypes, described from unknown locality with their purplish umbones and a white radial patch on the anterior side of the beaks and internally a purplish hue match instead the Panamic ***S. bicolor***. Whether the third BMNH syntype a smaller whitish specimen, whitish with yellowish umbones belongs to *bicolor* is very doubtful. Consequently the N.-NW. Australian species is unnamed. Here ***Semele hedlandi*** is proposed as nom. nov. *Semele sinensis* Lamprell & Whitehead, 1992 non Reeve, 1853, nec Adams, 1854. Their depicted type sp. 424 is labeled Port Hedland, WA, 9182, which is taken as type locality. *Semele hedlandi* is a comparatively common species, often found beached, living at least from NWA, Port Hedland, through Broome to NT, Darwin. It is usually found less than 30 mm, exceptionally up to 38 mm. It lives shallow in sand with corals, and is also found in mangrove areas on sandy mud, intertidal to about 12 m. It is most likely that *Semele ?sinensis* reported by Slack-Smith & Bryce (2004) from Dampier Archipelago is also this species. Due to its affinities with the type species *S. hedlandi* is placed in group 1, *Semele* s.s.

A rare species, ***S. capensis*** quite small and rather fragile is known from SAF and represented by the BMNH type series. Smith, 1904 described it as juvenile from Port Alfred. Only two further specimens, slightly more than 16 mm from Durban could be analyzed. It seems closest to *Semele* s.s. However, the maximum size and the exact habitat are unknown.

Amphidesma compta Reeve, 1853 is difficult. It was originally described without locality, colored, radially yellowish brown streaked. Today, the BMNH holotype is bleached. Still visible is the strong radial sculpture. Boss (1972) included this species into an exaggerated *proficua* synonymy and attributed St. Thomas, Virgin Isl. as type locality. However, such colors and this sculpture are unknown for the Caribbean *proficua*. Also in shape *compta* does not match *proficua*. Instead it represents an uncommon IND semelid, strongly radially colored and with a marked sculpture. A specimen well fitting has been personally snorkeled in W. Thailand, Phuket, coral reef, on coarse sand, 3-4 m. The erroneous type locality attributed by Boss is here corrected to Phuket, W. Thailand.

RN4: ***Carnicolor***-group. The type of ***S. carnicolor***, originally described from the Philippines, is depicted in HIG01 B1009. This is an orbicular, comparatively small, whitish to yellowish shell, occasionally all white, but typically yellowish-orange inside especially towards the margins. The sculpture is rather finely lamellate, with strong radials which gives the lamellae a frilled impression. It is known from Japan, E. and S. China Sea, Phil, Australia, Andaman Sea, Tanzania (SPRY sp.188) and Rodrigues Isl. (OLI041 pl. 10). According to Dekker & Orlin (2000) it also occurs in the Red Sea and is as such depicted in Oliver (1992 pl. 30 fig. 5). Japanese authors synonymized Gould's ***alveata*** from Okinawa (type HIG01 B1009s). Having further studied specimens from N. Australia, Reeve's ***jukesii***, as indicated by Lamy (1914), is a further synonym. Neither sculpture, shape, nor pallial sinus differ; the same compression as in N. Australian specimens is found in Japanese specimens and Reeve's OD does not give any clear clue, justifying a separation. Furthermore, the BMNH holotype of ***S. aspasia***, described from unknown locality has been studied. Virtually identical specimens have been found in the Andaman Sea. These are somewhat finer ribbed, but are perceived too close to *carnicolor* to be separated. Angas, 1879 just compared *aspasia* with the marked distinct *phryne*, but not with *carnicolor*. Finally, Reeve, 1853 described ***A*. *vestalis*** from China. Zhongyan (2004 pl. 160 fig. G "*crenulata*") depicted a virtually identical specimen from China. Thus, other than Lamprell & Whitehead (1992), instead Higo et al. (1999) is followed who synonymized *vestalis* with *carnicolor*.

S. carnicolor is taken as base for the difficult, yet unnamed group of closely related, white, frilled lamellate IND semelids.

Easily confounded is ***S*. *crenulata*** (type HIG01 B1008). *S. crenulata* is a thicker species; all white internally, the pallial sinus rather broader and slightly shorter, with a denser lamellate sculpture. It has been described from the Indian Ocean, occurs also in Australia (Lamprell & Whitehead, 1992 sp. 421), but is not known from China. Coan (1988) synonymized the closely similar ***S*. *crenata*** from Qld, Moreton Bay. *S. crenulata* appears much less common than *carnicolor*. Both may be similar in size, approaching 40 mm.

Furthermore, Angas, 1879 described ***S*. *phryne*** from unknown locality. The BMNH-holotype has been studied. This species shares many traits with *crenulata* but seems to have an even finer, and more numerous and regular ribbing, the color is intense instead of dull white. Lamy did not place it. Boss (1972)'s synonymy with *proficua* and a forced type locality Virgin Isl. is simply false; *S. proficua* has a marked distinct sculpture. However, a specimen from New Caledonia, S. Noumea matches precisely. *Phryne* is currently perceived as recognizable and valid. Larger series were not available. Therefore, the differences to *crenulata* are not well established.

A related species is ***S*. *lamellosa*** described from Java and Australia, well depicted in Lamprell & Whitehead (1992 sp. 417). This species is widely distributed in the Indian Ocean including the Red Sea (DEK00), extending to the Philippines and the South China Sea, N. Borneo. Lamy (1914) recorded it from Mauritius and Oliver et al. (2004) depicted it from Rodrigues Isl. The species illustrated in Oliver (1995 sp. 1169 "*carnicolor*") from Arabia is instead also *lamellosa*; such specimens have been dived in the Gulf of Oman, 8 m in coral sand. The lamellae are stronger, the shell more compressed and all white, the pallial sinus is also steep, but more rounded compared to *carnicolor*. *S. lamellosa* is a comparatively small species, growing exceptionally to 41.5 mm in W. Thailand, off Phuket, coral reef, 5 m on coral sand. *S. lamellosa* is also known from the Philippines, e.g. Siquijor. From nearby Basay ***A*. *virginea*** has been described. The single abraded BMNH holotype appears conspecific and is here synonymized.

Another all white, frilled lamellate species, ***S*. *casta*** is found in Australian waters. This is unique in having strong and densely frilled lamellae, making the edges look spinose. In addition, the sculpture is much finer on the left than on the right valve.

S*. *amabilis described from Australia, also found in the Arafura Sea and Melanesia, Tonga is quite similar. However, in *amabilis* the laminae are less dense, less frilled and crenulated at the outer margins, not spinose. The pallial sinus is slightly shorter and narrower. *S. amabilis* seems to be less common than *casta*. *Amabilis* is well depicted in Lamprell & Whitehead (1992 sp. 416). Lynge (1909) identified *amabilis* from the Northern Gulf of Thailand, Gulf of Rayong, from 12-18 m, sand and mud. Subsequently, such specimens have been depicted from Pattani by Swennen et al. (2001 sp. 150) and are also known from S. China, Beibu Gulf (coll. auth.), from shallow water in sandy mud. S. China and Australian/Melanesian specimens are all white outside and porcellaneous inside, they share the ovate shape and both grow exceptionally larger than 60 mm. However, no intermediary *amabilis* records are as yet known from Indonesia and New Guinea (PRA, LAM140), or from the Philippines (HID, LAM140). Lynge (1909) further noted a perceivable difference: "The concentric lamellae upon the surface are placed more closely together than is indicated by Reeve's figure". This difference is consistent and has been observed so far in all specimens. It can, therefore, not be excluded that two closely related species are present and *amabilis* needs to be split. However, much more material would be necessary for such a step.

Another uncommon large, whitish semelid is ***S*. *scabra*** (Hanley 1845) from the Philippines. It appears comparatively variable in shape and there is little doubt that ***S*. *sponsa*** (Reeve 1853) is the same. Both were originally described from Cebu and share inflation and sculpture. Indeed in the BMNH both types were glued on the same wood board. *S. scabra* grows in excess of 60 mm. Fresh specimens have approximately a dozen faint yellow-brown radial lines. The strong inflation gives a convex shape and a deep purple lunule is present, well visible on the right valve. As stated by Hanley, the interior displays a yellow golden hue in fresh specimens. The sculpture is similarly dense as in *amabilis*, but equal on both valves. This uncommon species occurs in the SChi, N. Borneo-Hainan and Philippines. *Scabra* is well depicted in Zhongyan (2004 pl. 160H). In addition, Lamy, 1914 reported it from Indonesia, Aru Isl., but this record could not be verified.

Another whitish species with a typical red purplish hinge is ***S*. *zebuensis***. The type is depicted in HIG01 B1007. In shape it is invariable, but quite variable in color, from virtually all white (e.g. Okutani, 2000 pl. 489 fig. 1) to faint reddish radial streaks (e.g. Kira, 1972 pl. 59 fig. 19) or even interiorly rose (Philippine specimens, coll. auth.). Compared to *scabra*, *zebuensis* is smaller, much flatter and more trigonal, inequilateral with the umbones close to the posterior end. The surface sculpture is regular, weakly lamellar and equal on both valves. This species has been described from Cebu, Philippines and is also well known from Japan. *S. gouldi* Tryon, 1869 is a nom. nov. for *S. duplicata* Gould, 1861 (W. Kyushu, type: HIG01 B1007s) non Reeve, 1853. *Gouldi* is a synonym of *zebuensis*.

RN5: ***Exarata*-group**: ***S*. *exarata*** (Adams & Reeve 1850) described from the Sulu Sea is easily confounded with *zebuensis*. Indeed, the BMNH type of *exarata* was found in the general collection, labeled *zebuensis*, but on the back of the wood-board its true identity was clearly stated. *S. exarata* grows only about half the size of *zebuensis* and the reddish radials are generally much stronger. *S. exarata* has a very distinct rib sculpture under the lens. The ribs are broader, rounded at the top, at the end usually recurved and a strong radial sculpture is present. The hinge is predominantly white and the interior is often mottled with rust red blotches. The pallial sinus is somewhat broader and shorter. *S. exarata* is widely distributed and known from Indonesia, Australia, Qld, Phil and SChi, Borneo and possibly also New Caledonia.

A related species is ***S. gruneri*** described from unknown locality. Specimens precisely fitting Reeve's OD have been uncommonly found in Polynesia, Marquesas Isl. and seem to occur in the Cook Isl. as well. *S. gruneri* has a rougher commarginal sculpture and stronger interrib radials than *exarata* and is more vividly colored.

Another species which belongs into this group is ***S. monilis*** from SW. Australia. The type is depicted in Cotton (1961 fig. 304). It grows largest around Perth, reaching there almost 33 mm. However, Lamy (1914) mentioned the close affinities of *monilis* to Reeve's ***jucunda***. The 19.9 mm BMNH *jucunda* holotype has been analyzed and proved indeed, also in sculpture indistinguishable. As far as is known, *S. jucunda* was never collected in its supposed type locality Singapore. Furthermore, it was never reported from the Gulf of Thailand (LYN09; Swennen et al.; ROBBA). Nothing similar was found on or off N. Borneo or in the Philippines. All evidence points that *jucunda* bears an erroneous type locality. It is here corrected to SWA, Perth and *monilis* is synonymized.

Amphidesma duplicata Reeve, 1853 belongs into this group. This is a widely distributed, quite colorful, large IND species, close to the Panamic ***formosa***. Good pictures are found in Lamprell & Whitehead (1992 sp. 419, Australia) or Jarrett (2000 sp. 630, Seychelles). In the Caribbean, nothing similar is found and the synonymization of Boss (1972) with *proficua* is simply false. Antigua is an incorrect type locality and is here **corrected to Sri Lanka**. This species has been dived in Oman and Kenya, and is also known from Indonesia, New Caledonia, Australia, and the Philippines. Other than stated by Lamprell & Whitehead (1992), ***Semele gouldi*** Tryon, 1869 p. 120 does not belong here, but is instead a synonym of *zebuensis*.

In SAF, Natal waters the existence of a reddish solid *Semele* has long been known and this species has been variously named. Finally, Steyn & Lussi (1998 sp. 959) well characterized and illustrated it as *Semele "duplicata"* and gave a range from Durban to Kosi Bay and a size of 28 mm. However, true *S. duplicata* is markedly larger and distinct in shape and sculpture and is not known from Natal waters. In addition, the Natal species does not belong to the *exarata*-group. It was first considered to approach Adams and Reeve, 1850's enigmatic *A. simplex* erroneously from the "China Sea". However, *simplex* is a Samarang species and proved instead to be Panamic. Consequently, this well known SAF species is without a name. *Semele duplicata* Steyn & Lussy, 1998 non Reeve, 1853 is here renamed as ***Semele natalensis***. All specimens seen so far came from the type locality Durban to Kosi Bay. The largest studied is 29.9 m m (Richards Bay). Boshoff, 1965 only reported the larger *radiata* (= *cordiformis*) from Mozambique, but not *natalensis*. The periostracum is very thin, yellowish. In sculpture it is closest to *purpurascens* and *natalensis* is placed in the *Amphidesma* group 4. It is uncommon and the exact habitat, except dredged on sand, is not known.

RN6: Coan (1988) included some characteristic small species with a conspicuous radial sculpture usually at both ends of the valve in the ***guaymasensis*** group. This **unnamed** group is well recognizable and only known from Caribbean and Panamic waters. It currently consists of 4 species only. The type of ***Semele hanleyi*** Angas, 1879 is depicted in HIG01 B1014. It was originally described from Japanese Seas. However, this characteristic species was subsequently never found there. Instead it belongs to Coan's *guaymasensis*-group. ***S. bellastriata*** and ***verrucosa*** have strong radials also posteriorly, and *pulchra* is distinct in shape, size and sculpture with a double number of anterior radials. ***S. guaymasensis*** fits *hanleyi* precisely and is considered a junior synonym. The erroneous **type locality** of *hanleyi* is here corrected accordingly to Guaymas. The depicted specimen, which fits the figured syntype of *hanleyi* well, was collected in the N. Gulf of Mexico, Cholla Bay.

Furthermore, Adams & Reeve, 1850 described ***A. simplex*** from the "China Sea". However, nothing like this "Samarang" species was reported or found there. It is a yellowish species; commarginally sculptured with marked radials on the anterior slope, characteristic is also the large pallial sinus and the purple colored hinge. Also in shape it fits into this group and matches *S. pulchra* studied from Panama Bay well. *A. simplex* is understood as junior synonym of ***pulchra*** with an erroneous type locality. 3 BMNH syntypes are present.

RN7: In the ***decisa*** **group** rather large, heavy, irregular commarginally sculptured species are placed. Most are Panamic. From Brazil a rare, large, deeper water species is known. Most authors followed Boss (1972) and considered this species panatlantic with *modesta* as earliest name.

However, the Brazilian species has been well recognized as distinct from the WAF *modesta* and named ***A. martini*** by Reeve, 1853. Both species are uncommon. The Caribbean *S. martini* grows much larger, more than 62 mm, whereas the WAF ***S. modesta*** is usually found less than 30 mm, but grows exceptionally to 35 mm (WAF) or to 38.8 mm (Asc). The habitat is distinct; *S. martini* is sublittoral from at least 55-120 m in sand, whereas *modesta* has been divided subtidally in Sao Tomé in 4-6 m, usually gravel or sand with gravel. The sculpture in adults is quite distinct as well recognized by Reeve (1853). It is commarginal fading anteriorly and very irregular posteriorly in *martini* and rather equal roughly ridged with dense, fine radials in *modesta*. Without doubt ***S. aurora*** Tursch & Pierret, 1964 from off Rio in 55 m is a smaller *martini*. Rios (1994 fig. 1349) is instead *martini*, Boss (1972 pl. 4 fig. B) is a comparatively large *modesta* from WAF, Ascension. *S. martini* shares many traits with *decisa* and is placed here. On the other hand, *S. modesta* fits better in the *exarata*-group.

RN8: The difficult genus ***Abra***, with at present approximately 45 species, has never been reviewed. In the IND/JAP many species were described by Smith (1885), Prashad (1932) and Japanese authors. Many have been found only once, for others neither distribution, nor intraspecific variability is known. Inferring from MED and CAR specimens, abrids have generally a high intraspecific variability. Thus, it may be that some species listed here are synonyms.

Abrina has been synonymized by Keen in Moore (1969). ***Syndosmya*** has been accepted by her as subgenus. However, neither form, nor dentition gave a clear picture on a global scale. At present *Abra* is treated without subgenera. The high variability in shape, surface sculpture, lateral dentition, pallial sinus, and resilifer encountered, appears best expressed on the specific level.

An excellent key for the difficult European *Abra* is found in Balena et al. (2002). Some Asian species have been compared by Kamenev (2004).

From Mozambique, large deep water specimens are known which match Smith's type of ***philippinensis*** (HIG01, B1029). Comparing these with Sowerby III, 1894 *maxima* and Smith's *maxima* redescription (EAS94) from the Bay of Bengal I can not detect significant differences. Both *maxima* and *philippinensis* have been reported by different authors from mainland Japan. Poutiers (1981) reported only *maxima* from the Philippines, whereas Hidalgo reported only *philippinensis* from there. It appears that *maxima* was founded on large specimens of *philippinensis*.

A. profundorum is a broader, more ovate species, generally deeper living, but not a synonym, as first stated by Knudsen (1967), but later corrected by Knudsen (1970) himself.

Following Coan and Petit (2006) *Tellina* (*Merisca*) *proclivis* Hertlein & Strong, 1949 has been described as Panamic species with own type material, not as nom. nov. for the preoccupied *Tellina declivis* Sowerby II. *Proclivis* is a tellinid. Consequently, the abrid *Tellina declivis* Sowerby II, 1868 non Conrad, 1834 remains unnamed. The BMNH type 1900.3.9.11 described from unknown locality is depicted in Scott (1994 pl. 13 fig. A). Scott restricted the type locality to Hong Kong and placed it in *Abrina*. Here ***Abra scotti*** is proposed as nom. nov. for *Tellina declivis* Sowerby II, 1868 non Conrad, 1834. It is a small *Abra* from the South China Sea, reaching 10 mm, the umbones almost central, more ovate than *lunella* and comparatively higher and shorter than *fujitai*.

Higo et al. (1999) synonymized *A. kurodai* with *A. fujitai*, a view shared. In the same lot off N. Borneo, Sarawak, 73 m both extremes have been found and intermediaries as well. Both types are depicted in HIG01 B1026 and 1026a.

RN9: ***Cumingia***: *Cumingia* ***coarctata*** has been located by Sowerby I in Caracas Bay. However, this is E. Pacific, Ecuador and not Atlantic, Venezuela. *Coarctata* has been described among other new species from Cuming's first voyage to the East Pacific. The locality mentioned in Sowerby II (1873, Reeve's Icon.) Philippines is erroneous; *Cumingia* is American only, not known from the IND. *C. coarctata* appears to be a small, elongated ***lamellosa***. The smaller Caribbean cognate is ***C. antillarum*** A. Adams, 1850, described from the West Indies. This is the well known roughly lamellate form.

Mactra tellinoides Conrad, 1831 is the well known closely ridged *Cumingia* from the US Atlantic. However, this name is preoccupied by *Mactra tellinoides* Pulteney, 1799, described in error from British waters. According to Sherborn Pulteney's name has been validly proposed. As nothing similar occurs, Pulteney's name has been sparsely applied in European literature. Finally, Lamy (1917, mactrid revision) synonymized *Mactra tellinoides* Pulteney with the earlier Caribbean *Mactrotoma fragilis*. *Tellinoides* is not a nom. obl. and a reversal is not possible. Unless an ICZN petition could be successfully filed, the next available name has to be applied for this well known trigonal *Cumingia*. Adams, 1850 described and depicted ***C. sinuosa*** from the West Indies, which fits this commarginally ridged form well. Conrad's later ***borealis*** from Massachusetts and S. Carolina is perceived the same. Redfern (2001) depicted ***C. vanhyningi*** from the Bahamas. However, specimens from New York may display the same pallial sinus and shape, whereas Rehder's type displays an even longer pallial sinus, typically found in compressed, elongated specimens. As dentition and sculpture are identical, I fail to recognize clear criteria for more than one, quite variable, non lamellate CAR species, ranging from Nova Scotia to the northern West Indies and into the Gulf of Mexico.

Cumingia clerii A. Adams, 1850 from Chile is present in BMNH. It appears instead to represent a *Mulinia* close to the form called *byronensis*.

Cumingia hinduorum Preston, 1915 from India might be a *Hiatella*, but Preston's ***Tellina barhampurensis*** might be a semelid. However, without type material nothing can be stated for sure.

RN10: ***Leptomya*** is another difficult genus with mostly rare species. With at least 22 named species it appears marked over-named. Whereas shape may sometimes be deceptive, the hinge, especially the length and breadth of the resilifer and the pallial sinus are important. The resilifer differentiates immediately ***L. psittacus*** (very long, pointed), shape and resilifer differentiate ***L. trigonalis*** (comparatively broad resilifer, and trigonal, not or only moderately rostrate) from the *cochlearis* complex. *L. minuta*, *pura*, *ecuadoriana*, *retiaria* are distinct in size, shape and biogeography.

Crucial is the type species ***cochlearis***, identified as conspecific with Red Sea specimens (Lamy, 1914; Oliver, 1992 and 1995) or with Chinese/Japanese specimens (Japanese authors). *Neara cochlearis* has originally been described from a single valve, 24.4 mm, from the Cumingian collection from the Philippines, Negros. The BMNH type has been depicted by Hanley (1883 fig. 8). Specimens from the Red Sea/Arabia and specimens from Borneo/Phil/China have both rostrate, rather fragile, white shells with an almost identical resilium. However, the adult size, 40 mm (West) vs. approximately 20 mm (East) and the pallial sinus, very broad, descending and low anteriorly (West) vs. low, upper leg parallel to the margin, very deep (East) are differentiating characters. All Philippine species seen are comparatively small, fragile, the pallial sinus deep. Chinese specimens are considered indistinguishable and belong to *cochlearis*. As such Japanese authors are followed and the Red Sea/Arabian species is considered distinct. Here, ***R. bracheon*** Sturany, 1899, type NHMW 84.335, described from the Gulf of Suez fits well.

L. adunca Gould is perceived indistinguishable from L. *cochlearis*, which is widely distributed in the Pacific, apart from Philippines and China, also N. Borneo (coll. auth.), Micr (MAA84 as *adunca*), Fiji (coll. auth.). Habe (1978) demonstrated that Dall's ***stimpsoni*** from Okinawa is the same.

From Japan ***L. cuspidariaeformis*** has been described by Habe, which appears smaller, less rostrate and weaker sculptured.

Hanley, 1882 described and 1883 fig. 7 depicted ***L. spectabilis***. This is a large species, 32 mm, ventricose, finely sculptured. The type locality was questionably stated as Japan, but never recognized from there. Instead, Viader

(1951) considered it synonymous to Issel's *subrostrata* and Lamy (1914) to Adam's *rostrata*. This view is shared and *spectabilis* is considered the same as *subrostrata* and the earlier ***rostrata*** from the Indian Ocean.

L. ***gravida*** is depicted in Hanley (1883 sp. 5). The specimens identified so by Lamprell & Whitehead (1992) do not closely resemble and appear instead referable to *L. trigonalis*. Specimens identified as *gravida* by Viader (1951) are instead *psittacus*. Hanley, 1879 mentioned specimens from Arakan (= Myanmar) as close and this may be the true locality of this insufficiently known species.

As stated by Habe (1952) ***Poromya nitida*** Adams & Reeve, 1850 from Borneo might belong here. However, no type could be located at BMNH and *nitida* is currently treated as nom. dub.

Thus, 11 *Leptomya* species are considered valid.

RN11: The four groups ***Leptomyaria*** Habe, 1960, ***Thyellisca*** Vokes, 1956, ***Montrouzieria*** Souverbie in S. & M., 1863, ***Lonoa*** Dall, Bartsch & Rehder, 1938 consist of together 8 rare species. Their relations, variability and distribution are virtually unknown.

The inclusion of *Lonoa* and *Thyellisca* into the unique *Montrouzieria*, as proposed by Keen in Moore (1969) is not convincing, neither is the inclusion of *Leptomyaria* into *Leptomya*. Most IND/JAP authors separate these.

Thyellisca lamellosa was doubted to be distinct from *Leptomya rostrata* by authors (e.g. Lamy, 1914; Oliver, 1992). However, the BMNH holotype from Mauritius is perceived as valid species not particularly close in shape and dentition to *rostrata*. Maes (1967) well depicted one of these rare species from Cocos Keeling Isl. However, her cf. *lamellosa* appears closer to *T*. ***hargravesi*** in comparatively high, short shape and in small size. Maes added also the nestling habitat.

Thyellisca pulchra described from Singapore has never been depicted and no type could be located in BMNH. From the OD it is in sculpture and dentition reminiscent of *Lonoa*. Vokes (1956) did not comment while renaming *Thyella*.

RN12: ***Theora*** are uncommon and also insufficiently known to science. At least 14 species have been described, of which 8-9 species appear valid. Overall, this group needs much more material for a firm picture.

Based on BMNH type material *T*. ***fragilis*** has been synonymized by Lynge (1909) with *T*. ***lata***. The BMNH type material of both species is distinct in size and as such not precisely comparable, but Lynge's action is followed. From OD and type picture (JOH64) *T*. ***nitida*** Gould, 1861 appears the same, as stated by Lamy (1914).

If the above assumption, that *fragilis* is a juvenile *lata* is correct, then Hinds' *T*. ***opalina*** is a related, but distinct species, shorter and comparatively higher, but rather compressed and white as well.

T. ***iridescens*** Hinds, 1843 (depicted in Smith, 1885, type BMNH seen) is also distinct. However, here *T*. ***hindsiana*** matches well. Preston, 1916 described it from India, tumid in form, anteriorly excavated and strongly rostrate posteriorly.

Whether ***Theora translucens*** of Preston, 1916 is indeed a *Theora* needs confirmation. If *translucens* indeed belongs here, then a comparison with *cadabra* is indicated.

T. ***nasuta*** Hedley, 1909 and *T*. ***alfredensis*** Bartsch, 1915 may belong here, but in both cases the shape is not typical. Neither species was available for study.

In Japanese-Chinese literature *T*. ***lubrica*** is depicted as *fragilis* (e.g. Okutani, 2000 pl. 490 fig. 9) or as *lata* (Habe, 1971 pl. 61 fig. 17; Zhongyan, 2004 pl. 160E). This is obviously based on the erroneous statement of Habe (1952 p. 211) in that *"Th. fragilis* A. Adams is a syn. of *Th.* (*E.*) *lubrica* Gould". However, the lacking laterals and the oblique, inner radial fold clearly identify *lubrica* as ***Endopleura***, whereas *fragilis* is a *Theora*. The type of *lubrica* Gould, 1861 from Hokkaido is depicted in Johnson (1964). This Yellow Sea/Japanese species is nowadays widely distributed, introduced into the Med, SAU, NZ and California (Coan et al., 2000).

Theora obtusa Gould, 1861 was described without type locality and the single valve is lost. It is treated as nom. dub. (JOH64).

The BMNH type series demonstrates that ***Theora ovalis*** Smith, 1904 is not a semelid. No pallial sinus was found and the dentition does not match. However, the generic placement of *ovalis* is open. Bartsch (1915) and Turton (1932) placed it in *Aligena* and a position in LASAEIDAE seems indeed more fitting than in TELLINOIDEA.

RN13: Following Dall (1890) and Morton & Scott (1990) the genus ***Ervilia*** is placed in SEMELIDAE instead of MESODESMATIDAE. This is mainly based on anatomy (cruciform muscles, sense organs).

Whereas Morton & Scott kept ***Argyrodonax*** still in MESODESMATIDAE, most modern Caribbean authors transferred it to SEMELIDAE. As cruciform muscle scars are present, mesodesmatids are excluded. *Argyrodonax* shares traits with *Cumingia* and is placed close.

In ***Ervilia*** Rooij-Schuiling (1972 and 1974) is followed, except in *E. scaliola* which was confounded with true *purpurea* (i.e. Oliver, 1992 and 1995; Dekker & Orlin, 2000), and in ***Rochefortina***, which is considered by most modern authors generically distinct (e.g. Hayami & Kase, 1993; Oliver et al., 2004).

E. ***bisculpta*** (HIG01, B1039) and *R*. ***sandwichensis*** (OLI041/OLI104) are widely distributed from the Red Sea to Hawaii; both are found in Australia and in Japan. The quite large *E*. ***purpurea*** is restricted to the NW. Indian Ocean and the equally large *E*. ***castanea*** to the Eastern Atlantic. *R. sandwichensis* and *E. purpurea* are rather uniform and quite easily recognizable, whereas *E. bisculpta* displays an enormous variability in form and color. This misguided Gould into describing two distinct species from the same locality (HIG01, B1039 type ***bisculpta*** and B1039s type ***livida***, also in JOH64). However, all Japanese authors, as well as Rooij-Schuiling considered them conspecific.

Deshayes did not describe *E*. ***purpurea***, only named specimens in sched. in BMNH. Occasionally *purpurea* is ascribed to Lamy (1914); but Smith, 1906 p. 66 described the BMNH-Dahlac types earlier and recognizable.

In the **Caribbean** not only 6 *Ervilia* (ROO72), but including Weisbord's fossils, up to 13 names are available. Lamy (1914), Davis (1967 and 1969) and others reduced this number; Rooij-Schuiling (1974), confirmed by Coan et al. (2000), demonstrated, that *californica* is a misplaced *nitens*. Many authors consider 2-3 species, i.e. *nitens*, *concentrica*, occasionally also *subcancellata* as valid. Comparing, the types of *concentrica* (Johnson, 1964; Davis, 1967), the neotype of *nitens* (MOR90), *subcancellata* (OD of Smith, 1885), the arguments of Abbott (1974) and the discriminating factors of Rios (1994) or Redfern (2001), then no strong argument for 2 or even 3 species was found. Thus, Rooij-Schuiling (1972 and 1974) is followed. Based on large material, she considered only the type species *nitens* valid. Diaz & Puyana (1994) confirmed this view, also based on rich material. Whether Weisbord, 1964's Venezuelan fossils *E. antilleana*, *caribbeana* and *mareana* are indeed distinct may be questioned. They closely approach extant forms. The variability in ***nitens*** is even moderate compared to other *Ervilia*, e.g. *bisculpta*. Both have a predominantly commarginal sculpture, the radials are variable in strength, but usually weak, the shape trigonal to trigonal elongate and both are usually found less than 10 mm.

A rarely mentioned species is ***Ervilia producta*** Odhner, 1922. It has been described from PER (Juan Fernandez Isl.) and appears indeed to represent a true *Ervilia*, somewhat similar to *purpurea* in shape.

RN14: Following Lamy (1914), Trueman (1953), Coan (1988), and Willan in Beesley et al. (1998) the former family **SCROBICULARIIDAE** H. & A. Adams, 1856 seems too close to SEMELIDAE to be separated.

Once, semelids are better known, the differences in gills, and possibly in genetics may justify a subfamilial distinction.

Variously interpreted is the Sicilian ***Tellina rubiginosa*** Poli, 1791. As both well known European scrobicularids, i.e. *plana* and *cottardi* are found in Italy, biogeography is of no help. The OD is not decisive, "glabra" may even misguide to *cottardi*. However, the illustrated specimen pl. 15 fig. 31 and the explaining text "sa color est blanche obscurcie de taches ferrugineuses" exclude *cottardi*. Thus, Lamy is followed and *rubiginosa* is considered a further synonym of *plana*. Obviously, *rubiginosa* is not a red colored species, but a discolored one, presumably through iron in the brackish water.

Lamarck, 1818 used Poli's *lactea* as reference for two distinct species, *Lucina* and *Amphidesma lactea*. According to Récluz, who analyzed Lamarck's species *Amphidesma lactea* described from the Med, Golfe de Tarente, is a *Scrobicularia*, identical to and earlier than *S. cottardi* (LAM140), whereas *Lucina lactea* is a lucinid. However, according to Dautzenberg, who analyzed the same species in Geneva, ***Amphidesma lactea*** it is not *cottardi*, but probably *Abra alba* (LAM140). A study of Lamarck's Geneva type is pending.

S. ***plana*** grows much larger, is commonly found in the Atlantic, less so in the Med. It is rougher sculptured, rounded, and less glossy. The high variability is demonstrated by more than 30 synonyms, the most important are listed. *La Calcinelle* of Adanson, 1757 (FIP42) is the oldest, though invalid name, latinized as *Venus dealbata* Gmelin, 1791. However, to my knowledge *S. plana* does not occur in WAF proper.

S. cottardi is confined to the Med, has a glossy periostracum, posteriorly usually angled, the pallial sinus is much lower in adults. The maximum size seen is 33.2.mm (Italy), whereas *plana* reaches twice this size.

6.50 SOLECURTIDAE

RO1: This is another lesser known family. A modern review is not available and Lamy never treated this group. Furthermore, most genera suffer under an inflationary treatment by Sowerby II (1874, Reeve's Icon.) often with erroneous or no type localities.

Conventionally ***Solecurtus***, ***Tagelus*** and ***Azorinus*** are here included. In addition, Dall, 1899's ***Clunaculum*** is understood as valid genus, belonging here.

RO2: ***Solecurtus*** is a neglected genus of rather uncommon species. The literature is exceedingly difficult, as most Indo-Pacific *Solecurtus* are either erroneously named "*S. divaricatus"*, a species, confined to Japan and E. China, or are wrongly identified. Thus, the original descriptions and many type specimens had to be consulted. Here 20 species are globally recognized.

As concluded by Koyama et al. (1981) and confirmed by many Japanese specimens, there is little doubt, that Kira's ***dunkeri*** is the same as ***divaricatus***; but ***consimilis*** is a distinct, finer ribbed, rosy orange species. True *divaricatus* has only been found narrowly biogeographically restricted, confined to Japan, Taiwan and the Yellow Sea. From this latter location the largest specimens are known. *Consimilis* is recorded from Taiwan and Japan.

Both, ***Solen exaratus*** and ***Macha wilsonii*** were described as huge, slightly larger than 82 mm, whitish species; the former from unknown locality, the second from China. Sowerby II (1874 sp. 1 *S. exarata*) from China (BMNH) is not Philippi's type, which was smaller and seems lost. However, it fits Philippi's OD and has been accepted by subsequent authors to represent Philippi's species (e.g. Clessin, 1888; Bernard et al., 1993; Robba et al., 2002). Tryon, 1870 just compared his ***wilsonii*** with *strigilatus* and neglected Philippi's earlier name. From the specimens studied from E. Thailand to Japan, there is little doubt that both described the same *Solecurtus*. ***S. exaratus*** is quite variable during its growth, rather regularly radially ridged as juvenile (e.g. Okutani, 2000 pl. 492 sp. 2 as "*S. rhombus*") with almost vanishing, rough sculpture in large specimens (Habe, 1964, pl. 61 sp. 5 paratype *S. wilsonii*). Abbott & Dance (1994 p. 348) illustrated a medium sized specimen as "*S. consimilis*" and Zhongyan (2004 pl. 160 J) the same size as "*S. divaricatus*". The known range of *exaratus* is from Central Japan to the Gulf of Thailand. The records from W. and S. India (MEL07, HYL02) or Sri Lanka (KIRT) appear to refer to a distinct white species, possibly *subcandidus*.

Dunker, 1862 describing solenoids from the Cumingian collection gave no locality for his unique ***Macha australis***. Sowerby II (1874) illustrated the correct species but confused *australis* (= southern) with Australia. His type locality Moreton Bay is false. However, this misled most subsequent authors to look for this uncommon species at the wrong place. *S. australis*, as originally described, is a large and the densest sculptured *Solecurtus*. It is well known from Mozambique waters (i.e. Boshoff, 1965 sp. 131 as "*divaricatus*"). Once, it extended further south to the Durban Bay area (Steyn & Lussi, 1998 sp. 963 as "*divaricatus*"), but seems to be extinct there. *S. australis* is found in the W. Indian Ocean at least to Mozambique, but not in Australia. I have seen approximately a dozen specimens, the largest size 80.1 mm is from Kenya.

The single, somewhat worn BMNH holotype has been studied. In the Red Sea 2 *Solecurtus* uncommonly occur, the well known whitish *subcandidus* and a rare, densely ridged, rather broad, pale reddish form (Hurgada, Perim). 3 Hurgada specimens from 3 m, sand among seagrass proved closest to Dunker's *australis* and are perceived conspecific. In addition, Oliver (1995 sp. 1184) illustrated *australis* also from Arabia. As such ***S. australis*** is a W. Indian Ocean species, ranging from the Northern Red Sea, into the Persian Gulf down to Mozambique.

S. philippinarum was originally described from the Philippines, from where it is well known. In addition, this species is very widely distributed, as indicated by Lynge (1909). His Kenya record is confirmed by Mozambique specimens. Large specimens are known from Vietnam and S. China, Beibu Gulf. *Philippinarum* is often misidentified as *australis*, e.g. Lamprell & Whitehead (1992 sp. 438). However, *australis* is finer ridged and less rounded, more squarish and broader in shape. The species illustrated by Zhongyan (2004 pl. 160 fig. K "*exaratus*") from Guangdong and Hainan represents instead large end of range *philippinarum*.

S. quoyi Sowerby II, 1874 is also a white, elongated species. It has been described from a smaller specimen from the Philippines. Juveniles are difficult to differentiate from *exaratus*, but adults preserve the radial, only slightly oblique sculpture well, whereas this sculpture is usually abraded in large *exaratus*. *S. quoyi* is smaller (60 mm) and glossy white, whereas *exaratus* reaches 100 mm and is dull or dirty white. *S. quoyi* appears to extend to Australia (Lamprell & Whitehead, 1992 sp. 441 as "*S. divaricatus*"). However, ***S. leone*** is perceived as distinct, whitish, deeper water species from NSW, with a narrower pallial sinus. Lamprell & Whitehead (1992)'s synonymy is not shared. However, **true *Solecurtus quoyi*** was validly erected by Deshayes, 1835 p. 524 as nom. nov. "*Solen candidus* Quoy. Voy. de l'Astrolabe, pl. 83 f. 11. 12." In reality, Quoy & Gaimard, 1835 p. 543 named their *Solen* blanc, illustrated on pl. 83 fig. 11-12 not *candidus* but ***Solen albus*** from Tonga-Tabou, a name indeed preoccupied. Obviously, Deshayes confounded *albus* and *candidus*. Deshayes added as reference for *quoyi* Chemn. 6 6 44 and stated "plus petite et proportionellement plus large que la précédente." In MNHN there is a "syntype" of *Solecurtus quoyi* Deshayes, with a doubtful old label "*Chama quoyi* Deshayes, New Zealand". Nevertheless, this short and broad Paris specimen conforms to Deshayes' Chemnitz reference, which was accepted by Lynge (1909 p. 278) for *rhombus*, and to his brief characterization. As such *S. quoyi* Deshayes, 1835 is understood as further synonym of *S. rhombus* (Spengler, 1794) which is indeed also found in Melanesia.

Definitely, neither Deshayes' reference nor his characterization or the Paris specimen conform to Sowerby's more elongate and distinctly sculptured Philippine *quoyi*. Therefore, *S. quoyi* "Deshayes ms." Sowerby II, 1874 non Deshayes, 1835 is here renamed as ***Solecurtus quaeritus***.

The name ***Solecurtus pacificus*** "Pease, 1870" was not found published. It is also not included in Ruhoff (1980) or in Kay (1975), who listed Pease's valid names. However, the species illustrated under this name by Abbott & Dance (1986 p. 348) matches Spengler's OD of ***Solen rhombus*** well (HYL012, LYN09) and is here considered synonymous. Sowerby II (1874 sp. 9) illustrated this species as *S. sanctaemarthae* erroneously as of Dunker from N. Australia. Later, Lamprell & Healy (1998 sp. 757) illustrated this species from N. Qld. True ***sanctaemarthae*** of Orbigny in Sagra, 1853 is a small Caribbean species. Dautzenberg well recognized Sowerby II's error and renamed the Australian specimen, though unnecessarily, ***reevei***. The white *S. rhombus* is the broadest Indo-Pacific *Solecurtus* and comparatively short in shape.

In addition to *rhombus*, another all white, but more slender-elongate and slightly rougher sculptured species occurs from the Red Sea to East Africa, the Maldives to W.-E. Australia. It has been named ***Macha deshayesii*** by Dunker, 1862, originally described from Australia. However, this name is preoccupied by the fossil *Solecurtus deshayesii* Des Moulins, 1832. Later, Sturany, 1899 described ***S. subcandidus*** from the Red Sea. The single, small type was studied in NHMW. It is somewhat worn, not live taken and the depth of 314 m is misleading. A larger specimen is illustrated in Oliver (1992 pl. 31 fig. 9). Comparing Red Sea specimens with specimens found in the Maldives and W. Australia I could not detect significant differences in size, shape, sculpture, or pallial sinus. Thus, Sturany's name is applied for this species. Lamprell & Whitehead's "*quoyi*" sp. 439 appears the same.

According to Mörch (1871) ***Solen lineatus*** Spengler, 1794 is a thin, white *Solecurtus*. The OD fits the Mediterranean *multistriatus* quite well. However, as neither a similar *Solecurtus* has been identified from tropical West Africa, nor the range of *multistriatus* is confirmed south of Gibraltar *S. lineatus* is for the time being kept separate. The ZMUC type could not be studied as yet. Spengler's name antedates the Panamic *Tagelus lineatus* of Gabb, 1861, which was listed by Skoglund (2000 sp. 613) as an earlier name for Pilsbry & Olsson's *Solecurtus broggii*. Thus, *broggii* stands, irrespective whether Gabb's *lineatus* is the same or not.

The original picture of ***Solen gallicus*** Chenu, 1843 (pl. 6 fig. 8) fits the criteria worked out for *S. multistriatus* by Nolf & Verstraaten (2002) well: umbones centered, smaller gap between both valves, margins rounded and smaller size. It is therefore considered a junior synonym of the latter instead of *scopula*.

Otherwise, the WAF (1), MED (3), Hawaiian (1), Caribbean (2), E. Pacific (2) *Solecurtus* do not pose problems. Most are uncommon to rare.

RO3: ***Clunaculum***: Obviously, Dall, 1899 studied specimens from S. America. He based *Clunaculum* on "Gould" Sowerby II, 1874's *Solecurtus mollis* and gave Brazil and Uruguay as locations. However, the BMNH syntypes of *Solecurtus mollis* proved to represent a valid Asian *Sinonovacula* (see there). Thus, the South American type species *Clunaculum*, OD *Solecurtus mollis* Dall, 1899 non Sowerby II, 1874 is without name.

Indeed, an uncommon species is known from S. Brazil, likely extending to Uruguay. It shares an elongated shape with *mollis* and the valves may be interpreted as "obliquely restricted". Other than in true *mollis* the umbones are indeed subanterior. However, Dall's "internal thickened elevation" is the anterior leg of the divergent, radials as typically found in *Solecurtus*. Other than in *Solecurtus* the outer sculpture of the valves does not bear the typical incised oblique sculpture. Instead, irregular growth lines are present. The periostracum is thin, cream, slightly wrinkled. The dentition is as in the type species of *Solecurtus*, the trigonal posterior adductor as well, the narrow thick external ligament and also the larger, broad, largely confluent pallial sinus extends to the hinge line as in *S. strigilatus*. *Solecurtus mollis* Dall, 1899 non Sowerby II, 1874 is here renamed ***Clunaculum dalli***.

Clunaculum is understood as valid, monospecific genus, closely related to *Solecurtus*, but with a distinct sculpture. Its anatomy is unknown. The specimen analyzed came from Anchieta area, E.S., Brazil on low tide at sand banks, 53.7 mm. In Brazil *C. dalli* is known, but usually termed "*Solecurtus cumingianus"* (e.g. BRASIL, 29 mm from Guarapari, E.S.). True *cumingianus* is a *Solecurtus*, also white, similar shaped, but with the typical solecurtid sculpture. It is rarely found in Brazil.

RO4: ***Tagelus***: The type of ***Solecurtus inaequalis*** described from unknown locality was not found in the BMNH type collection. Panamic authors did not perceive Sowerby II's figure the same as *peruvianus*. In the general collection a couple of huge specimens where found, labeled *inaequalis* Senegal. However, the identity with Sowerby's specimen is doubtful. Furthermore, the reverse muscle impression in these specimens proved to be sinonovaculid, but not tagelid and consequently also the locality is highly unlikely. *S. inaequalis* is therefore treated as nom. dub. Even its generic identity is unclear.

Tagelus peruvianus Pilsbry & Olsson, 1941 itself is known to attain approximately 100 mm in Peruvian waters; Panamic specimens usually grow only about half of the maximum size.

Also the type of ***Solecurtus complanatus*** described from unknown locality was not found, BMNH 11/08. This species remains dubious as well, but is definitely not a *Solecurtus*. Also ***Tagelus dunkerianus*** Clessin, 1888 form unknown locality with a lost type is best treated as nom. dub.

Dall, 1899 described ***T. poeyi*** from Cuba, also recorded from Central America and Brazil. However, the features mentioned do not differ substantially from ***T. plebeius*** analysed from US, nor are Brazilian specimens distinct. *T. plebeius* is a quite variable species throughout its range, as the other 7 synonyms witness.

Dunker, 1862 described two *Siliquaria* species, ***carpenteri*** from Ecuador and ***nitidissima*** from Peru. One as a quadrangular, glossier species, with a slightly higher shell and the other as elongate, dull species, with a slightly lower shell and a characteristic brown streak centrally. Both of Dunker's species have been synonymized by authors with *politus* of Carpenter. However, *T. nitidissima* appears to fit instead Hertlein's *bourgeoisae*. Unfortunately, Dunker's type which should be at BMNH could not be isolated. Thus, a confirmation was, as yet, not possible.

RO5: ***Azorinus***: Gmelin's ***coarctatus*** is shaky and has caused confusion ever since (see Lynge, 1909; Scott, 1994). Spengler based his ***emarginatus*** on a Nicobar species as well, but his first reference is the earlier British species of Pennant. In all probability Gmelin and Spengler considered the European and the Indo-Pacific species conspecific, which they are not. CLEMAM considered *emarginatus* in contradiction to Lynge (1909) as European, and *coarctatus* as Indo-Pacific. Some modern authors accepted this (e.g. Swennen et al., 2001), most authors not (e.g. Scott, 1994; Okutani, 2000; Robba et al., 2002).

Here, both *Solen coarctatus* Gmelin, 1791 and *Solen emarginatus* Spengler, 1794 are considered **nom. dub**. They are replaced by two species with an unambiguous type locality.

Récluz, 1869 obviously had the European species in mind and also identified (*Azor*, Leach, Gray) with his *Azorinus*. The type species of the preoccupied *Azor* is *Solen antiquatus* SD Gray, 1854 (= *A. chamasolen*).

The type species of *Azorinus*, MT is *Solen coarctatus* Récluz, 1869 non Gmelin, 1791 (= nom. dub) = ***A. chamasolen*** from Great Britain.

The oldest, unambiguous name for the Indo-Pacific species is ***A. abbreviatus*** (Gould 1861) from Hong Kong. Dunker's ***A. solidus*** is treated by most modern authors as synonym of *abbreviatus*.

A. scheepmakeri Dunker, 1852 is accepted by most modern authors as large, valid species (e.g. Swennen et al., ZHO). The 72.7 mm BMNH-holotype of ***A. oblongus*** described by Dunker, 1862 from Luzon, Philippines has been studied and shares the same distinctive marks towards *abbreviatus*. It is considered the same as Dunker's earlier *scheepmakeri*.

Azorinus cunhai, originally described as *Tagelus* (*Clunaculum*), is closer to *Azorinus* than to *Clunaculum*. Compared to *abbreviatus* the umbones are distinctly anteriorly placed, the shape more pointed, and the size much smaller. It appears as uncommon, valid species, currently only known from S. Mozambique.

Oliver (1995 and 2004) consistently named a W. Indian Ocean species *A. coarctatus*. However, the specimens illustrated do not conform to Gould's *abbreviatus*. The position of the umbones is less central and the shell more pointed. In addition, the oblique ridge well marked in *abbreviatus*, but also in *cunhai*, is much more weakly expressed. This species also grows much smaller than abbreviatus. Instead ***Novaculina xyreces*** Melvill, 1898 described from Aden fits well. In addition, Dekker & Orlin reported "*coarctatus*" also from the Red Sea. This record seems also referable to *xyreces*. In shape *A. xyreces* approaches *A. cunhai* and these two merit further comparison with sufficient material.

6.51 GLOSSIDAE

SA1: ***Glossus***: Reeve's ***hibernica*** is without doubt synonymous with ***G. humanus*** as stated by most modern authors. The same elongated shapes are known from Ireland and from Italy. The distribution is continuous. Neither habitat nor size offer distinguishing features.

SA2: ***Meiocardia***: Matsukuma and Habe (1995) excellently reviewed this small group of 6 species and corrected Reeve's errors. However, their findings are sparsely reflected in modern literature and still many misidentifications persist.

As they then did not find a BMNH type, they declared ***Bucardia*** (***Meiocardia***) ***cumingi*** A. Adams, 1864 nom. dub. They assumed it identical to *hawaiana* and described

M*. *globosa new. However, 2 1/2 *cumingi* syntypes are present in BMNH 1993169 and there is no doubt that these represent Adams' species. Their short globose, inflated shape with a comparatively rough ribbing reveals that *cumingi* is not close to *hawaiana*, but instead the earlier name for Matsukuma & Habe's ***M*. *globosa***. The latter has also been described from China Seas. Additionally, *Meiocardia cumingi* occurs in the Philippines and in W. Thailand and reaches almost 32 mm (Cebu).

The type species ***moltkiana*** is uncommon, but widely distributed from Madagascar to Japan.

M*. *vulgaris is the largest species with more than 60 mm (Phil) and known from the Red Sea-Australia-Okinawa, it is also quite variable in shape. Lamprell & Whitehead (1992) listed ***Isocardia dussumieri*** Valenciennes in Cuvier, 1837 as senior synonym of *vulgaris*. No source was given; this name was not found in Sherborn, or in any other literature consulted. Oliver (1992 pl. 37 fig. 8) is instead *vulgaris*, which is the only Red Sea species (MIE001). Abbott & Dance (1986 pl. 351 sp. 7) is also *vulgaris*.

M*. *sanguineomaculata is rarely found, but widely distributed from Seychelles, Philippines to Solomon Isl. This small species is "*moltkiana"* of Reeve (1845 fig. 1).

M*. *samarangiae is wider distributed and also lives shallower than stated by Matsukuma & Habe. It has been personally dived off N. Borneo, coral reef area, about 10 m. Specimens from Japan have also been dived subtidally 10-12 m. *Samarangiae* is usually more elongate and less waxy compared to ***M*. *hawaiana***, both are quite thin.

Lamprell & Whitehead (1992 sp. 450) seems instead to represent a huge *hawaiana*.

6.52 KELLIELLIDAE

SC1: ***Kelliella***: According to Keen in Moore (1969) the type species MT of *Kelliella* M. Sars, 1870 is *K. abyssicola* (= *Venus miliaris* Philippi, 1844).

According to Coan et al. (2000) the type species MT is *Kellia abyssicola* M. Sars, 1870 non Forbes, 1843, = *Venus miliaris* Philippi, 1844.

According to Allen (2001) the type species MT is *Venus? miliaris* Philippi, 1844 (syn. *Kelliella abyssicola* (Forbes, 1844)).

According to CLEMAM (2006), based on Salas (1996), the type species is *Kellia abyssicola* Forbes, 1844 (syn. *Venus miliaris* Philippi, 1844).

Without a doubt, *Kellia abyssicola* Sars, 1870 (= type *Kelliella*, MT) is the same as *Venus miliaris* Philippi, 1844 (ODH60). The question is whether ***abyssicola*** of Sars and of Forbes are the same.

Both, *Kellia abyssicola* Forbes and *Venus miliaris* Philippi where published in 1844. Sherborn gives no month for either. For Philippi's work no precise publication month was found; thus, it is dated 31 DEC 1844. *Forbes abyssicola* was first presented in the 1843 annual meeting and published in June, 1844 (BA, R. Kundu, 1/08). Thus, *abyssicola* antedates *miliaris* by half a year. Comparing the OD's of *abyssicola* Forbes and *miliaris* Philippi, I see no argument not to consider them conspecific. The respective descriptions are very close; size, depth, locality and distribution of Forbes' *abyssicola* agree with the known data of *miliaris*.

Thus, CLEMAM/Salas' is the correct version, i.e. type ***Kelliella***, MT *Kelliella abyssicola* Sars, 1870 (= *Venus? miliaris* Philippi, 1844; = ***Kellia abyssicola*** Forbes, 1844).

The type species, OD of ***Vesicomya*** is ***Callocardia atlantica*** Smith, 1885 forming the family **VESICOMYIDAE**. *Atlantica* is usually considered an abyssal species. However, it has been reported from 538 m off Fernandina, S. Georgia and even shallower by Allen (2001). A species studied was taken live in Massachusetts from a lobster trap in 50 m, 4.5 mm. *Nitida* (type VER98 pl. 91 and 93) is considered the same. Thus, *atlantica* appears to have a similar bathymetric range as *Kelliella*. Neither for *atlantica* nor for *miliaris* a **vent** or **seep** habitat was reported.

Furthermore, ***atlantica*** and ***miliaris*** have ever since been considered as congeneric or at least very close.

Whereas Smith (1885) considered *pacifica* and *atlantica* as virtually identical, differing in shape and both very close to *miliaris*, Keen in Moore (1969) placed them in two distinct families. Comparing her definitions of KELLIELLIDAE with VESICOMYIDAE, also *Vesicomya* with *Kelliella*, there is not much to justify this distinction and a placement even in two superfamilies as proposed by authors. Odhner (1960) listed *Vesicomya* as distinct from *Kelliella*, but placed both genera together with the large chalky species within KELLIELLIDAE. Furthermore, he considered *nitida* a *Kelliella* close to *miliaris*. Interesting is Knudsen (1970). Neglecting type species, he included *atlantica* together with *pacifica* as *Kelliella* in KELLIELLIDAE and placed the large chalky species, e.g. *longa* or *guineensis* in VESICOMYIDAE. However, even if two distinct families, one for large, seep, and the other for small, mud species would be justified, the specific type species do not allow such a separation at all.

Also Bernard (1989) included *atlantica*, *pacifica*, *elegantula*, *miliari*s and others in KELLIELLIDAE. Allen (2001) analyzed and considered both type species *miliaris* and *atlantica* congeneric. Even if Allen's *nitida*, as stated by Cosel & Salas (2001) is instead *atlantica*, nonetheless, Allen compared the type species of *Kelliella* with a true *Vesicomya* and came to the conclusion, that generic separation is not warranted.

Finally, Cosel & Salas (2001) upheld a distinction in two families and stated *Vesicomya* distinct from *Kelliella* in having:
a) a tiny foot permanently concealed by the gills, whereas *Kelliella* has a large functional foot
b) an anteriorly displaced cardinal 1, whereas in *Kelliella* this is lacking
c) two clearly separated inhalant and exhalant apertures, whereas *Kelliella* has a wide exhalant siphon

However, Bernard, 1989's *Kelliella elegantula* shows a kelliellid foot a vesicomyid siphonal structure and a kelliellid dentition. All 5 kelliellids analysed by Knudsen (1970) have a vesicomyid siphonal structure, whereas at least some have typical kelliellid hinges. Furthermore, Knudsen did not consider the soft parts of *miliaris* as markedly distinct from small "vesicomyids" and placed species formerly described as *Vesicomya* back into *Kelliella*. In addition, some larger vesicomyids have a clear functional foot (e.g. *bigoti*, *australis*, or *pacifica*).

Evidence shows that neither the closely related type species, nor feet, or teeth or apertures support a distinction of two families, VESICOMYIDAE and KELLIELLIDAE.

It could be further argued that KELLIELLIDAE and VESICOMYIDAE are wrongly composed. The few, small "vesicomyids" close to *Kelliella* should be placed there, whereas the majority of large, modern seepage and vent "vesicomyids" should form another group. Indeed, today in VESICOMYIDAE mostly huge, often chalky species are discussed. Many of the characters attributed to "large, modern vesicomyids" do not fit the type species *atlantica*. At first glance, these chalky species appear in size, habitat and feeding quite distinct from the minute kelliellids, which are largely known as suspension feeders from muddy or clayey bottoms. However, these two extremes are clearly intermediated by two genera with also small ovate kelliellids (***Isorropodon***, ***Waisiuconcha***), which at least partly live in seepage areas (e.g. *W. helios*). Furthermore, morphological features are obviously not significant enough to build two distinct families around the small and the large species, as many authors since 1885 witness. Smith (1901) who analyzed many species had no problems to include *atlantica*, *pacifica*, *pilula* as well as *lepta*, *angulata* and *stearnsii* in the same family. As concluded by Boss (1970) it seems that one family and generic distinction is sufficient.

Definitely, a family VESICOMYIDAE based on *Vesicomya atlantica* is the wrong way to go. Thus, Smith (1885), Odhner (1960), Knudsen (1970), and Allen (2001) are followed, VESICOMYIDAE is synonymized. The older KELLIELLIDAE takes precedence.

According to Keen in Moore (1969) and Allen (2001) *Pauliella* is correctly placed here. Bernard (1898) discussed ***Pauliella*** in detail and stated affinities with *Alveinus miliaceus*. Allen (2001) and Middelfart (2002) demonstrated that ***Warrana*** belongs instead to CONDYLOCARDIIDAE. The other genera here included in KELLIELLIDAE are widely shared.

Overall, more than 90 kelliellids are currently considered distinct; almost half have been described in the last 30 years. However, many undescribed species have been reported by various authors. Therefore it is likely that this family contains more than 100 species.

All known species are attributed as closely as possible to available type species.

Thus, the small, rounded deeper water species with a similar hinge are considered ***Kelliella*** following here mainly Allen (2001).

Waisiuconcha is a closely related group, with slightly larger species, but a broader hinge plate and a stronger dentition.

Isorropodon with larger, rather chalky, oblong-ovate valves, but lacking a clear lunule intermediates to the larger genera.

These large, chalky species are attributed to various genera as outlined by Cosel & Salas (2001), Krylova and Sahling (2006) and Krylova & Janssen (2006).

However, there are **too few kelliellid genera** available. The ***chuni***-group does not fit into *Callogonia* and the ***magnifica***-group does not match *Ectenagena*. Some species could not be attributed, e.g. ***C. fossajaponica***; some others are only tentatively placed. Much more work is necessary to bring these mostly uncommon deeper water species in a well founded relation.

SC2: ***Kelliella abyssicola*** Allen, 2001 is obviously preoccupied. Furthermore, the type locality is instead Guybas, according to the coordinates, in addition, Siebas, and Eurbas, SW of Ireland have been mentioned. If this is a valid species, then it needs a new name.

The true identity of ***C. dalli*** Verrill & Bush, 1898, 5 mm, but otherwise of doubtful origin, is without Dall's type not restorable.

Veneriglossa vesica is superficially similar in shape to *Kelliella*. However, the dentition is very close and almost identical to *Callocardia guttata*. Thus, it is removed from KELLIELLIDAE and tentatively placed in venerids close to *Callocardia*.

SC3: Oliver & Zuschin (2001) placed *Kellia miliaceus* in ***Alveinus***. They illustrated *miliaceus* and selected a lectotype. However, they considered *Kellia ojianus* with an external ligament as not congeneric and proposed instead placement in *Lutetia* (*Spaniodontella*).

Evseev et al. (2004) treated ***ojianus*** in two articles and placed it in *Alveinus*. Apparently they did neither compare in detail with *miliaceus*, nor with the type species of *Alveinus* or *Lutetia*. They only stated "forms similar to *A. ojianus* also inhabit the Red and Arabian Sea".

However, hinge structure, shape, size and habitat rather imply that both species are correctly placed in *Alveinus* despite differences in ligament.

SC4: Cosel & Salas (2001) characterized ***Isorropodon*** and included a few species. They also placed *Kelliella elongata* within *Isorropodon*.

Following Krylova & Janssen (2006) ***katsuae*** is better placed here than in *Waisiuconcha*. *V. nakaii* is closely related and was even synonymized with *katsuae* by Koyama et al. (1981); but Higo et al. (1999) kept them distinct. Both types are illustrated in HIG01 B1099 and B1100. The species illustrated as *katsuae* by Okutani (2000 pl. 496 fig. 2) appears instead to represent *hayashii*.

SC5: As indicated by Krylova & Janssen (2006) Smith's ***Vesicomya indica*** fits quite well into ***Pliocardia***. Recently, *indica* has been commonly trawled off W. Madagascar, 400-900 m. The many specimens studied show variability in shape and inflation which makes it difficult to keep *brevis* and *compressa* apart; also *cretacea* is very close and it is likely that also Dall's *ticaonica* from the Philippines is the same species. Unfortunately, no fresh material from the Philippines was available. The largest specimen seen is 60.5 mm.

P. solidissima Prashad, 1932 appears distinct in elongated shape, not or very weakly circumscribed lunule and oblique, rougher sculpture.

Boss, 1968 described ***cordata*** from Colombia. This species ranges further south and is also known from Brazil, off Itajai. It is very close to *indica* in ovate shape, size, incised lunule, rough commarginal sculpture, dentition, and marked internally with the same radial vermiculations. Also in *cordata* the variability in shape and inflation is high.

SC6: Cosel & Salas (2001) characterized ***Callogonia*** and included a few species.

K. tenina does not fit well in *Kelliella*, though very small, it seems closer to *Callogonia*.

Callogonia philippinensis Habe & Okutani, 1983 belongs instead to the venerid *Hyphantosoma*.

V. ***chuni*** was often placed in *Callogonia*. However, Cosel & Salas (2001) demonstrated that *Callogonia* does not match. *V. stearnsi* thin and with a similar shape and hinge as well as *C. angulata* and *C. birmani* appear to belong also in this *chuni*-group, probably also *C. lepta*. Krylova and Janssen (2006) placed *angulata*, *suavis*, and *chuni* in VESICOMYIDAE gen. indet.; Coan et al. (2000) had earlier synonymized *suavis* and *lepta*. These species are placed in ***Callocardia*** **s.l**. A new genus seems necessary to accommodate this group.

Domaneschi & Lopes, 1990 compared their ***birmani*** with *albida*, *valdiviae* and many more, but not with Dall's earlier ***venusta***. However, their fig. 11 closely approaches Dall's species, the size is comparable, muscle scars are the same and the inner margins is incised in both species by unique oblique lines, similar as in *Transennella*. Most likely these two are conspecific.

SC7: Krylova & Sahling (2006) and Krylova & Janssen (2006) characterized ***Calyptogena***, included 10 species and removed all others from this genus.

SC8: ***Ectenagena***, as characterized by Krylova & Sahling (2006) appears monospecific. It seems most closely related to the *Pleurophopsis* group.

The small, hadal ***fossajaponica*** does not match anywhere and seems to represent an **undescribed** lineage.

The large heavy species with a pallial sinus, named "*Ectenagena"* by various authors are placed in ***Ectenagena*** **s.l**. At least one further genus is here necessary.

6.53 TRAPEZIDAE

RZ1: Important are Reeve (1843), Lamy (1920), and especially Solem (1954), who depicted many types. Morton (1982) treated *Fluviolanatus*; Matsukuma & Habe (1985) treated *Glossocardia.*

5 genera with a dozen species are recognized.

RZ2: ***Trapezium***: Solem (1954) recognized that Martyn's 148 *Cochlea gilva* is the same as Reeve's *Cypricardia oblonga* and Hidalgo's *Cypricardia sowerbyi*. Although Martyn's work was invalidated (ICZN 456), *gilva* has been validly used by Martens, 1872, p. 48. Martens considered, based on Hanley (1855) *C. oblonga* Reeve non Linnaeus the same and noted "… so dürfte der Artname *gilva* Berücksichtigung verdienen", his references are clear. Hidalgo (1903) was not aware of *gilva*, he only referred to Sowerby, Wood and Reeve and found as before Martens, that Reeve's *oblonga* was erroneously applied and renamed it. Lamy (1920) used *Trapezium gilvum* validly and synonymized Hidalgo's *sowerbyi*. Solem (1954) stated "nothing would be gained be reviving it when Hidalgo's name is available" and used instead *Trapezium sowerbyi*.

However, Solem's opinion does not stand. *T. gilvum* was used after 1899 by Lamy and Solem did not file an ICZN petition to suppress it. Even though *sowerbyi* has been applied very commonly in recent years, Lamy (1920) has to be followed. The valid name for this colorful, large species is ***Trapezium gilvum*** (Martens 1872). The type locality is Poulo Condor Isl., now Con Son, off South Vietnam. Wood, 1828's *Chama angulata* from Australia, an erroneous interpretation of Lamarck's *Cypricardia angulata*, is perceived the same.

RZ3: ***Glossocardia***: Solem reported *Glossocardia* as monospecific. He was not aware of the rare Caribbean ***agassizii*** and synonymized *stoliczkana* erroneously with *obesa*.

Instead, as recognized by Matsukuma and Habe (1995) these three species are distinct. Whereas *obesa* is by far the largest and quite commonly encountered while diving in coral reefs, *agassizii* and *stoliczkana* are uncommon and deeper, predominantly bathyal.

G. ***stoliczkana*** is less than 25 mm, with a very acute dorsal ridge, and a second ridge in the middle of the posterior slope, it also has a much denser, finer commarginal sculpture. It has been excellently illustrated by Prashad (1932 pl. 8 figs. 15-16).

RZ4: ***Neotrapezium***: Following Coan et al. (2000) *Neotrapezium* is treated as of generic status.

Following Solem (1954) and the type pictures, 2 well known species exist. Both are highly variable in shape and color.

It appears that ***Petricola esculpturata*** Preston, 1915, 47 mm from Lake Chilka, is a further synonym of *N. sublaevigatum*. The type at ZSI should be compared for confirmation.

RZ5: ***Coralliophaga***: Most authors followed Keen in Moore (1969) and considered *Cardita dactyla* Bruguière, 1792 the type OD of *Lithophagella* Gray, 1854. However, the type OD *Lithophagella* Gray, 1854 p. 21 is instead the Mediterranean *C. lithophagella*. At present, however, there are no data available to separate ***Lithophagella*** from ***Coralliophaga***.

Whereas a Mediterranean immigration of ***coralliophaga*** is probable (accepted by Repetto et al., 2005; not as yet by CIESM and CLEMAM), a specimen has been found near the Light Tower, Mosselbay, South Africa, which enlarges also the Southern range.

Oliver et al. (2004) questioned whether the subtidal cave species ***C***. ***hyalina*** is not a juvenile *coralliophaga*. As the sculpture in juvenile *coralliophaga* is often coarser and very close to Hayami & Kase (1993 fig. 331 and 333), as neither in pallial sinus, nor in dentition sufficient differences are present, and as *coralliophaga* is well known from mainland Japan, this course is followed. Furthermore, from the localities, where *hyalina* has been mentioned, *coralliophaga* is also reported. Thus, *C. hyalina* is not considered speleoxene. As far as is known, genetic results are not available to prove the contrary.

As concluded by Solem there is no reason not to include Reeve's ***C***. ***laminata*** in the *coralliophaga* synonymy. It is a fragile, somewhat broader form; the BMNH type series has weak radials as well.

Cypricardia incarnata Reeve, 1843 from the Philippines and ***Cypricardia rosea*** Gould, 1850 from Fiji are not well known and were differently treated by Lamy (1920) and Solem (1954). Both types are illustrated in Solem. From the material at hand it seems, as stated by Solem, that Gould's *rosea* is indeed a *coralliophaga*. It is very close to Australian material (Darwin, Lee Point), also depicted by Lamprell & Whitehead (1992 sp. 448). The Australian specimens reach the same size; in addition, *coralliophaga* has been reported from Melanesia, from where *rosea* has been described. Thus, *rosea* is considered a further synonym of *coralliophaga*.

The BMNH type of Reeve's ***C. incarnata*** originally described from the Philippines has been studied. This species is perceived to surpass the high variability of *coralliophaga*, where Solem placed it. Instead, from sculpture, shape and margin it appears much closer to the holotype of *decussata*. ***C. decussata*** was described from unknown locality but is accepted to occur also in the Philippines. For the time being *C. incarnata* is treated as synonym of *decussata*. The latter has page priority, and has been accepted as distinct from *coralliophaga* by all authors consulted. The proposed identity of *incarnata* with *sublaevigatum* of authors does not match in shape, sculpture and margin. *C. decussata* appears as quite uncommon species and very few specimens have been seen so far.

6.54 VENERIDAE

SF1: Venerids are by far the most speciose family in marine bivalves. Almost 10% of all marine bivalves are venerids. While beachcombing, approximately every 5th species found is a venerid. Here almost 700 species are recognized. The number of 800 species as mentioned by authors could not be verified. Many shallow water species display a stunning variability and often, many synonyms in color or shape exist.

Two authors are mainly used, **Römer (1857-69)** and **Fischer-Piette (1938-77)**. Both dedicated many years of their life's to this family. Whereas Römer tended to split, Fischer-Piette tended to lump. As such, the comparison of two strong opinions was challenging.

In addition, Sowerby and Reeve monographed venerids in many papers. Jukes-Browne (1906-1914) treated venerids in many papers. Tomlin (1923) reviewed BMNH-venerids and established the synonymy of many Cumingian species, used here extensively. In addition, a multitude of venerid papers cover OD's, revisions and other important aspects. Finally, very many type species, notably BMNH, MNHN, MHNG, NHMW, MfN and USNM have been studied and compared.

Venerids merit a very sophisticated view. Many genera contain species with a stunning intraspecific variability, in other genera slight differences constitute distinct species. Especially in two genera (***Dosinia***, ***Pitar***) intraspecific variability is still poorly understood and the number of valid IND species not well known.

The question of **CHIONINAE** (synonymous or separate from VENERINAE) has been intensely discussed since Frizzell separated them in 1936. Whereas Kappner & Bieler (2006) argued to separate, Mikkelsen, Bieler & Kappner later in 2006 proposed a combined CHIONINAE and VENERINAE clade. It appears best, as also concluded by Coan et al. (2000), to consider CHIONINAE synonymous to VENERINAE. In many genera and in many species the similarities are much closer than their distinctiveness (e.g. *Circomphalus* and *Bassina*; *Antinioche* and *Antigona*, *Placamen* and *Clausinella* and some more).

Here, VENERINAE equals what older authors (e.g. Sowerby II and Reeve) understood as *Venus*.

SF2: ***Venus***: Following Keen in Moore (1969) ***Ventricoloidea*** is considered a weak, but useful subgenus to differentiate finely lamellate, trigonal-ovate species with a wanting radial sculpture. The type of *V. multilamella* Lamarck, 1818 is illustrated in Fischer-Piette (1975 pl. 2 fig. 23-24).

Römer's *Ventricola*, 1867 combined both, true *Venus*, e.g. *verrucosa* and true *Globivenus*, e.g. *effossa*. Römer, 1867 did not formally designate a type species. The selection of *V. verrucosa* by Keen in Moore, 1969, makes *Ventricola* an objective synonym of *Venus*.

Difficult is the *V. albina - foveolata* complex. Usually ***Venus foveolata*** is placed in Japan and ***Venus albina*** is synonymized. However, from Sowerby's OD these two are clearly distinct. Whereas the latter was described from China, the former was described from the West Indies, Martinique. The BMNH type collection contains a *Venus albina* lot with two distinct species. The species with the brown lunule conforms to Sowerby' OD of *albina* and has been illustrated by Higo et al. (2001 B1121). The other species, as written on the back of the wood board, is the NZ *Dosina oblonga* (=*mactracea*). Following Higo et al. (1999) *V. albina* is understood as more inflated Chinese species, as characterized by Zhongyan (2004 as *Venus* "*foveolata*"). The correct name for the compressed Japanese species is Yokoyama's ***cassinaeformis***. *V. foveolata* was not accepted by Higo et al. (1999) to occur in Asia. Whereas Reeve's *V. foveolata* sp. 11 despite an erroneous type locality, well conforms to the Japanese *cassinaeformis*, Sowerby's sp. 80 differs. However, no ***foveolata*** type is available and none was found in the general collection. Consequently, *Venus foveolata* has to be considered a nom. dub. (see also under ***G. lepidoglypta***).

The two syntypes of ***Venus crebrisulca*** Lamarck, 1818 are well illustrated in Fischer-Piette (1975 pl. 1 figs. 1-5), also Chenu pl. 7 sp. 2. In addition, the syntypes have been studied in Geneva (MNHG, 1084/79, 2 sp., 44/46 mm). *V. crebrisulca* is the same and the valid earlier name for ***V. rosalina*** Rang, 1834. Obviously Römer (1867) also recognized this, whereas Fischer-Piette (1975) did not. The original type locality "Océan indien?" is herein corrected to WAF, Senegal. *Crebrisulca* is a true *Venus*. It is Lamarck's *Venus* no 10, whereas his *Venus* no 9 is *Venus casina* L. (also MNHG, Chenu, pl. 7 sp. 3). *Venus crebrisulca* is variable in strength of sculpture, number of ribs and especially also in color: white, yellowish, and pinkish, but always with an irregular brownish radial pattern. *Crebrisulca* has a finer commarginal sculpture and consequently more ribs compared to *declivis* and *subrosalina*. The ribs are low and not lamellate as in *declivis* and not broad and erect as in *subrosalina*. *Venus crebrisulca* grows larger than the two other WAF species.

Reeve's BMNH syntypes of ***Venus irregularis*** from Gabon proved to represent a bleached, now white *declivis*. Internally the rose umbonal color is still visible. Fresh *declivis* are quite colorful cream or rose with brown irregular patterns. Fischer-Piette's ***V. lavezzarii*** from "Peru" is perceived conspecific as well, the type locality is false.

Sowerby III's BMNH holotype of ***Venus keppeliana*** from "Sierra Leone" proved surprisingly to represent a misplaced Panamaic *Leukoma*.

SF4: ***Ameghinomya***: Although *A. antiquata* is morphologically very close to *Leukoma* (e.g. *thaca*), Soot-Ryen (1959) stated a small anterior lateral and placed *V. antiquata* near *Venus*. Modern molecular data place *A. antiquata* away from *Leukoma*, close to *Dosina zelandica* among the basal venerids (Kappner & Bieler, 2006).

Austrovenus is here still placed close to *Leukoma*. Beu (2004 and 2006) stated morphological affinities to *Ameghinomya*; but this view should be genetically substantiated.

2 species were doubtfully synonymized with *antiquata* by authors. ***Venus agrestis*** Philippi, 1845 (PHIL2, tab. Venus 4 sp. 2) was described from the Magellan Strait, but never found there again. Lunule, shape, sculpture and size of *agrestis* are impossible for an *Ameghinomya*, but as Fischer-Piette (1975) indicated very close to *Globivenus*. *V. agrestis* may well be a misplaced *Globivenus fordii*. This is currently the only *Globivenus* known being very close in sculpture, lunule and shape. The type of Philippi's species might be in Chile.

Venus inflata King & Broderip, 1832 is the other enigmatic species which does not fit; the lunule was described as obsolete. However, the type species of *Venus inflata* could not be localized at BMNH, and *inflata* is best considered a nom. dub.

SF5: ***Dosina***: This genus is only known from NZ and usually 2 species –*zelandica* and *crebra* - are differentiated.

An enigmatic species was ***Venus mactracea***. The syntypic lot from "Valparaiso" is present in the BMNH type collection. However, from hinge, lunule and pallial sinus two closely related, but distinct species are glued on the same board. Subsequently, the smaller species with the heavier hinge was identified by the curator in March, 2009 as the measured syntype and is herein selected as **lectotype**. None of these remotely conform to *A. antiquata* where synonymized by many authors. Nothing close is known from Valparaiso or from elsewhere in Chile. However, the lamellate commarginal sculpture, the heavy hinge and the very small, impressed rounded trigonal pallial sinus leave no doubt that *mactracea* is instead the NZ *D. zelandica*. It is even not excluded that the closely related second species with a finer hinge and a slightly larger pallial sinus represents a large *crebra*.

According to Duncan, *V. mactracea* was described by Broderip in Broderip & Sowerby I in June, 1835 in PZSL. *Dosina zelandica* was, according to Sherborn, described by Gray in Yate in 1835, meaning 31.12. 1835. The preface of Yate's book bears the date August 10th., 1835 and Gray described his species in the appendix, p. 309.

V. mactracea has been validly proposed and is not preoccupied. As *mactracea* is, though erroneously, included in many recent listings and as especially an unambiguous lectotype is present, there is no way of avoiding the use of *Dosina mactracea* (Broderip in Broderip & Sowerby I, 1835) as the earlier name for the well known ***Dosina zelandica***. The type locality of *D. mactracea* is herein corrected to New Zealand.

SF6: ***Globivenus***: More than 10 names are available for Caribbean *Globivenus*. At least 6 species are considered distinct.

Following Dodge (1952) and Fischer-Piette (1975) *Venus cincta* "Chemnitz" Gmelin, 1791, described without locality, is considered a nom. dub. Most likely *cincta* was a small *rigida*. Without analysis of Chemnitz' type material, possibly in St. Petersburg, a firm determination is not possible.

Venus rigida (= *V. rugosa* Gmelin, 1791 non Linnaeus 1771) is the large, widely distributed well known species. It is typically strongly inflated, with strong lamellae, 2-5 interrib ridges, a very broad lunule and a trigonal relatively small pallial sinus. Specimens very close are found from Florida to Brazil. I was unable to differentiate the form illustrated as *Venus rugatina* auctt. non Heilprin, 1886, e.g. by Abbott; true *rugatina* of Heilprin appears fossil only. Neither number of interrib ridges, nor lunule, or color of the left valve's escutcheon or inflation offer any reliable and constant aid to differentiate. *Rugatina* auctt. non Heilprin is considered synonymous to *rigida*. ***Venus pilula*** was described without locality, but the BMNH wood board with its 2 syntypes bears a fitting label St. Thomas, West Indies. This species has been synonymized by virtually all authors with *rigida* (e.g. Smith, 1916; Fischer-Piette, 1975). Indeed, the illustrated syntype appears too close to *rigida* to be separated. However, the not illustrated syntype represents a somewhat more elongate, more compressed specimen, as typically found in the West Indies (Martinique, St. Lucia). Whether such less inflated, more squarish, and stronger brownish colored specimens are indeed conspecific should be genetically analyzed.

V. listeroides originally described from Brazil is a smaller specimen. It occurs widely and is known from Florida and Louisiana (illustrated in GAR99; or DIA94).

V. kempfi and ***foresti*** are considered valid species as originally described.

V. snellii has been described off Suriname (type in Fischer-Piette, 1975 sp. 28) from a single right valve. Small *rigida* specimens from East Panama have a more rounded shape, a stronger inflation; the pallial sinus is smaller and more trigonal. It appears that Macsotay & Campos (2001 p. 183) illustrated this species as *Clausinella cf. gayi*. If this is substantiated, then *snellii* is a rare species living sublittoral in Suriname and in Venezuela.

V. strigillina is an uncommon whitish species, originally described from Florida. It is known to occur from S.C. to E. Panama and Colombia (DIA94). From Suriname and Brazil another uncommon species is known, usually also termed *strigillina*. However, this species is distinct. In addition to its more southern biogeography, it is more elongate, grows larger, is stronger colored, denser and stronger lamellately ribbed and the heart shaped lunule is narrower than in *strigillina*. An excellent picture is found in Okutani (1983 p. 338). It is not completely excluded that this was true ***Venus foveolata*** Sowerby II, 1853 from Martinique. However, its type is lost and *foveolata*, misused by many authors around the globe, has to be considered a nom. dub. On the other hand, Dall, 1902 described an enigmatic species from Acapulco, ***Cytherea*** (***foveolata var.?***) ***lepidoglypta***. *Lepidoglypta* was never accepted from Panamic waters. Keen (1971) stated "apparently an Oriental form, perhaps *V. foveolata* (Sowerby, 1853)". The USNM-holotype 103286 could be studied. It conforms in all respects to this uncommon deeper water species form Suriname and N. Brazil. Here N. Brazil, Amapa is clarified as **type locality** for *Globivenus lepidoglypta*. From there specimens, up to

50.5 mm have been studied. However, BRASIL reported it from Amapa even up to 55 mm, obviously commonly found in deeper water in 150-300 m.

Globivenus embrithes has been described from Torres Strait. Typical specimens have a very broad, deep lunule close to the type species ***G. effossa***. In specimens from the Philippines and SChi, N. Borneo the lunule is still broad, but somewhat less sunken.

Spry (1964) reported "*embrithes"* from EAfr, Tanzania. The same form is also known from the Red Sea, Egypt, Maldives, and Mozambique. This species is also illustrated as "*toreuma"* by Steyn & Lussi (1998 sp. 990) from Kosi Bay to Natal. However, this Indian Ocean form is distinct from *embrithes* and *toreuma*; the lunule is much broader than in *toreuma*, but not sunken as in *embrithes*. The shells are more orbicular than *toreuma* and *embrithes*. Cox, 1930 described ***Antigona*** (***Ventricola***) ***orientalis*** from post-Pleistocene deposits from Mombasa, Kenya. The characters fit well and this name is here applied for this special Red Sea and W. Indian Ocean *Globivenus*.

In addition, at least two further, as yet **unnamed** *Globivenus*, occur in the IND.

SF7: The ***Antigona*** group is one of the most difficult in venerids. Thanks to the kind help of K. Way and Mr. Crabb, BMNH and Y. Finet, MHNG and photos of the various types involved it was possible to achieve firm conclusion. Globally almost 20 species are recognized.

The distinction between *Antigona* and ***Periglypta*** is shaky, as perceived by Lamprell & Whitehead (1992). At first glance, the respective type species *V. puerpera* and *V. lamellaris* are distinct. However, some *Periglypta* have strong lamellation (e.g. *laqueata*, *materna*, *chemnitzii*, *listeri*, *somwangi* sp. nov.), whereas others have a small pallial sinus (e.g. *gladstonensis*), in some the lunule is expressed, in others it is impressed. *Somwangi* is in form, strong lamellation and inset lunule with radial ribs very close to *lamellaris*, has a clear anterior lateral tooth (as also *laqueata*). On the other hand, a deep pallial sinus extends over one third of shell length, typical for *Periglypta*. Some juveniles are lamellate (e.g. *multicostata*), changing to a rather cancellate sculpture as adults. Placing all known global *Antigona*/*Periglypta* species side by side, there is a continuum from the small, fine, lamellate *Antigona lamellaris* to the rough, heavy, cancellate *Periglypta puerpera*. As the main criteria of Jukes-Browne's subgenus intergrade, and as additional criteria mentioned by Bieler et al. (2004) do not hold firm, *Periglypta* is synonymized with *Antigona*.

The very few species molecularly analyzed do not oppose. Kappner & Bieler (2006) stated identity in the three characters analyzed for *A. lamellaris*, *P. listeri* and *P. puerpera* (marginal crenulation, anterior lateral tooth, siphons), but some distinctiveness in molecular data. However, later in 2006, Mikkelsen, Bieler and Kappner placed *Antigona lamellaris* and *Periglypta listeri* closely related in the CHIONINAE/VENERINAE -clade.

Iredale did not accept *Periglypta* and created instead two new genera. Following most modern authors, Iredale's ***Tigammona*** is included in *Antigona*. Iredale and McMichael (1962) used *Tigammona* for both, *A. chemnitzii* austr. auctt. non Hanley, 1845 (= *laqueata*) and *persimilis* from Qld and NSW.

Proxichione is variously treated, as full genus, as subgenus or as synonym. Darragh (1965) tried to separate *Proxichione* from *Antigona*/*Periglypta*. However, reflecting the variability in the known *Antigona* species, his criteria appear to highlight specific extremes. Both, the compared type species of *Antigona* and of *Periglypta* are extremes and not typical for the majority of *Antigona*. Neither pallial sinus, nor dentition holds, and even the escutcheon are too close to warrant generic distinction. Comparing NSW-*materna* with Qld-*gladstonensis* or WA-*laqueata* there remains nothing, not expressible on the specific level, a conclusion approach by Darragh himself: "Adult specimens of *Tigammona chemnitzii* (Hanley) are so close to *Proxichione materna* that they are possibly congeneric." I am convinced they are.

Thus, ***Antigona*** is understood as: medium to large sized, ovate to trigonal-ovate; generally brownish-white; with solid, light to heavy shells; combined radial and commarginal sculpture, in some lamellation, in some radials predominant; anterior lateral in the left valve strong to almost absent; pallial sinus small-trigonal to broad-rounded; lunule well marked, margins crenulate. All *Antigona* measure more than 50 mm in adult size and half reach more than 100 mm.

Studying the global *Antigona* one species has been found new to science. Another undescribed species, but only known from a single valve off N. Borneo, closely resembles the Caribbean *listeri*, but is internally white. Specimens alike from the Philippines might have caused the confusion in locality of *listeri*. However, too little material prevents description at this point in time. Further, it transpired that ***Antigona langfordi*** Kuroda is an uncommon *Timoclea* from Okinawa. In addition, Fischer-Piette (1975 sp. 21) placed *Venus crenulata* Chemnitz in the Indo-Pacific and considered the Australian *Antigona laqueata* the same. However, ***A. laqueata*** is a valid tropical Australian *Antigona*. Chemnitz' species (i.e. ***Puberella crenata*** (J. F. Gmelin 1791)) antedates instead the Caribbean *Venus pubera* Bory de St. Vincent, 1827. Furthermore, ***Venus clathrata*** Deshayes, 1853 is twice preoccupied and needs a new name.

Antigona somwangi sp. nov.

Introduction: During a research trip to the Andaman Sea, a unique large venerid from deeper water has been encountered. Further inquiries revealed more specimens and more information on habitat and bathymetric range. As none of the known IND *Antigona* matches, it is here described as new.

Diagnosis: A large, inflated, strongly lamellate and marginally finely crenulate, white and brownish tented *Antigona* from deeper water with a deep trigonal pallial sinus.

Description: Shell large, robust, elongate-subquadrate, with prominent lamellae. Posteriorly the dorsal slope is first slightly convex and then broadly truncated. The ventral part is rounded. Anteriorly the shell is strongly, tongue-like extended. About 30 thin frilled, erect lamellae cover the surface. This primary commarginal sculpture is crossed by a secondary structure of dense radial riblets, regularly dispersed over the whole surface. These radial riblets include the lamellae and make them frilled. The lunule is clearly demarcated, slightly impressed, radially lamellate and yellow-brown. The escutcheon is long; whereas the right half overlaps the left. The dark brown, moderately inset ligament is long, encompassing halfway of the escutcheon. The dentition is as for the genus, the posterior cardinal in the right and the middle cardinal in the left valve split, with a small anterior lateral in the left valve. The pallial sinus is particularly impressed, deep, extending more than one third of shells length, trigonal, the dorsal leg horizontal and the ventral leg ascending. The whole inner margin, except along the escutcheon is finely crenulate. The color is externally white with irregular brownish-yellow tents or streaks, internally all white.

Maximum dimensions studied (length x height) 84.4 mm x 63 mm. However, a specimen off Racha Island, Thailand, 100 m, measures 90.5 mm (coll. A. Alf, Germany).

Derivatio nominis: This new venerid is named after Somwang Patamakanthin, Phuket. Somwang built, together with his father Somnuk, one of the finest public shell museums in Thailand. He is himself an ardent collector and has supported additional specimens of this uncommon new *Antigona*.

Type locality: Andaman Sea, off NE. Sumatra, trawled 80-120 m, by Thai fishermen.

Type material:

Holotype: MNHN, Paris type collection, 1 p.v., Andaman Sea, off NE. Sumatra trawled by Thai fishermen in 80-120 m, 64.9 mm, 51 mm, 40.8 mm, leg. Somwang and Somnuk Patamakanthin, 2006

Paratype 1: MNHN, Paris type collection, 1 p.v., data as holotype.

Paratype 2: MHU SF5421 3 s.v., Andaman Sea, off Phuket W. Thailand, trawled before 2006, 84.4, 83.6, and 83.5 mm

Paratype 3: MHU SF542 1 p.v. Andaman Sea, off W. Thailand, trawled in about 40 m, 75.8 mm (bought 2006, Phuket)

Paratype 4: MHU SF5422 3 p.v. data as holotype, 72.9, 64.7 and 57.8 mm

Further specimens are in ZMA, confounded with *A. lamellaris* and in coll. H. Dekker, The Netherlands, all from the Andaman Sea.

Distribution: The new species is currently only known from the Andaman Sea (NE. Sumatra, W. Thailand to S. Myanmar).

Habitat: The data known so far, point to a sublittoral habitat, from about 40-120 m. As far as is known, *A. somwangi* has never been found on beaches or by diving. All specimens studied came from fishermen trawls. Soft parts were not available.

Discussion and comparison:

- Superficially *A. somwangi* could be confounded with *Fimbria soverbii* (Reeve 1842). Both have a similar shape, reaching a similar size, having lamellae and radials, a crenulate margin and share a similar whitish streaked color. Nonetheless, the distinct dentition with two strong laterals and the lacking pallial sinus dismisses *F. soverbii* at once.

- Closer to the new species is the type species ***Antigona lamellaris*** Schumacher, 1817. However, the latter has a trigonal, less inflated shape, posteriorly with only a narrow truncation. The lamellae are more robust and stronger frilled. *A. lamellaris* is also distinct in color, usually darker brown outside and on the lunule, inside generally orange-rose-red or at least flushed so. The pallial sinus in *lamellaris* is trigonal as well, but much shorter. Furthermore, *A. lamellaris* is a shallow water species, usually found within 30 m. *A. lamellaris* usually grows less than 50 mm, exceptionally up to 67.8 mm (Philippines), whereas *A. somwangi* reaches at least 90 mm.

- ***Venus laqueata*** Sowerby II, 1853. This species has been described from Perth, SWA, and is known from Cockburn Sound to Qld. It is well illustrated in Sowerby II (1853 sp. 9), Reeve (1863 fig. 20), Lamprell & Whitehead (1992 fig. 453 *"chemnitzii"*), Abbott & Dance (1986 pl. 353 sp.11 as *P." clathrata"*). This Australian species is comparatively close to *A. somwangi*, but the lamellae are more numerous, more than 40, and therefore denser arranged. The form is generally higher, less extended anteriorly and rounded instead of truncated posteriorly. The pallial sinus is generally shorter. *A. laqueata*, as stated by Jukes-Browne (1914) is distinct from *chemnitzii*. Compared to the latter, *laqueata* is comparatively higher, is less densely lamellate and has a shorter pallial sinus. *A. laqueat*a is widely distributed in Australian waters, from SWA, NWA, NT, and Qld. True *chemnitzii* does not occur there.

Specimens from Qld and NSW (= *Tigammona* ***persimilis*** Iredale, 1930 pl. 62 figs. 1-2) are somewhat more elongate, more compressed and smaller than typical *laqueata*, and less close to *somwangi*.

Furthermore, Angas, 1872 described from Port Curtis, tropical Queensland *Venus* ***gladstonensis***. This species was neither mentioned by Jukes-Browne (1914), nor by Iredale (1930). The juvenile, densely ribbed form was illustrated by Angas, 1872 fig. 8; the adult form in Lamprell & Whitehead (1992 fig. 454). Angas compared his new "pale ashy-brown" species with *laqueata* and stated it distinct mainly on account of denser ribbing. It has a pallial sinus, which is smaller and more angular. It appears that Iredale compared his *persimilis* to this species and not to true *laqueata*, in stating "it (e.g. *persimilis*) is more elongate, the brown lunule is distinctive, while the pallial sinus is less angular and comparatively larger".

Proxichione materna Iredale, 1929 is uncommon, a deeper water *Antigona*, at present only known from SE. Australia, NSW. In shape and densely ribbed sculpture it somewhat approaches *laqueata* as stated by Darragh (1965), but is quite distinct from *A. somwangi*.

- ***Venus chemnitzii*** Hanley, 1845. A syntype is illustrated in HIG01 B1129 (= BMNH196244/2), see also Abbott & Dance (1986 p. 353), Okutani (2000 pl. 499 fig. 6). This uncommon species is similar in shape to *A. somwangi*, but it is more tumid, less elongate anteriorly and rounded instead of truncate posteriorly. It has almost the double number of lamellae. The anterior lateral in the left valve is weak and closer to the anterior cardinal. The surface bears a regular marking of 3-4 brown rows, whereas in *A. somwangi* this sculpture is weaker and irregular. This species is known from SChi, N. Borneo, the Philippines (type locality), East China Sea, Japan (Kyushu-Honshu, Kii), possibly also in the Andaman Sea, but not in Australia. ***Periglypta amica*** Pilsbry. 1904 (W. Kyushu) is considered the same by Japanese authors (holotype HIG01 B1129s). However, no material was as yet studied from Japan. Biogeography, description and picture of ***Venus fischeri*** Récluz, 1852 (China) fit *chemnitzii* well, less so *reticulata* (Higo, Callomon & Goto, 1999), or *V. crispata* (Tomlin, 1923), or *laqueata* (Lamprell & Whitehead, 1992). However, as the type is lost and as *V. fischeri* was variously interpreted, it is here declared a nom. dub.

- Cytherea **(*Dosina*)** ***listeri*** Gray, 1838. This lamellate species, described from unknown locality, caused many errors in older literature. Nowadays, it is accepted to represent the large Caribbean species. It has also fine, strongly erect lamellae. However, the denser lamellae as well as the broad posterior part distinguish it easily from *A. somwangi*. In addition, *listeri* has a characteristic purplish-brown internal color, especially so around the muscle scars. BMNH No 196247/1 (= 1962047) fits the Caribbean form precisely. It is the species illustrated by Sowerby II (1853 pl. 152 fig. 7 as *listeri*) from Philippines and Australia and also by Reeve (1863 sp. 14 *listeri*) from the Philippines, whereas Deshayes, 1853 considered it as belonging to his *crispata*. This specimen may even have originated from the Gray collection, later confounded with Philippine Cumingian-material. It is here designated as **neotype** of *Antigona listeri* (Gray 1838). The **type locality** is corrected to Caribbean, Jamaica, where such forms were found.

- Venus multicostata Sowerby I, 1835 does not pose any problems. It is unambiguously illustrated by Sowerby II (1853 sp. 7 fig. 10). It has been described from Panama and is Panamic in distribution. It is the largest *Antigona* and may measure more than 150 mm. Adults are heavier and strongly ridged with much more ridges than *somwangi*. Juveniles, however, are closer with relatively few erect lamellae. In general the posterior area is broader, the anterior less expanded and the pallial sinus shorter and rounder. Compared to the Caribbean *listeri*, *multicostata* is white inside and grows much larger. Furthermore, similar sized *listeri* are in general more inflated.

All other IND *Antigona* are not close to *somwangi*, less lamellate or even predominantly radially sculptured:

- Venus puerpera Linnaeus 1771: According to Dodge (1952) Reeve (1863 fig. 10) represents this species. Such rounded brownish forms are mainly known from the Philippines to Australia. However, from New Caledonia, very heavy tumid, strongly inflated forms are known which fit Linnaeus' OD even better. Such forms are most remote from the *Antigona* type species and were consequently selected by Jukes-Browne to represent *Periglypta*.

Antigona puerpera is a widely distributed species. It ranges from the Red Sea (Soma Bay, Egypt, rarely), through Australia to Japan and displays a high variability in color and shapes. Specimens are usually ovate-elongate in form, typically quite solid. The sculpture is almost cancellate, the pallial sinus comparatively round and short. Typical is the rusty outside and the purplish inside, and a strong curbed hinge. However, specimens inside yellowish or even all white occur (e.g. Lamprell & Whitehead, 1992 sp. 457; Spry, 1964 sp. 154 as *clathrata*; Jarrett, 2000 fig. 643).

- Venus magnifica Hanley 1845 from the Philippines is rounder, strongly inflated, more solid and heavier than *puerpera*. The sculpture is cancellate, the lamellae low and the radial ribs strong. The pallial sinus is short and rounded. This is a characteristic species, stronger cancellate, much larger and purplish-brown colored. Although it quite commonly occurs in the Philippines, it is rarely illustrated. The best figures are still Reeve (1863 fig. 17) and Sowerby (1853 sp. 2 fig. 5) (corrected by Sowerby II, 1854 as first named by Hanley).The maximum size known is 124 mm. Color, form and sculpture are quite stable and no intermediaries to *puerpera* were ever met in the maybe 100 specimens seen. This huge and heavy *Antigona* appears confined to Philippine waters.

- Venus resticulata Sowerby II, 1853. The BMNH-type is illustrated in Fischer-Piette (1975 pl. 3 fig. 29 and pl. 4 fig. 30-33), see also Lamprell & Whitehead (1992 fig. 460). This uncommon species is easily differentiated by its almost rounded form. It has a predominantly commarginal sculpture, but rather ridged then lamellate. The ridges are more numerous than in *somwangi*. The pallial sinus is broader and less elongate. Externally and internally *resticulata* is whitish, outside sprinkled brownish in juveniles. No intermediaries were seen, which could link this species to *puerpera*, as proposed by Fischer-Piette (1975). However, he also synonymized *chemnitzii*, *magnifica*, *clathrata* and *crispata* with *puerpera*, an opinion, not shared by modern authors. *Antigona resticulata* is mainly known from tropical NW.-NE. Australia.

- Venus corbis Lamarck, 1818 is an impressive, huge, but little known species. The lacking lamellae, the strong, regular radial sculpture and the quadrangular form, with a red-orange hinge distinguish this species at once from *A. somwangi*. This uncommon species has been precisely characterized by Lamarck, 1818, but is often misunderstood as *reticulata*. Fisher-Piette & Vukadinovic (1977) considered the synonymous Chinese *compressa* as valid "… nous l'aurions placée juste après *reticulata*", whereas *V. corbis* was confused with *reticulata* by Fischer-Piette two years earlier. The holotype MHNG 1084/74 has been studied. Without doubt this is the same as *Venus monilifera* Sowerby II, 1853 sp. 11 fig. 19 (Philippines, Mindoro) as stated by Lamprell & Whitehead (1992 sp. 461) or Higo et al. (1999). Identical is also the "endemic" *Periglypta compressa* Zhuang, 1964 p. 105, pl. 7 fig. 4-5 from China, Hainan, Hsinying (also: Zhongyan, 2004 pl. 167 fig. D). Though uncommon, *corbis* is widely distributed from Mozambique, Nacala Bay (coll. auth.) to Australia, and the Philippines to Okinawa.

- Venus reticulata Linnaeus 1758. Reeve (1863 fig. 34) has been accepted to represent this species by Dodge (1952), see also Lamprell & Whitehead (1992 fig. 459), Abbott & Dance (1986 p. 353). *Reticulata* is usually a comparatively small *Antigona* with a strong, rough cancellate sculpture, a more tumid shape, and a comparatively short round pallial sinus which distinguishes it immediately. Characteristic is a weak marginal dentition, almost invisible in some specimens. This induced Linnaeus to his, at first astonishing, "margine integro". Most authors followed Linnaeus and considered the red orange hinge as characteristic for this species. However, *reticulata* specimens often occur with all white hinges (e.g. Steyn & Lussi, 1998 fig. 991 as *Periglypta* sp.; Spry, 1964 sp. 155 as *P.* (*Tigammona*) *chemnitzii*). Occasionally, the hinge or the inside is purplish (e.g. Oliver, 1995 fig. 1189 as *P. puerpera*; Okutani, 2000 pl. 499 fig. 4). Apart from *V. puerpera*, *V. reticulata* is the most common, most variable and widest distributed *Antigona*. It occurs from the Red Sea, S. Natal to Hawaii. *P. edmondsoni* Dall, Bartsch & Rehder, 1938 is too close for separation as well recognized by Kay (1979).

- Venus clathrata Deshayes, 1853. The type is illustrated in Higo et al. (2001 B1129, = BMNH 1981259/2), also Fischer-Piette (1975 pl. 3 fig. 25-28). Deshayes name is twice preoccupied by Röding, 1798, which is a Caribbean *Chione* and by Dujardin, 1837, a fossil (SHE). Thus, ***Antigona albocancellata*** nom. nov. *Venus clathrata* Deshayes, 1853 non Röding, 1798 nec Dujardin, 1837 is here proposed.

Deshayes gave no type locality, neither did Reeve (1863). Specimens close to the type species are found in the Philippines, e.g. Bohol, Cebu and in NE. Australia (Lamprell & Whitehead, 1992 sp. 458). Here, Philippines, Bohol is clarified as **type locality**. *A. albocancellata* is a well known, rather common, ovate, huge species, reaching 118 mm (Phil). The pallial sinus is broad, extending about one third of shell length, and rounded. *Albocancellata* has the name giving strong cancellate sculpture, often with 3 weak brownish radial streaks and usually brownish on the posterior part, the base color is white. It is distributed from Indonesia, Australia to the Philippines.

- Venus sowerbyi Deshayes, 1853 originally described from the Philippines has been an enigma ever since and was rarely mentioned. However, it fits "*clathrata"* of Chinese and Japanese authors (e.g. Taki, 1951 pl. 36 fig. 4, Ryukyu; Kira, 1972 pl. 57 fig. 14; Zhongyan, 2004 pl. 168 fig. B, China). Two syntypes are present BMNH 1991050 and 1962182. The former is the one illustrated by Reeve (1863 sp. 24). *A. sowerbyi* is a rather tumid, inflated whitish shell, usually with 4 radial brown rays and typically a brown lunule. The surface is comparatively rough, irregularly ridged; the inside is yellowish white in fresh specimens. Specimens are known from NE Borneo, Philippines, China, Hainan and Okinawa, Naha. Kira recorded it also from central Honshu. However, none was collected there, and in all other Japanese books consulted it is not illustrated. Thus, a presence in mainland Japan needs confirmation. The largest specimens are found end of range in Okinawa (TAK0). The differences to *albocancellata* are well visible in juveniles from the Philippines, where both species occur. Whereas juvenile *sowerbyi* are rather inflated and irregular densely ridged, juvenile *albocancellata* are flatter and more regular, less densely ridged. Adult *sowerbyi* are heavier and more solid. Both species attain more than 100 mm, but *albocancellata* is not known northeast of the Philippines.

- Venus lacerata Hanley 1845 is not well understood. Hanley, 1845 described his species as close to *puerpera*, but less inflated, much rounder than *listeri* and with commarginal lamellae, external white with rusty brown lines. He referenced his description to Index Test. Sup. T. 16 fig. 23, which shows indeed this rounded species. The size of his specimen from Maluku was height and length 63.5 mm, but Hanley's type is lost. Whereas Sowerby II, 1853 illustrated a distinct species, Reeve (1863 sp. 18) is a rounded species, slightly larger, but well fitting Hanley's OD and figure. This specimen is available, BMNH 196246 (= 1962046). It is here selected as **neotype** to stabilize *lacerata*. *A. lacerata* is also illustrated in Zhuang (1964 pl. 5 fig. 1) and in Zhongyan (2004 pl. 167 C), both from China. Zhuang gave as distribution South China Sea-Maluku. As described by Hanley, it is most similar to *puerpera*. However, full adults reach 100 mm (Phil, Sulu See) and grow larger than *puerpera*. They are less heavy and less inflated; the pallial sinus is broad, rounded, and slightly deeper than in *puerpera*. As stated by Hanley, the fringed, crowded lamellae forming a raised reticulation are indeed found in most specimens anteriorly, whereas the typical posterior rusty color of *puerpera* is lacking. *A. lacerata* is known from the Maldives, Andaman Sea, W. Thailand, SChi, E. Thailand, N. Borneo, Philippines, Vietnam (coll. auth.) and, finally, Hainan (ZHO, ZHU64), but neither from Japan nor from Australia. Hanley's original locality is possible, Reeve's Philippines, Cebu is verified. The depicted specimen, which closely resembles the neotype, was dived off N. Borneo in 15 m. Furthermore, Reeve, 1863 sp. 74 described ***Venus aegrota*** from Singapore, round, whitish, and 60 mm. The syntypes are present BMNH 1991052/1-2. Both are understood as medium sized *A. lacerata*. Thus, Reeve's *V. aegrota* is here synonymized. Born's *Venus reticulata* non Linnaeus (NHMW 3010) is also this species.

- Venus crispata Deshayes, 1853 is another poorly understood species. It was first mentioned in the Catalogus (1853) and was later described in PZSL, published 1854. Deshayes' reference was erroneously to Sowerby II (1853 fig. 7). Whereas fig. 7 is true *listeri* and does not fit Deshayes' OD, fig. 9 *listeri* var. does. Two specimens are available in BMNH. The larger of these two, No 1981256/1 is here selected **lectotype**. It is the one illustrated by Reeve (1863 sp. 31). The paralectotype BMNH 1981257 is quite similar, both presumably from the same unknown locality. *Antigona crispata* is a comparatively small, ovate species, exceptionally up to 80 mm (Red Sea). Deshayes gave no type locality, neither did Reeve. Specimens closest to the lectotype are known form the Andaman Sea, W. Thailand, Phuket which is here designated as **type locality**. Apart from the identical surface color, they also show the flesh colored hue, well visible internally in both BMNH-specimens. At the type locality the depicted specimen has been personally snorkeled, 6 m, coral reef area, on sand, 1/06, 73 mm. *A. crispata* is an Indian Ocean species, well known under various names: From the Red Sea (Oliver, 1992 pl. 38 fig. 3a-b as *P. reticulata*, corrected to *P. crispata* by Dekker & Orlin, 2000), Djibouti (Coloumbel, 1994 as *P. reticulata*), Gulf of Oman (Oliver, 1995 sp. 1190 as *P. reticulata*), Mascarenes (Drivas & Jay, 1988, pl. 58 fig. 1 as *P. crispata*). It is known from the Red Sea, Eilat, Hurgada, EAfr, Kenya, S. Mombasa, Andaman Sea, Similan Isl. and Phuket. *Crispata* does not occur in Australia, in the Philippines or in Japan. It is also not Abbott and Dance (1986 pl. 353 sp. 10 "*crispata*") which is instead *lacerata*. It is similar to *sowerbyi*, but less tumid and more ovate, vividly brownish colored on a cream background, the lunule brown. Inside it may be flesh-orange or yellowish. The pallial sinus is broad and rounded, but somewhat less deep than in *sowerbyi*.

Turton, 1932 described 3 ***Antigona*** species from Port Alfred, all less than 1.7 mm. Neither *A. kowiensis*, nor *dubia*, or *assimilians* with smooth surfaces, edentate are *Antigona* and probably not even venerids. The true identity of these minute species is, as far as is known unresolved.

SF8: ***Circomphalus***: *V. foliaceolamellosa* "Chemnitz" Schröter, 1788 was proposed in an invalid publication. Instead, *Venus pacifica* Röding, 1798 was validly proposed (SHE), based on Chemnitz 6 28 295-7. The same reference has been used for *Venus plicata* Gmelin, 1791 and *Venus* *foliaceolamellosa* “Chemnitz” Dillwyn, 1817. As *Venus plicata* Gmelin 1791 is preoccupied by Barbut 1788 (SHE), *Venus pacifica* Röding, 1798 is the oldest available name.

However, *V. pacifica* has never been used for this species, whereas *V. foliaceolamellosa* has consistently been applied for more than 150 years (Römer, 1865 and more than 15 references; Nicklès, 1950/1955; Marche-Marchad, 1958; Fischer-Piette, 1975 and more than 15 references; Ardovini & Cossignani, 2004). Based on ICZN Art. 23.9.2. ***Venus foliaceolamellosa*** “Chemnitz” Dillwyn, 1817 is here declared valid and as **nomen protectum** and the older *Venus pacifica* Röding, 1798 is declared as nomen oblitum.

Beu (2004) synonymized some Australian and NZ genera with the exclusively WAF *Circomphalus*. Juveniles are morphologically similar, adults much less. This action should be supported by strong phylogenetic data. Without this, his views are not shared.

SF9: Although ***Clausinella*** and ***Placamen*** are morphologically very close (and even synonymized by Fischer-Piette et al., 1977) Kappner & Bieler (2006)’s molecular data place them (i.e. *punctigera* vs. *berrii*, *flindersi*) apart. This course is adopted.

Based on morphology and biogeography ***Anaitis punctigera*** is placed in *Clausinella*. The European type species ***C. fasciata*** is exceedingly variable as the many synonyms witness. A well known form ***brongniartii*** is illustrated.

Venus decipiens Hanley, 1845 was doubtfully described from Australia and later considered by Hanley himself as possible juvenile of *fasciata*. The BMNH-holotype labelled ?Australia proved to represent the European *fasciata* as earlier concluded by Fischer-Piette and Vukadinovic (1977).

SF10: ***Placamen***: This is a difficult genus and the names in modern literature are often misleading. *Tiara* has been used by authors for three distinct species, but it is a junior synonym. Römer (1865 *Anaitis*) gave a good overview.

Chemnitz is indispensable for *Placamen*. As stated by Mörch (1853) on Chemnitz’ famous *orientalis* 6 27 279-81 are based: ***Venus tiara*** Dillwyn, 1817 (279-81) and ***Venus lamellata*** Röding, 1798 (280). By most authors these were synonymized with *Venus foliacea* Philippi, 1846 (e.g. Fischer-Piette & Vukadinovic, 1977; recently also Higo et al., 1999). However, as concluded by Römer (1865), this does not match. Chemnitz description is precise and excludes *foliacea*. Instead, Chemnitz’s characteristics as shape, large size, color, fine lamellate ribs are found in Philippi’s ***calophyllum***. Specimens precisely fitting Chemnitz’ figures are known from the Andaman Sea; these show the same rose coloring outside as Chemnitz’ specimens, which misled most authors. Specimens from the Philippines or China are typically all white, sometimes chalky; inside white. Furthermore, Chemnitz explicitly considered Born’s *cancellata* non Linnaeus, 1767 the same. This species has been synonymized by Prashad with *calophyllum*. Thus, ***Venus lamellata*** Röding, 1798 is the earliest valid name for this old species, Philippi’s *calophyllum* is the same. *V. tiara* is an obj. junior synonym. Also Kotaka’s *Bassina* (*Callanatis*, sic) *hayasakai* and *javana* are the same, following Higo et al. (1999). The lunule indicates that Kotaka cross mixed *Bassina* and *Placamen*.

This leaves Philippi’s ***foliacea*** described from the Red Sea and Madagascar, 17.5 mm for the much smaller species with stronger lamellae, generally red at the tip of the umbones, and often with 3 rust or red radial color bands. It is widely distributed from the Red Sea (Oliver, 1992 pl. 38 fig. 5 as *Bassina foliacea*) and Natal to Japan (Okutani, 2000 pl. 500 fig. 9 as *Placamen tiara*). The maximum size seen is 23 mm (Philippines), but usually *P. foliaceum* is approximately 15 mm, whereas *P. lamellatum* attains 45 mm. True *foliaceum*, but not *lamellatum* is known from Australia (e.g. WA, Shark Bay; Qld, Keppel Bay).

Contrary to Römer’s opinion, ***Venus alta*** as recognized by Sowerby II, 1853 and by Reeve is a valid species, to date only reliably known from the Philippines. *P. altum* is more triangular, higher than *lamellatum* and generally flatter, with numerous, more solid and with lower ribs. Often it is deep purple stained on the escutcheon; internally, it is posteriorly purplish.

Another valid species is ***Placamen retroversum*** (Deshayes 1853), as recognized by Römer (1865) and Fischer-Piette (1975). It is well illustrated from the original locality by Lamprell & Whitehead (1992 sp. 472 erroneously as “*tiara*”).

Usually, ***Venus roseotincta*** Baird from New Caledonia is synonymized. However, a comparison of the BMNH *retroversum* type series with the holotype of *roseotinctum* did not conform. Ovate shape, strong lamellate sculpture, intense rose red internal color and the larger pallial sinus of *P. roseotinctum* do not match *P. retroversum*. Thus, Baird’s species is recognized as uncommon, valid species, currently known from New Caledonia and Polynesia, Tuamotu (HAT921”*retroversa*”). Compared to the SAU ***flindersi***, *P. retroversum* is a tropical species only. Compared to *foliaceum* the E. Australian *retroversum* grows larger, is more solid and has a characteristic rust red coloring internally, the color at the umbonal tip is white.

P. lamellosum is another characteristic *Placamen*, based on Chemnitz 6 28 293-4, originally from the Indian Ocean. Fischer Piette & Vukadinovic (1977) recognized it, but attributed the first use to Schröter, 1788. However, Schröter’s Namensregister is invalid. The first unambiguous application found is Sowerby I, 1825 p. 16 (Tankerville). *P. lamellosum* is known from Aden (Shopland), Arabia (Oliver, 1995 sp.1191 as *calophylla*) and from the Philippines (Hidalgo, 1904). Compared to *lamellatum*, *lamellosum* is more solid, rounder, more inflated, has more lamellae and is posteriorly strongly sculptured. The color is generally more livid. Chemnitz’ specimen features, in addition to the characteristic dorsal sculpture, also a reddish colored escutcheon, which is sometimes but not always found. Such specimens are also known from tropical Australia (Lamprell & Whitehead, 1992 sp. 473 as “*calophyllum*”). The Australian specimens were originally described as *Venus cumingii* Sowerby II, 1853 from Sydney, Port Jackson. However, I fail to perceive this preoccupied Australian *cumingii* distinct from the Indian Ocean *P. lamellosum*. Scott (1994) localized true *calophyllum* (= *lamellatum*) in Hong Kong, and elaborated the distinctness to *cumingii* (= *lamellosum*).

Both, ***V. chlorotica*** and ***V. isabellina*** are illustrated in Philippi (1849 pl. 10 (as 9). Both have been indicated from China Sea and also occur there. Fischer-Piette (1975) concluded them as conspecific; however, they are perceived as related, but distinct. *Isabellina*, as stated by Philippi has more, erect ribs, the lunule is narrow elongate and not ovate, heart shaped. Zhongyan (2004 pl. 169 fig. A) illustrates *P. isabellina* from Chinese waters. Bernard, Cai & Morton, 1993 reported *multilamellata* from Xisha Isl. in S. China waters. Indeed, Kotaka's *Bassina* (*Callanatis*) *multilamellata* 30.7 mm from Singapore Strait seems to represent *isabellina*. It further appears that Chemnitz 6 28 291-2 illustrated ***P. chloroticum***. Based on these figures 291-2 Menke, 1858 erected ***Venus sidneyensis***. This Australian form is well illustrated in Lamprell & Healy (1998 sp. 761 *sydneyensis*). It is perceived as not discernible from *chloroticum* from Indonesia and China Sea's and the same. As such the larger *P. chloroticum* has a wider distribution and the smaller *P. isabellina* is confined to the South and East China Sea.

Thus, 13 IND *Placamen* are here recognized.

SF11: ***Timoclea***: Considering the variability within the approximately 25 timocleids the existing subgenera do not help much. A comparatively clear subgenus seems *Veremolpa*, but this was synonymized by Keen in Moore (1969). Some species are close to *Parvivenus* Sacco, also synonymized by Keen. For the time being, I follow Fischer-Piette (1975) and Oliver (1995) and synonymize all subgenera. Without doubt, there are various groups in *Timoclea*. To divide properly, more and precisely defined subgenera are necessary and much more work is needed.

On the other hand, ***Chioneryx*** is distinct from *Timoclea* with a very long posterior lateral and a clear escutcheon. *Chioneryx* is generically separated. In addition to the type species from SA, also a few Panamic and Caribbean species are here tentatively included. They all have an elongated shape, an escutcheon and a long posterior lateral. The Panamic ***effeminata*** was not refound since its OD. However, it is that close to the type species *cardioides* that a mislabeling is the most probable assumption.

Fischer-Piette & Vukadinovic (1977) illustrated Smith's original series of ***mindanensis***. Following Japanese authors, e.g. Koyama et al. (1981) and Higo et al. (1999) *Chione minuta* is synonymized. Habe, 1971 pl. 59 fig. 2 *minuta* does not support separation from *mindanensis*. Furthermore, Turton, 1932 described ***Chione curiosa*** from SAF, Port Alfred. Barnard (1964) synonymized it as juvenile with *arakana*. Fischer-Piette (1977) removed it from this unwarranted synonymy and considered it valid. However, *curiosa* is adult and matches *mindanensis* well. From the SAF material studied some specimens are rose white, some are all white. Some have radials all over (as Smith's *mindanensis*), some have a concentration of radials on the posterior part (as Turton's *curiosa*); but base shape, marginal crenulations and dentition are the same. This gives *mindanensis* a range from SAF to mainland Japan.

As stated by Lynge (1909), Fischer-Piette & Vukadinovic (1977) and well depicted by Swennen et al. (2001 sp. 182), *T.* ***micra*** is perceived as juvenile, stronger sculptured form of ***scabra***. The two types are illustrated in HIG01 B1139 and B1140. The two *micra* figures of Okutani (2000 pl. 500) show this variance in sculpture well.

In ***T. imbricata*** and ***T. cochinensis*** the interpretation of Römer (1867) and Fischer-Piette & Vukadinovic (1977) is followed. This also seems to reflect Sowerby II's intention. These species are not synonymous as proposed by authors. *T. imbricata* is purplish-brown around the umbones with white interstices. It is more solid than *cochinensis* and interior posteriorly finely denticulate, whereas *cochinensis* is more fragile, generally more rounded and usually posteriorly not denticulate. ***T. staadti*** is perceived as *cochinensis* form, denticulate posteriorly. Specimens collected in India show in color, shape and sculpture intergrades between the two extremes illustrated.

T. habei is currently only known from Taiwan, from where originally described. It has a trigonal-elongate, posteriorly strongly rostrate shape and a unique anteriorly ridged sculpture, the reddish escutcheon is striated.

T. siamensis is a much smaller species, somewhat similar to *lionota* and so far only known from E. Thailand and Borneo waters.

T. subnodulosa (type HIG01 B1144) has the same sculptural pattern as Smith's later ***recognita***. Fischer-Piette & Vukadinovic (1977) illustrated both types, and formally synonymized *recognita* with *subnodulosa*. This view was not shared by most subsequent authors. However, having studied many specimens throughout the IND and both BMNH types no reason was found to doubt Fischer-Piette's decision. In juveniles the commarginal sculpture is generally stronger than in adults. During its growth the shape changes and becomes higher, the number of commarginal ribs increases. The color in *subnodulosa* is highly variable, often brownish outside and purplish inside, but also all white, yellowish, reddish forms occur. The species usually illustrated as *subnodulosa* from Australia is instead a distinct *Tawera*.

3 IND species are easily confused: ***T. hypopta*** (Red Sea) with a knobby sculpture only; ***T. costellifera*** (SAF, Arab-JAP), anterior knobby, posterior scaly and ***T. subnodulosa*** (Mozambique-Australia, China) anterior knobby, posterior lamellate, with the strongest commarginal sculpture.

Venus juvenilis Smith, 1895 is preoccupied by Gmelin, 1791, a well known *Dosinia*. As nom. nov. ***Timoclea smithiana*** is herein proposed. The type locality is Investigator Station 162, Bay of Bengal, off Coromandel Coast, in 260-732 m. The holotype is in ZSI M 207/1 (RAMA). The new name honours an outstanding author, who contributed significantly over many years to our knowledge of bivalves. The species is well depicted in Smith (1895), also ANA09 pl. 4 fig. 4, and in Knudsen (1967 p. 289). Knudsen added anatomical details. Winckworth (1940) and later Fischer-Piette & Vukadinovic (1977) recognized it as *Timoclea*. *T. smithiana* is a small, whitish, deep water species, usually less than 12.3 mm and living bathyal from 200 to at least 400 m. The distribution has been from Gulf of Aden to Bali. However, a specimen trawled at about 200 m, 1/05 from the East China Sea extends the range further east. *T. smithiana* has a special shape, is almost as high as long with prominent, incurved umbones. Though not well visible, as also stated by Knudsen (1967), the pallial sinus is broad and shallow. The surface sculpture is similar to *T. ovata*.

Timoclea infans was synonymized by Fischer-Piette & Vukadinovic (1977) with *lionota*, but this action was not followed by subsequent authors (e.g. LYN09, ROBBA). Lamprell & Healy (1998 sp. 762 and 763) illustrated both species form Australia. It appears that except the *infans* syntypes, all specimens illustrated by Fischer-Piette & Vukadinovic are *lionota*. *T. infans* is smaller, more tumid with less ribs.

Oliver (1995) illustrated ***T. arakana*** from Arabia and considered the two minute, 6 mm ***T. macfadyeni*** and ***T. farsiana*** as probable synonyms. After comparison of the two BMNH type series and from material at hand, Oliver's *farsiana* synonymy is shared. *T. macfadyeni* Dance & Eames, 1966 is instead perceived as valid species, narrower, higher, stronger commarginally ridged and anteriorly and posteriorly strongly radially incised. It was described as S. Iraq fossil. Currently, no identical extant material is known. Closest is Lynge's *siamensis*.

SF12: ***Tawera***: Beu (2004) synonymized *Tawera* and *Plurigens* with the Mediterranean *Chamelea*. These genera share some morphological traits, but are definitely not the same. Fortunately in 2006, Beu dissolved and accepted *Tawera*. Against Powell's arguments Beu's *Plurigens* synonymy with *Tawera* is for the time being followed. However, a genetic analysis could add more weight.

T. sphaericula (Deshayes 1853) has been well depicted by Fischer-Piette & Vukadinovic (1977 p. 44, pl. 3 figs. 31-35). ***Tawera bollonsi*** has been well depicted and precisely described by Powell, 1932. Deshayes' 33.5 mm BMNH holotype from unknown locality has been compared. No differences were found in size, in subcircular, inflated shape, in small trigonal pallial sinus, in dentition, or in the characteristic sculpture of broad, low, somewhat anastomosing ribs. Without doubt *Dione sphaericula* Deshayes, 1853 is a valid name and has been recently used. Here, *Tawera bollonsi* Powell, 1932 is synonymized. The **type locality** of *T. sphaericula* is clarified as Antipodes, Auckland Isl.

A solid, inflated *Tawera* has been dredged off NZ, Otago Heads 120-140 m. Although found near the type locality of ***T. marionae***, it fits in massive hinge and internally purplish stained ***T. rosa*** better, where it is tentatively placed. On the other hand, *T. rosa* was as far as is known only reported from valves from the Antipodes Isl.

T. lagopus and ***gallinula*** are close; Römer (1867) even synonymized *lagopus* with *gallinula*. However, most authors divide, a course here followed. Lamarck's types and hinges are illustrated in Fischer-Piette & Vukadinovic (1977). *T. lagopus* has a stronger, shorter anterior cardinal in the right valve, appears slightly less high, and slightly more rostrate, the pallial sinus is rather horizontal and significantly shorter, less ascending. Strength of radial sculpture and especially internal colors are misleading features.

Timoclea subnodulosa is a widely distributed timocleid described from the Philippines; *T. recognita*, also described from there is a synonym. Both types are illustrated in Fischer-Piette & Vukadinovic (1977 pl. 5). On the other hand, in Australian literature, based on Hedley (1906), consistently a generically distinct tropical Australian *Tawera* is named so. It is well depicted and characterized as *Tawera subnodulosa* Lamprell & Whitehead, 1992 non Hanley, 1844, sp. 485. This Australian species is here renamed as ***Tawera australiana***. Lamprell & Whitehead gave NW, NT and Qld as type locality, of which Central to North Queensland could be verified. Compared to *Timoclea subnodulosa* this tropical Australian species is a true *Tawera* with a predominantly commarginal sculpture. *Tawera australiana* is comparatively small. Lamprell & Whitehead gave 2 0 mm; the largest specimen seen is 19.9 mm (Townsville). *Timoclea subnodulos*a grows more than 23 mm (Shark Bay). The position of the pallial sinus is distinct, whereas it is horizontal (top leg) in *australiana*, in *subnodulosa* it is ascending, well visible also in the above mentioned type figure of *recognita*. Furthermore, *T. australiana* is coarser ribbed with less and stronger ribs. Both species occur in tropical Australian waters; but *subnodulosa* is much wider distributed (Mozambique to Hainan), whereas *australiana* is currently only known from Australia.

Tawera gayi is a well known Magellanic species. It is highly variable in shape, inflation, color and strength of ribbing. Specimens from the Golfo San Jose on the Atlantic side are very close to specimens from Golfo de Ancud on the Pacific side and as many authors before (e.g. SOO59; DELL64; Forcelli, 2000) I fail to differentiate morphologically more than one species. However, earlier than Hupé in Gay, 1854, Deshayes, 1853 described a species in his British Museum Catalogus as ***Chione obovalis*** from unknown locality. The holotype is present in the BMNH type collection. This is a typical elliptical *Tawera*, with a small pallial sinus and a finely crenulate margin. The colors in *obovalis* have now faded, but on the sides traces of the typical strong purplish-brown internal colors are still visible. Even earlier, Lamarck, 1818 described *elliptica* also from unknown locality. ***Venus elliptica*** Lamarck, 1818 is well depicted by Chenu pl. 8 sp. 4. Dall (1909) reported it as valid *Chione* from Chile, Talcahuano to Chiloé. Fischer-Piette & Vukadinovic (1977) placed it in *Tawera* and recognized it as valid species, but without further comment. In modern regional literature *elliptica* is not found. Lamarck's type, ink marked 20 is present, MHNG 1084/88. It is large, 30.6 mm, with a quite regular elliptical shape, strongly commarginally ridged, with more than 35 ribs, slightly anastomosing anteriorly and posteriorly. As typical for *Tawera*, the pallial sinus is very small, the top leg horizontal, the margin finely crenulate and the narrow lunule incised. There is no doubt that *V. elliptica* is conspecific with *obovalis* and with *gayi*. Unless more than one MAG species can be genetically separated, ***Tawera elliptica*** (Lamarck, 1818) is the earliest name for this well known, rather common species.

Chione (***Nioche***) ***keenae*** from Corcovado appears as worn, juvenile *elliptica*. However, a beached growth series should be compared for confirmation.

The true identity of Viader's ***similicentrifuga*** is currently unknown.

Furthermore, 2 rather fragile specimens from Japan, Honshu, dredged from 80 m could as yet not be allocated and may represent an **undescribed** species.

SF13: ***Eurhomalea*** has been placed in TAPETINAE (Keen in Moore, 1969; Del Rio, 1997) or in CHIONINAE (Fischer-Piette & Vukadinovic, 1977; Beesley et al., 1998; Mikkelsen et al., 2006). New molecular data demonstrate a close relation between *Eurhomalea lenticularis* and *Tawera spissa* (Kappner & Bieler, 2006) supporting the latter opinion. Biogeography and general morphology do not oppose to place the temperate *Eurhomalea* close to *Tawera* and remote form *Tapes*.

Whereas Ramorino, 1968 considered his new ***E. salinensis*** closely related to *lenticularis*, but quite distinct from *rufa*, Del Rio, 1997 created a new genus ***Retrotapes*** and considered *salinensis* as closely resembling *rufa* and generically distinct from *lenticularis*. However, it is not accurate that *Eurhomalea* (e.g. *rufa* and *salinensis*) are lacking a lunule as stated by Del Rio. Whereas in *rufa* the lunule is weak, but extant, Ramorino explicitly noted also for *salinensis* a clear lunule "la lúnula en ambos casos [e.g. *salinensis* and *lenticularis*] está marcadamente limitada …". In addition, both "genera" e.g. *Eurhomalea* and *"Retrotapes"* have a smooth inner margin, a structurally identical hinge with 3 cardinals, of which at least the middle bifid. The differences among the 4 extant *Eurhomalea* are rather found in shape and surface sculpture.

As most distinct appears the biogeographically separated *E. exalbida*. However, the findings of Gallardo et al. (2003) do not support a division.

Following Jukes-Browne (1909), Ramorino (1968), Fischer-Piette & Vukadinovic (1977), Forcelli (2000), and Gallardo et al. (2003) *Eurhomalea* is perceived as group. *Retrotapes* is unclear defined and is perceived as unnecessary, at least so for extant species. It is here synonymized.

SF14: ***Mercenaria***: *Mercenaria* ***campechiensis texana*** was originally described as *campechiensis* var. and was also understood so by many authors, e.g. Andrews (1977). Many other American authors, e.g. Abbott (1974) considered it as *mercenaria*. Obviously, *texana* is recognizable. All specimens studied are in sculpture, inflation, lunule and pallial sinus precisely in between *campechiensis* and *mercenaria*; a synonymization with either species is not warranted. Obviously, hybridization is not excluded. For the time being *texana* is treated distinct from *campechiensis* and from *mercenaria*, awaiting further results.

Thus, 4 *Mercenaria* are here recognized.

SF15: ***Chione***: Linnaeus' Uppsala lot 1315 and Linnaeus' London lot 99 are both labelled *Venus cancellata*; but they contain two distinct species from two distinct biogeographic provinces. The Uppsala lot 1315 refers to lot 1351 which is *Protapes ziczac* (Linnaeus 1758) from the Indian Ocean (see below). The London lot contains one complete specimen and four only partly conspecific single valves, which were isolated by Hanley (1855). The inside of the complete London specimen is marked "[*Ven*] *us cancellata*" but not, fide Hanley, in the handwriting of Linnaeus. None of the London valves bears any number and a later introduction can therefore not at all be excluded. The London lot contains Western Atlantic *Chione* specimens. Roopnarine & Vermeij (2000) separated the Northern ***Chione elevata*** (Florida, Cuba and Belize northwards) from the Southern ***Chione cancellata*** (Cuba and Panama southwards); a view shared by subsequent authors. They analyzed this London lot and stated on p. 523 "*Venus cancellata* Linnaeus, 1767 **Holotype**: In the Linnean collection, Burlington House, London". It is understood that Roopnarine & Vermeij's *holotype* selection can only refer to the complete specimen present at London, marked *cancellata*. Their selection is followed to stabilize the type species of *Chione*. Understood as such *Chione cancellata* (Linnaeus 1767) is a common species, widely distributed from Cuba, throughout the West Indies to Brazil. Specimens studied from Brazil, ES are conspecific.

Chione cancellata and ***Chione elevata*** are very close and both are usually found less than 30 mm, exceptionally up to 35 mm. Both are common in their areas. In *cancellata* the radial ribs are usually denser and the commarginal ribs more numerous, whereas in *elevata* the radials are further apart and the commarginal ribs wider spaced. Internally *elevata* is usually brightly colored, but often whitish outside, whereas *cancellata* is usually whitish inside. The whitish or whitish brown sprinkled lunules are more difficult, they may be identical (e.g. *elevata* from Cancun and *cancellata* from Martinique), whereas in Floridan *elevata* the commarginal ridges are often stronger marked. Redfern (2001 fig. 962 *elevata* 29 mm) is perceived as typical specimen. On the other hand, his recorded size of 55 mm could not be confirmed for any *elevata*, but may refer to the following species.

In addition, a 3rd larger species is present in the Western Atlantic, which may reach Redfern's size. Chemnitz 6 28 290 illustrated a large *Chione* from Spengler's collection from the West Indies. Röding, 1798 named it ***Venus clathrata***. Specimens found at Puerto Rico and Martinique fit well. These uncommon large, rostrate, white-brown forms are not subsumable under the much smaller ***cancellata***, where most authors, also Dodge (1952), placed it. Such specimens are much heavier and more solid. Also the ribbing is distinct, the radial sculpture weaker, vanishing ventrally. The escutcheon and lunule are typically deep chocolate brown; inside, posteriorly brownish-purple marks are present. The pallial sinus is very small and trigonal. The surface has a somewhat glossy sheen. This large species is also well depicted in Chenu, pl. 7 sp. 5 (*Venus cancellata* L.), whereas true *cancellata* is sp. 6 (*cancellata* var.). There is little doubt, that Macsotay, 1968's large ***Chione pailasana constricta*** from Venezuela represents this species. However, earlier than Chemnitz and Röding, Linnaeus, 1758 No. 93 described his ***Venus dysera*** from the Western Atlantic. In the Linnean Society, London where Linnaeus' former personal collection is housed, no specimen was isolated (DANC67). However, in the supplementary material of the Linnean collection there is one specimen referable, which has been analyzed by Roopnarine and has been considered distinct by him from *cancellata*. An unambiguous *dysera* is present in the Queen Ulrike-collection "M L U", now in the Museum of Evolution, No 419. Linnaeus, 1767 indicated its presence in "M L U". This large, 42 mm specimen conforms precisely to Linnaeus, OD and to his type locality and is here selected **lectotype**. This specimen matches Röding's *clathrata*. It is cream with irregular brown marks, a deep brown lunule, internally white and posteriorly with brown marks, with a small trigonal pallial sinus and a crenulate margin. It is herein restored as valid Caribbean species. Linnaeus' type locality "O. Americanae" is correct. The known range is from Puerto Rico to Venezuela. Chemnitz' perception has been largely correct, his 290 is in shape, and his 287-8 in color virtually identical to Linnaeus' type. However, fig. 289 is distinct and represents a typical *cancellata*. The presence of a lectotype in Museum Ulricae not visited by Hanley (1855) or Jukes-Browne (1914), as well as the conclusion of Dodge (1952 p. 91) supersede the unwarranted nom. obl. notion of Beu (2004 p. 172). *Chione dysera* (Linnaeus, 1758) is currently reliably known from the Caribbean Sea, living subtidally 2-8 m on sandy bottoms. Sizes larger than 40 mm are common and the largest seen so far is 46 mm.

Chione mazyckii is more quadrate than *clathrata*, stronger lamellate, internally rose, with a narrower lunule. The largest specimens appear to occur in Roatan (27.6 mm) and in Venezuela (18 mm). Macsotay & Campos (2001) illustrated even a 28 mm specimen which might concur.

Chione undatella (Sowerby I 1835) is a well known E. Pacific species. ***Venus perdix*** Valenciennes, 1846 was considered synonymous (e.g. Fischer-Piette & Vukadinovic, 1977; Coan et al., 2000). However, Bory de Saint-Vincent, 1827 (Encyclopédie méthodique. p. 152, pl. 268 fig. 4) named *Venus perdix* Val. earlier. On the other hand, not even Sherborn mentioned Bory's validly proposed name. Fischer-Piette & Vukadinovic (1977) also considered Valenciennes, 1846 as first usage. Thus, Bory's *perdix* may qualify as nom. obl., and an action by American authors is indicated to protect *undatella*.

Other than stated by Tomlin & Winckworth (1936), ***Venus plicataria*** Link, 1807, from its reference, does not match the Med *Clausinella fasciata*, but seems Caribbean and may belong to *Chione*. The name is not preoccupied and has been validly proposed (SHE). The type at Rostock should be restudied.

The true identity of Say's ***Venus inequalis*** from E. US waters is also unknown. Fischer-Piette and Vukadinovic (1977) could not resolve it. However, the type should be traced by American authors.

SF16: ***Puberella***: According to molecular data (Kappner & Bieler, 2006) ***Puberella intrapurpurea*** is distinct from *Chione*, *Lirophora*, and *Chionista*, as recognized before by Roopnarine (1996). Compared to *Chionopsis* the lunule is not impressed, but rather bulging, the lamellae are lower, more numerous and therefore denser, the radial structure is very narrow and the colors generally more vivid.

Fischer-Piette & Vukadinovic, 1977 designated the Caribbean ***P. pubera*** as type species of *Puberella*. They considered Sowerby's and Reeve's *Venus crenulata* Chemnitz 6 36 385 (= *Venus crenata* Gmelin, 1791) as erroneously located in the West Indies. Earlier, Fischer-Piette (1975) had synonymized Chemnitz' *crenulata* with the Australian *Antigona laqueata*. However, Chemnitz' species is, without any doubt, a true *Puberella* and not an *Antigona*, but with an erroneous original locality. *Puberella* does not occur in the IND, but is in fact confined to American waters. Lamarck's *crenulata* (Chenu, pl. 1 fig. 3, MNHG) is an American *Puberella* as well and also Römer (1871) came to the same conclusion and located it in Brazil and West Indies. The only *Puberella* which fits Chemnitz' description, having this form, the color and the large size is Bory's *pubera*. Thus, ***Venus crenata*** Gmelin, 1791 is removed from the erroneous locality and here reinstated as earliest name for *pubera*. Mörch (1853) added Philippi's *eximia* and Dall (1902) Guppy's *superba* to the synonymy of this old species.

The Panamic cognate is the smaller ***lilacina***.

SF17: ***Lirophora***: Dall described 3 enigmatic "Schott" venerids from "Humboldt Bay, Panama Pacific". *Chione* (*Lirophora*) *obliterata* has been considered by Olsson (1961) and later by Fischer-Piette & Vukadinovic (1977) as misplaced species and as earlier name for the Caribbean *Lirophora clenchi*. The type USNM 11821 has been studied and above conclusion is here confirmed. The **type locality** of ***Lirophora obliterata*** (Dall 1902) is herein corrected to Texas, Port Isabel.

Venus apodema Dall, 1902 has been recognized by most subsequent authors as misplaced Caribbean *Mercenaria*. Indeed, the USNM type represents a beach worn Caribbean *Mercenaria campechiensis* (J. F. Gmelin 1791).

Chione (***Lirophora***) ***schottii*** was synonymized by Fischer-Piette & Vukadinovic (1977) with *Chamelea gallina*. However, as the two other Schott species stem from the W. Atlantic, there was some doubt for an Eastern Atlantic origin of *schottii*, but the USNM-type 6243 proved in all structural elements identical to *gallina* from the Mediterranean and Fischer-Piette & Vukadinovic's conclusion is here confirmed.

SF18: ***Anomalocardia***: Schumacher, 1817 only named *Anomalocardia rugosa* and stated his species identical to ***Venus flexuosa*** of Linnaeus, but distinct from *V. squamosa*; thus, *Anomalocardia rugosa*, type *Anomalocardia* MT (= *V. flexuosa* L.). Linnaeus type is illustrated in Hanley (1855). Linnaeus' and Schumacher's specimens show the same variable Caribbean species. Neither from the Indo-Pacific (as originally stated by Linnaeus in error), nor from W. Africa (as erroneously concluded by Keen in Moore, 1969) is anything similar known. Followed, without any hesitation, is Fischer-Piette & Vukadinovic (1977) who synonymized ***Venus brasiliana*** Gmelin, 1791, *Cytherea macrodon* Lamarck, 1818 and *Cytherea lunularis* Lamarck, 1818 with *A. flexuosa*. The here illustrated beached specimen, closely resembling Linnaeus' type was collected at Guadeloupe. As such it is most likely, that Linnaeus' specimen came originally from the West Indies.

Sowerby II's "*flexuosa"* from China is instead ***Cryptonemella producta*** (Kuroda & Habe 1951).

Venus subrugosa is here included and *Iliochione* is synonymized. The differences to the type species *Anomalocardia* are not perceived to justify separation. Especially northern *subrugosa* are virtually indistinguishable from *flexuosa*, also regarding the fine marginal dentition. In the South they grow much larger, with a somewhat rougher marginal dentition. *A. subrugosa* also shares the same shallow lagoon and muddy bottom habitat with *flexuosa*, which differs significantly from other chionids. Roopnarine (1996) also demonstrated a close relation between *flexuosa* and *subrugosa*.

Venus puella Pfeiffer in Philippi, 1846 predates ***Venus auberiana*** Orbigny in Sagra, which was not published before 1853. Both were described from Cuba. *V. puella* is an elongate, fragile, dull, moderately inflated species, with none or only a very weakly marked lunule. It is not known larger than 20 mm. It is variable in number of commarginal ribs: ranging in specimens from the same population from about 15 to 25. It is also variable in color: whitish, yellowish, brownish. It appears that *A. membranula* falls into its variability. ***A. leptalea*** was described as fragile, compressed species from the Bahamas. Typically, the commarginal ribs are fewer and sharper and the texture is even thinner than in *puella*. Such forms are also known from the Floridan everglades. However, many intermediaries to *puella* exist. Redfern (2001) obviously recognized only one highly variable species from the Bahamas. His figs. 964 C-D are perceived as typical *leptalea*, whereas fig. B is closer to typical *puella*. Originally, Dall only compared *leptalea* with the larger and more solid *cuneimeris*, but not with *auberiana* (= *puella*). As in some specimens also the pallial sinus is quite weak, there remains little doubt that *leptalea* is a further synonym of *puella*, typically found in lagoon habitats.

A. nesiotica has been described from Bahamas, Andros Isl., Lake Forsyth. The type series (ANSP 152251) has been studied. This is a minute elongate, ochraceous-tawny colored, somewhat glossy form only about 7 mm in length. As stated by Pilsbry, 1930 *nesiotica* indeed surpasses even the high variability of *puella*. In shape and sculpture it is closest to *flexuosa*. It may be a brackish northern dwarf form of *flexuosa* or then a valid species. Modern methods could easily solve the riddle of its affinities.

A. cuneimeris is more robust, glossy, stronger inflated and has a well demarked lunule. Generally it has a posterior indention, well visible in Sowerby II's *rostrata*. Compared to *flexuosa* the ribs are equally covering the whole surface. *A. cuneimeris* is also known from E. Panama. *A. paziana* (type in Fischer-Piette et al., 1977 figs. 41-45) described from there is considered conspecific.

As such 4, or with *nesiotica*, 5 American *Anomalocardia* are recognized. The IND species belong to ***Anomalodiscus*** or to ***Cryptonemella***.

SF19: ***Leukoma*** antedates ***Protothaca*** by almost 50 years. Römer, 1867 included today's Panamic/Caribbean "*Protothaca*" in his *Leukoma*. His first mentioned species, *granulata*, was selected by Kobelt, 1881 as type species. On the other hand, Dall (1902) included many of Römer's *Leukoma* in his *Protothaca* and some in the unrelated IND *Timoclea*.

For the fewer than 20 *Leukoma* species almost 10 genera/subgenera are available. However, the differences are weak, and most are intergrading. *Tropithaca*, *Granithaca*, and *Nioche* have been synoymized by many authors. Beu (2006) synonymized also *Tuangia* and the Japanese species (e.g. *Novathaca*, *Notochione*) with *Protothaca*. On the other hand, ***Antinioche*** is an untypical *Leukoma* with ***beili*** quite close to *Periglypta*, especially to *P. laqueata* and *chemnitzii*. The anterior thickening could even be interpreted as rudimentary tooth. ***Antinioche*** is here kept generically distinct, awaiting further genetic results.

Specimens identical to ***zorritensis*** are known from Panama, where according to Keen, ***methodon*** should occur. Both have a very similar form and sculpture and appear conspecific. In these specimens the anterior lateral is usually extended, making *T. subaequilateralis*, which also closely resembles in from and sculpture, a shaky species. *L. methodon* is a comparatively small, rather rounded and inflated species with a predominant commarginal sculpture and internally often purplish anteriorly; the lunule is usually brownish. It is likely that ***L. mcgintyi*** is only another form of *methodon*. Also the species illustrated as *mcgintyi* by Fischer-Piette & Vukadinovic (1977 pl. 16 figs. 150-154) fits well. Surprisingly an enigmatic species ***Venus*** (***Chione***) ***keppeliana*** described by Sowerby III, 1905 from WAF, Sierra Leone proved instead to represent a large *Leukoma* very close to *methodon* and most likely the earliest name for this Panamic species. However, here a second opinion should confirm this unexpected locality and affinity. The unique holotype is present in BMNH 1905.10.23.32. Definitely, nothing close is known from W. Africa and Fischer-Piette & Vukadinovic's associations (1977, p. 134) do not match.

Reeve (1863) synonymized *L. cardioides* with *L. pectorina* and Römer (1867) synonymized *cardilla* with *cardioides*. Fischer-Piette & Vukadinovic (1977) confirmed all three the same and illustrated the types of *cardioides* and *cardilla*. ***Pectorina*** itself is illustrated in Chenu pl. 8 sp. 1.

Both types, ***V. subrostrata*** Lamarck, 1818 and *V. beauii* Récluz, 1852 are illustrated in Fischer-Piette & Vukadinovic (1977). Their stated synonymy is shared.

Deshayes, 1853 described ***Saxidomus decussatus*** from Peru. Fischer-Piette & Vukadinovic (1971 p. 136) considered it close to *Irus ellipticus*. Skoglund (2000) listed it as valid Panamic *Eurhomalea* from Peru. The holotype is present in the BMNH type collection, inside numbered 42.5.10.1584. This is a small, thin, rather fragile, inflated, whitish species with a medium sized, rounded-pointed, horizontal pallial sinus and a bifid medium cardinal in the right valve and a very weakly defined lunule. It closely resembles *Leukoma*, but has virtually smooth margins. From Peru nothing close is known, but from Japan. Comparing *schenki* specimens collected in Honshu, Chiba Pref., no marked differences were found. All evidence points that *decussata* is a misplaced ***Protothaca schencki*** Nomura, 1937 and the valid earlier name. The erroneous type locality is herein corrected to Honshu, Fukushima.

Tapes lima was described by Sowerby II, 1852 from New Zealand, but not supported to occur there (i.e. POW, Otago; BEU06). It is validly proposed and is not preoccupied. The beautiful syntypic lot is present in the BMNH type collection. It consists of 3 ovate specimens, up to 30.1 mm, with a strongly cancellate sculpture and finely crenulate margins, and a comparatively small pallial sinus. The color is white with weak brownish wavy lines and blotches; the comparatively broad, well marked, heart shaped lunule is whitish-with some yellowish-brown streaks. The escutcheon is brownish striate. Fischer-Piette & Vukadinovic (1977) considered it a valid *Protothaca*, as also in the case of Dall's *pertincta*. However, they did not possess either of these. Closest of all *Leukoma* globally studied are 2 smaller *pertincta* specimens from Isla Isabela, Galapagos. *Lima* also matches Dall's *pertincta* OD quite well. *Leukoma lima* is tentatively placed as earlier name for this uncommon Panamic species. This conclusion, however, needs confirmation with further and larger material.

SF20: ***Gouldia***: The four species accepted by most workers as true *Gouldia* differ remarkably from each other in surface sculpture and marginal dentition.

The type species ***cerina*** has radials only on both sides. The two cognate ***californica*** and ***insularis*** have radials all over giving a cancellate appearance. ***G. minima*** has no radials. Large *cerina*, *insularis* and *minima* often have a weak marginal dentition, whereas juveniles and even large *californica* have smooth margins. Thus, in addition to the extent of radial sculpture, especially also the marginal dentition is variable.

Assuming that all 4 species are related and correctly placed, this then indicates an unexpected high variability in the important type genus of GOULDIINAE (syn. CIRCINAE and GAFRARIINAE).

SF21: ***Dorisca***: As stated by Oliver & Zuschin (2000) *Dorisca* are similar to *Gouldia*. However, their divergent sculpture is unique and not found in *Gouldia*. Generally *Dorisca* are also smaller and more compressed. Compared to *Circe*, they stay smaller and live deeper. Biogeographically, *Dorisca* are only found in the Indo-Pacific and adjacent areas (JAP, HAW).

C. jucunda has been described from Australia and Hawaii, and reported from S. Africa (BA64). Without doubt, the specimen illustrated by Smith is a juvenile; adults attain more than 8 mm. Additionally, specimens from Natal, Philippines, S. China Sea and Hawaii have been compared to confirm a distribution throughout the Indo-Pacific. This and Smith, 1885' further remarks on p. 145 leave no doubt, that ***Dorisca cookei*** is conspecific.

Furthermore, in two large lots off N. Borneo and Philippines, Mactan some specimens where found with quite strong crenulate margins (= *Crenocirce*-condition), some with very weak (as in Smith's original) and some without crenulations (= *Dorisca*-condition). Otherwise, the specimens are in the same minute range 4-8 mm, sculpture and hinge is identical. Thus, the distinction of *Dorisca* to ***Crenocirce*** vanishes and ***Crenocirce picta*** (type HIG01 B1156) is considered a further synonym of *jucunda*. In addition, no significant features could be detected to keep *G.* ***micronodulosa*** from S. China apart.

D. amica has a much weaker sculpture than *jucunda*, leaving the central part commarginally sculptured only. No difference has been found to ***Circe nana***. Melvill just compared it with the European *Gouldia minima*. *D. amica* has also a wide range. As *nana* it is reported from the Red Sea to Japan. Koyama et al. (1981) included here also *hanzawai* and *salamensis*. As the OD's do not contradict, this course is followed. The color in *amica* is usually whitish, some occur with red-brown blotches, and occasionally yellowish or orange specimens are found.

D. melvilli has a distinct sculpture compared to *jucunda* and is more slender and higher than *amica*, though close in sculpture to the latter. It was originally compared to the above mentioned species by Lynge, 1909 and is also well depicted in modern literature (ROBBA; OLI011).

D. kilburni has a special pattern of posterior blotches, grey-brown with white, and a comparatively weak sculpture. It has been described from Reunion, but has been also found in the Philippines, Davao.

D. subtrigona is currently the largest *Dorisca* known from deeper S. China and Philippine waters, reaching 11.2 mm (type). It has a well defined lanceolate lunule and is glossier and finer sculptured than *amica*.

SF22: ***Gouldiopa*** has a distinct shape, remains much smaller, the commarginal sculpture is weak and radials are absent. As indicated by Oliver & Zuschin (2000) no convincing reasons exist to keep *Microcirce* apart. The very small size, the higher form and the weak sculpture without radials distinguishes this small group from *Gouldia* and *Dorisca*.

SF23: ***Redicirce*** has a similar sculpture as *Gouldia*. However, the characteristic commarginally ridged lunule, the distinctive ovate form, and the much larger size, in addition to biogeography, do not favor a synonymization as proposed by Kilburn (2000). Earlier, Keen in Moore (1969) proposed *Redicirce* as subgenus of *Circe*, but this has correctly been opposed by Iredale (1936). *Redicirce* is here considered as of full generic rank. Also in *Redicirce* the ventral margin may be smooth or weakly denticulate.

R. sulcata is a widely distributed, highly variable species in color, shape, convexity, strength of commarginal ribbing and marginal denticulation. Iredale, 1936 did not accept an Australian presence of *sulcata*, but created instead *mistura* and *consola*. However, from the OD, as stated by Fischer-Piette and Vukadinovic (1975), there are no convincing reasons to keep these separate. Whether Lamprell & Whitehead (1992) captured Iredale's *consola* correctly is doubtful; at least longitudinal (in the sense of radial) lunular striae are not known in *Redicirce*, nor were these mentioned by Iredale. The many E. Australian specimens studied match *sulcata* well. Thus, *Redicirce* is considered monospecific. The largest specimens analyzed are slightly larger than 34 mm (E. Australia).

SF24: The distinction between ***Gafrarium*** and *Circe* is complex. At least four groups are discernible: The flat, strongly commarginal ***Circe***, usually with smooth margins; the heavy, thick shelled, commarginal ***Parmulophora*** with a crenulate margin; the strong nodose, radially ribbed ***Gafrarium***, and a group of intermediary forms, with a fine divergent sculpture (e.g. *divaricatum*, *australe*, *aequivocum*, *barandae* and *numulinum*). Whereas Fischer-Piette & Vukadinovic (1975) only accepted *Gafrarium*, most modern authors differentiate between *Circe* and *Gafrarium*. Molecular data is not sufficiently available. Here, Römer's proposal is followed, including *Parmulophora* subgenerically in *Circe* and the "*divaricata* group" subgenerically in *Gafrarium*.

Keen in Moore (1969) stated *Gafrarium* typified by ***Venus pectinata*** SD Dall, 1902 and ***Crista*** Römer, 1857 as objective synonym. However, in 1871, Stoliczka designated *Crista* as typified by ***C. divaricata*** Chemn. (= *Venus divaricata* Gmelin, 1791). Römer himself included the *pectinatum*- and the *divaricatum*-group in *Crista*. As such *Crista* is available and here subgenerically applied for *divaricatum* and closely related forms.

Despite distinct extremes, there are, as stated by many authors, morphological intermediaries connecting ***G. tumidum*** with the type species ***pectinatum***. Whether these morphological affinities are confirmed by genetic results is open. For the time being the white, larger *tumidum* is treated as synonymous form of *pectinatum*.

Either way, Fischer-Piette & Vukadinovic (1975) merged far too much valid species with *pectinatum*. ***G. divaricatum***, ***G. dispar***, ***G. aequivocum***, ***G. australe***, ***G. barandae*** and ***G. numulinum*** are recognizable and distinct, as demonstrated by most authors before and after 1975. However, ***Circe pythinoides*** Tenison-Woods, 1878 described from Victoria (type MV F674) belongs indeed into *pectinatum*, closely resembling smaller *tumidum* forms. This species is not found at the type locality and is understood as misplaced.

G. aequivocum is an old species, well interpreted by Römer (1869 p. 179). It indeed also occurs in Australia. However, instead of sp. 504 Lamprell & Whitehead's too large "*nana*" sp. 495 represents *aequivocum*. True *Dorisca nana* (= *amica*) grows less than half this size and is currently not known from Australia.

Circe transversaria was originally described from the Philippines. Then Lamprell & Whitehead (1992) misidentified it from Australia. However, their sp. 505 instead appears the same as their sp. 504 and sp. 503, namely the widely distributed, variable ***C. dispar***. Instead, the 3 BMNH syntypes revealed that true *transversaria* represents small, inside still strongly colored ***G. divaricatum***. Adult *divaricatum* reach almost twice this size. *Divaricatum* is well known from the Philippines, but does not, as far as is known, occur in Australia. Reeve's *C.* ***marmorata*** was synonymized with *divaricatum* by Roemer (1869). Tomlin (1923) did not treat either.

C. ***abbreviata*** Lamarck, 1818 has been variously treated. The syntypes are present in Geneva, MHNG 1084/60 ink marked 62. It demonstrated that not Lamy's (LA372) and Sowerby's or Reeve's interpretation of a *Circenita*, but rather Römer (1869)'s view was precise. *C. abbreviata* is a somewhat humped, more inflated, and shorter, strongly colored ***G. dispar***. The type locality Indian Ocean is correct. CHENU pl. 12 fig. 4 illustrated a syntype; the other syntype is internally weaker colored. Lamprell & Whitehead (1992 sp. 503) approaches closely, whereas their sp. 504 represents typical *dispar*.

A locally quite common *Gafrarium* is well known from French Polynesia. Compared to *pectinatum* it is more elongate, typically ellipsoidal, more regularly and finer ridged. The color is typically purple brown, internally often deep purple colored along its margins. Harte (1992) well characterized this species as *pectinatum* from Society Isl., Cook's Bay, intertidal byssally attached to the underside of coral rubble. Identical species have been analyzed from Huahine, Maera and Tahiti. *Gafrarium pectinatum* Harte, 1992 non Linnaeus, 1758 is here renamed ***Gafrarium hartei***. The type locality is Society Isl., Cook's Bay. This species is currently only known from Central French Polynesia. In the Marquesas nothing close was found.

All above members of the *Gafrarium* s.s. and the *Crista*-group have a smooth lunule, occasionally longitudinally weakly ridged. But Römer, 1869 indicated in the Indian Ocean a further group with **transversely ridged lunules**. This distinction got subsequently lost and most species have been confounded with *Gafrarium* s.s. *pectinatum*. The condition of the lunule is the same as found in *Redicirce*, whereas shape, sculpture and habitats are close to *Gafrarium* s.s. Römer included here 2 species, namely ***C. discors*** and his newly described ***C. adunca***. He located both in the Indian Ocean. However, from the material at hand a very inflated third species occurs in Natal and Mozambique. For this small group of *Gafrarium*-like, Indian Ocean bivalves with a transversely ridged lunule ***Roemeriana*** is here proposed. ***Venus discors*** is herein designated as type species. As far as is currently known *Roemeriana* is confined to the E. Med to Natal. Due to its overall affinities it is at present understood as subgenus of *Gafrarium*. Genetic results are lacking.

G. discors (Gmelin 1791) is based on Schröter, 1786 pl. 8 fig. 11. The picture does not reveal much, but the description clearly points to the Indian Ocean species as understood by Römer (1869 p. 183, pl. 49 figs. 2a-c). Römer stated Indian Ocean, without further details. Specimens precisely fitting are known from Natal, Durban Bay, found at low tide. But likely they have a yet unknown further Indian Ocean distribution. *G. discors* is identical with *G. "divaricatum"* Steyn & Lussi, 1998 sp. 978. They stated it as uncommon in Durban Bay and gave a maximum size of 32 mm. Römer gave 32.7 mm, all specimens studied were below 30 mm. *G. divaricatum* itself is a distinct, larger *Crista* not occurring in S. Africa.

In the same waters as *discors*, a second ***Roemeriana*** lives, namely ***alfredense*** (Steyn & Lussi, 1998 sp. 979). This species was unknown to Römer, but Bartsch, 1915 recognized juveniles as distinct and named it *Circe alfredensis*. The most striking differences between *discors* and *alfredensis* are more rounded shape and much stronger inflation in *alfredensis* as well elaborated by Steyn and Lussy. The largest *alfredensis* from N. Mozambique, Pemba was 36.8 mm. The data of Boshoff (1965) may indicate even larger sizes in Mozambique. Both SE. African species have these unique strong transversely ridged lunules.

In addition, a larger, rougher ridged and more elongated *Roemeriana* is well known from the Red Sea. Large specimens were collected in Egypt, Hurgada. Erroneously this species was identified as "*pectinatum*" by most authors. Römer, 1869 described such a larger, more elongate ***Christa adunca*** also from the Indian Ocean, but without precise locality. Shape and colors of *adunca* conform to these specimens. However, the Red Sea material consists of thick and heavy species, whereas Römer described *adunca* as rather thin, almost translucent. Tentatively Römer's *adunca* is associated with these Red Sea specimens. However, this Red Sea species was unambiguously recognized and described much earlier as ***Cytherea savignyi*** by Jonas, 1846. Bouchet & Danrigal, 1982 (fig. 15) depicted a broad and moderately elongate specimen of Savigny and CIESM, erroneously as *G. "pectinatum"*, a more elongate specimen immigrated into the Med. Oliver (1992 pl. 39 fig. 6) from "ZMC" appears to represent in fact a typical *pectinatum* of Linnaeus, but this species is not reliably known to occur in the Red Sea and the true locality of Oliver's specimen is not known. The westernmost localities of *pectinatum* are Mauritius (coll. auth.) and possibly Gulf of Oman (Oliver, 1995 sp. 1200). Commonly, true *pectinatum* is found in the Pacific. The largest *pectinatum* is known from Okinawa 42.1 mm, whereas *savignyi* reaches at least 47.4 mm in the Red Sea (coll. auth.). Besides transversely ridged lunule and larger size, ***Gafrarium*** (***Roemeriana***) ***savignyi*** (J. H. Jonas 1846) has in general a finer ribbing and is more conservative in shape and colors than true *pectinatum*.

SF25: ***Circe*** *scripta* is a variable species, known from the Red Sea to Japan; but Fischer-Piette & Vukadinovic (1975) synonymized here far too much. ***C. scripta*** has a fine ribbing, is generally vividly colored and usually posteriorly truncate. The divaricate sculpture is generally weak, occasionally almost absent. In Australia *scripta* is uncommon, known from Qld (Lamprell & Whitehead, 1992 sp. 490 *personata*). Instead, most "*scripta*" of Australian authors are either *quoyi* (WA) or *plicatina* (Qld, NSW).

Born's holotype of ***Venus rivularis*** has been analyzed (NHMW 14.078). As stated by Brauer (1878) this is not the Australian *Circe* (e.g. Lamprell & Whitehead, 1992 sp. 493 "*rivularis*"; Wells & Bryce, 1988 sp. 649 "*scripta*"; Sowerby, 1851 sp. 12 "*rivularis*"), but instead the well known *Parmulophora* from the Red Sea. ***Cytherea crocea*** Gray, 1838 is a junior synonym. Born's figure 1780 tab. 5 fig. 7 is unmistakable and Reeve's *Circe* 10a (*crocea*) or Sowerby's Circe No.50 (*crocea*) are identical. The error started 150 years ago, when Menke (1843) misidentified Western Australian *Circe* specimens as *rivularis*, followed by all subsequent authors.

Mikkelsen et al. (2006) stated molecular differences among W. Australian species Thus, the Australian "*rivularis*" can not be synonymized with *plicatina*, but needs another name. According to Römer (1869) and Tomlin (1923) the next available name is ***Cytherea quoyi*** Hanley, 1844. Hanley created this name on p. 11 footnote for pl. 15 (1844) for the Australian *scripta* auctt. non Linnaeus, 1758. Earlier, Hanley (1843 p. 108) had accepted *plicatina* as a distinct Australian species. The 48.6 mm holotype, labeled Australia is present in BMNH. *Circe quoyi* is a variable species in convexity and form; *Circe plana* Odhner, 1917 (flattish form) and *Circe weedingi* Cotton, 1934 (SA-form, Wells & Bryce, 1988) are considered synonymous. *C. quoyi* is known from the West Coast. It is somewhat more ovate than *plicatina* and internally generally weaker colored.

C. plicatina described from Australia has a special, somewhat vertically pointed shape. It is moderately inflated. The commarginal ribbing is rougher than in *scripta*. It is well known from the Australian East coast. Against Römer (1869)'s opinion, Tomlin (1923) synonymized Reeve's ***C. trigona***, described without locality, but labeled Australia with *scripta*. However, the 3 *C. trigona* BMNH syntypes represent the same species as illustrated by Lamprell & Whitehead (1992 sp. 492 *plicatina*), but definitely not *scripta*. Römer's correct synonymy is here reinstated.

C.* (*Parmulophora*) *tumefacta is another WA-species, as yet not seen outside this area. This is a solid, thick form, a typical *Parmulophora*. Bryce & Wells (1988 sp. 651) illustrated it under the synonymous name of ***C. lenticularis*** from WA. Tomlin (1923) instead placed *C. lenticularis* as synonym of *plicatina*. However, the large, heavy almost 60 mm BMNH *lenticularis* syntypes with a crenulate margin confirmed Bryce & Wells' view. The lunule in *tumefacta* is sunken and marbled, the shell heavier, more solid and more inflated than *plicatina*. It is in texture, inflation, and crenulated margin much closer to the type species of *Parmulophora* than to *Circe scripta*.

C. undatina Lamarck, 1818 is considered a valid species, similar, but distinct from *scripta*, following here Lamarck and Römer (1869). Lamarck described *undatina* from the Indo-Pacific without a specific locality. Specimens well fitting the unique 41.4 mm MNHN holotype are known from the Philippines and the S. China Sea. *Undatina* is generally more rounded and smaller than *scripta*, the commarginal ribbing is coarser, the ligament stronger immersed, the lunule is dark and shorter than in *scripta*. Internally it is glossy white, usually with a dark brown area centrally. *C. undatina* is illustrated in Römer (1869 pl. 54 fig. 2a-f (not 2g, h); Zhongyan (2004 fig. 165N; true *scripta* is fig. 165 M).

Circe undata Dunker, 1863 remained enigmatic. It was neither localized anywhere, nor could it positively be synonymized with existing species by Fischer-Piette & Vukadinovic (1975). It appears not to belong here but seems instead to represent a *Crassatina*.

SF26: ***Circenita***: The number of valid species ranges from 1 (Fischer-Piette; Oliver, 1992), 2 (Tomlin, 1923), 3 (JUK14; GRAY38), 5 (PHIL3) to 10 (ROE690). Special weight merits Tomlin (1923) who studied the BMNH-types and differentiated *callipyga* from *arabica*.

The taxonomy here has been clouded ever since. Unresolved are Forsskål in Niebuhr, 1775's ***Venus cordata*** and ***Venus varia***, both collected in the Red Sea and both older than Born's ***callipyga*** and Dillwyn's ***arabica***. Yaron et al. (1986) illustrated the possible ZMUC type material and also the specimens used by Chemnitz for his *Venus arabica* (= Dillwyn, 1817), *lentiginosa*, *bicolor* and *radiata*. They left the designation of a type open. As recognized by Forsskål, based on material from various Red Sea and Arabian localities two species are involved. First, a species with a very small pallial sinus (= *Circenita*) named *arabica* (Dillwyn, 1817; Römer, 1869; Tomlin, 1923) and a second species with a much larger pallial sinus (= *Marcia*) named *flammea* by most authors (Fischer-Piette & Métivier, 1971; Oliver, 1992 and 1995).

I follow Mörch (1853 p. 22)'s interpretation in Yaron et al. against Chemnitz' (6 p. 366, 6 35 376-7) and select the ZMUC-species illustrated by Yaron et al. (1986 No. 13) as **lectotype** for *Venus cordata*, and the four specimens illustrated as No. 11 as paralectotypes. Thus, ***Marcia cordata*** (Forsskål in Niebuhr, 1775) equals Chemnitz 11 201 1971-3 (*«Venus radiata», = Chione radiata* Deshayes, 1853) and Gmelin's *Venus flammea*. This species is placed in Marcia, TAPETINAE.

For *Circenita*, I here select the ZMUC species illustrated by Yaron et al. (1986 No. 16, «*Venus arabica* Chemnitz 1968-70»= *Venus arabica* Dillwyn, 1817) as lectotype for *Venus varia*, and the species No. 14 («*Venus lentiginosa* Chemnitz, 1963-4» = *Cytherea lentiginosa* Sowerby II, 1853) and No. 15 («*Venus bicolor* Chemnitz, 1965-7»= *Venus bicolorata* Dillwyn, 1817) as paralectotypes. Chemnitz 6 35 376-7 (prob. Yaron et al. No. 12) may be a somewhat humped form of the same species. As such ***Circenita varia*** (Forsskål in Niebuhr, 1775) equals the well known *Venus arabica* "Chemnitz" Dillwyn, 1817 (= type *Circenita*, OD). Furthermore, *Venus bicolor* and *lentiginosa* Chemnitz are objective synonyms, as already stated by Mörch (1853 p. 26). Many specimens of these three forms have been collected at the same place Red Sea, Egypt, Hurgada, 2/84. Following Mörch also ***Venus caliste*** Gmelin, 1791 based on Schröter (1786 pl. 8 fig. 8-9) from the Red Sea is placed in synonymy; Oliver (1992 pl. 41 fig. 14) shares many features. *Circenita varia* is variable, but generally robust, rather thick shelled, comparatively inflated, short and smaller than *callipyga*. Mörch (1853) designated the Red Sea as type locality.

Born's holotype of ***Venus callipyga*** (NHMW 14.073) has been analyzed. Specimens identical to Born's type have been found in Oman, Muscat. Comparable specimens are known from other localities along the Gulf of Oman and the Persian Gulf (Dubai), but not from the Red Sea. These specimens are generally flatter, and more elongate. Together with many authors *callipyga* is considered distinct from *varia*. Unfortunately, modern results are not available. Based on recent material *C. funiculata* Römer and *V. adenensis* Philippi are *callipyga*-forms and found together with typical forms in the Gulf of Oman. The specimens illustrated in Oliver (1995) appear all as true *callipyga*, the central one closest to Born's type. The BMNH type lot of ***Tapes amphidesmoides*** Reeve, 1864 doubtfully from the Red Sea contains 2 distinct species. The smallest, ovate, colored specimen is the depicted syntype. This represents ovate *C. callipyga* with an erroneous type locality. The larger two specimens are *Marcia*. Tomlin (1923) did not treat *Tapes amphidesmoides*.

The third *Circenita* is ***Cytherea*** (***Circe***) ***paralytica*** Römer, 1861. It was originally described without locality, but Römer (1869) stated Madagascar. It appears that Reeve (1863 fig. 31) illustrated the same as "interesting variety". It is further not excluded that ***Cytherea splendens*** Sowerby II, 1851 meant this species. However, no locality was given, no type could be located at BMNH and *splendens* must be considered a nom. dub. *Circenita paralytica* surpasses even the high variability of *callipyga*. This is a small and uncommon species. Römer gave 23 mm, the largest seen from Masirah Isl. is 25.2 mm. The shape is ovate, the umbones are more central, the shell centrally inflated, the surface rather glossy, and the sculpture irregular.

SF27: ***Lioconcha***: The molecular analysis of Mikkelsen et al. (2006) confirms a much closer relation of *Lioconcha* to *Circe*/*Gafrarium* than to *Pitar*. This was first recognized by Reeve (1863). Subsequently, Römer (1869) set *Lioconcha* close to *Crista*, *Gafrarium* and *Circe* and even included *Circenita* within *Lioconcha*.

Whether and in which composition LIOCONCHINAE becomes a valid subfamily or stays a further synonym of GOULDIINAE needs clarification of the affinities of *Circenita* and *Comus*. Tentatively *Lioconcha* is included in GOULDIINAE waiting for further results. All species have a very small pallial sinus.

In addition to old venerid literature, mainly Lamprell's papers are used, especially the excellent paper of Lamprell & Healy (2002):

Whereas for most of their newly described *Lioconcha*, no intermediaries were found, i.e. ***berthaulti***, ***macaulayi*** this is not the case for ***L. pseudofastigiata***. Most specimens from the Philippines with these patterns do not have the required brown blotch internally, though some do. There is no difference in texture to *fastigiata*, and specimens with *pseudofastigiata*-patterns are at least also found in Borneo together with "normal" *fastigiata*. Most important, Sowerby II's original concept of *fastigiata* explicitly allowed this variability, exemplified by the two specimens illustrated. Sowerby also mentioned the posterior expansion. *L. pseudofastigiata* is considered as mere variety in shape. ***L. fastigiata*** is widely distributed, at least from the Andaman Sea, down to Australia and up to Japan, Shikoku.

L. tigrina Lamarck, 1819 is not well understood. It has been described from the Indian Ocean and is virtually only known from the holotype (type in LAK99 pl. 1 fig. 4-5) and very few additional specimens. The MHNG holotype of ***L. tigrina*** MHNG 1084/35 alone is difficult, but additional material in the MHNG general collection labelled *L. tigrina*, Indian Ocean helped to understand this species somewhat better. As such *tigrina* is a whitish species, variously sculptured in brown, internally whitish to brown. All MHNG specimens referable are more ovate, but still without sinuations, and are larger than the type. As such, *tigrina* approaches *sowerbyi* and *schioettei*. Its precise distribution is currently unknown. Dharma's (1992) interpretation of a frequent Indonesian species is not excluded but could not be verified as yet.

L. ornata is a comparatively small, rather fragile Indian Ocean species, generally less than 30 mm. As captured by Oliver (1992) it has a comparatively smooth surface with a variable zigzag pattern. In shape it is subovate, longer than high, generally posteriorly extended. Typically, it is inside yellowish colored. *Cytherea picta* of Lamarck, 1818 as illustrated by Chenu has the same concept as *V. ornata* of Dillwyn, 1817 based on Chemnitz 6 35 380-1 from Mauritius.

On the other hand, the large, solid, cream-colored Australian species, illustrated in Lamprell & Whitehead (1992 sp. 544 "*ornata*", = Lamprell & Healy, 2002 pl. 7 fig. G-I) represents a significantly distinct, as yet unnamed species. Having studied very many true *ornata* throughout the Red Sea, Gulf of Oman, Kenya, Mozambique, W. Thailand, Indonesia, Phil and SChi, N. Borneo nothing comes close in size, texture and pattern. This Australian species is here renamed ***Lioconcha*** (***L.***) ***lamprelli*** nom. nov. *Lioconcha* (*L.*) *ornata* "Dillwyn" Lamprell & Whitehead, 1992 non Dillwyn, 1817. The type locality as stated by Lamprell & Whitehead is E. Australia, central to north Qld and GBR. Further specimens studied enlarge the distribution to NW. Australia, Broome and to Mela, Solomon Isl. All Australian specimens are quite uniform. *L. lamprelli* grows with more than 46 mm almost twice the size of typical *ornata*, which are usually approximately 25 mm, the largest *ornata* seen is 31 mm and Lamprell's neotype from Mauritius has 26.2 mm (LHE02 fig. 7 A-C and D). As mentioned by Lamprell & Whitehead *lamprelli* has solid and thick valves, whereas *ornata* is a rather thin and fragile species. The pattern is quite distinct. In all true *ornata* studied the brownish chevron pattern on a white ground is comparatively roughly tented, whereas the pattern in all *lamprelli* seen is very fine, usually composed of minute brownish dots on a cream-colored background. Inside both species may be deep yellow umbonally, but the hinge plate in *lamprelli* is exceptionally broad and the pallial sinus slightly more expressed. Overall, *lamprelli* is closer to *annettae* than to *ornata*. However, the former is generally posteriorly attenuate, has a less inflated and lighter shell and anteriorly usually a commarginal sculpture of weak ribs. While proofreading I learned that Moolenbeek et al., 2008 published earlier the same conclusion in Zoologische Mededelingen 82: 627 – 630. Thus *Lioconcha* (*L.*) *lamprelli* has to bear as authors: **Moolenbeek**, **Dekker & Meij**, **2008**.

Specimens from Polynesia were also identified as *L. ornata* or *L. picta* (e.g. HAT921, TROEN). However, also these are marked distinct from the true, predominantly Indian Ocean *ornata*. They grow much larger, are more solid, decidedly more rounded especially posteriorly giving an ovate impression, inside and on the lunular area whitish, whereas *ornata* is inside typically yellowish. The whitish periostracum is present in a uniquely thick layer, whereas in fresh *ornata* this layer is much finer and thinner. The pallial sinus is very small and easily overlooked. The lunular area has a clear, heart shaped incision, which is in general lacking in true *ornata*. The Hawaiian *L. hieroglyphica* is more inflated with much stronger umbones, shorter in shape and with a finer pattern. *L. fastigiata* centered on the Philippines has a stronger pattern, is generally brownish on the lunular area, and often yellowish inside, and has a stronger marked pallial sinuation. *L. picta* Harte, 1992 non Lamarck, 1818 is here renamed ***Lioconcha*** (***L***) ***hartei***. Harte gave Society Islands and Marquesas as localities. In the Marquesas this species has been quite commonly found in 15-20 m in rough, coral sand. Lamprell & Stanisic (1996 fig. 2e-f) seems to illustrated *hartei* also from New Caledonia, Poindimie, Stn. 800, 33 m. However, as they also confused *lamprelli* with "*ornata*" their data can not be applied before reexamination of the original material. It is likely that *hartei* is wider distributed in the tropical Pacific islands.

In addition 3, apparently **undescribed** *Lioconcha* are illustrated.

Following Japanese authors, for a few ovate, usually small, trigonal-rounded species, with a strong commarginal sculpture ***Sulcilioconcha*** is perceived useful and here subgenerically applied.

Having analysed many specimens from the Red Sea, Reunion, Indonesia, Borneo, Okinawa, and Polynesia, I follow Japanese authors, e.g. Higo et al. (1999) and consider *dautzenbergi*, as also *amirantium*, as further synonym of ***philippinarum***. Neither color, nor sculpture, or shape is special enough to consider *dautzenbergi* as distinct. In the same lots various ribbings may occur. The color forms include all white and all brown specimens. The shape is usually trigonal; however, rounded ovate specimens occur. Römer (1868 pl. 37 sp 2-2d) displays this variability well.

SF29: ***Meretrix***: The number of valid *Meretrix* and the synonymy changes with every author consulted; between 3 and 14 species are considered valid. Thus, all OD's had to be consulted and most types have been studied. Stable appears India (HOR17) and Japan, with 3 distinct species each. Kumagai & Ozawa (2001) arrived at 10 species, grouped in 4 clades. Except, the omitted *M. planisulcata*, *M. morphina* and *M. vestita*, their findings are largely shared. Their sp. may well be *M. aurora*. *M. zonalis* does not exist, presumably *M. attenuata* was intended.

All species have been available in sufficient quantities. However, from the two rarest *subtrigona* (New Guinea, Bougainvillea, Solomon Isl.) and *attenuata* from S. Andaman Sea/Sumatra only a few specimens have been studied. Here 13 *Meretrix* are considered valid.

M. meretrix with type locality India is mainly an Indian Ocean species. Hornell (1917) treated it well. He gave a maximum size of 77 mm. All true *M. meretrix* identified were less than this mark.

In the Philippine, mainly in Palawan a huge species occurs, reaching almost twice the *meretrix* size. Some specimens larger than 100 mm have been studied; the largest reported is 138 mm. Most authors identify these as *meretrix*. I also, long considered them as huge end of range *meretrix*. However, the large size always aroused suspicion and did not match Linnaeus' species and Hornell's interpretation. Furthermore, on close inspection these specimens are slightly more rounded and slightly more inflated in shape than *meretrix*. The colors are rather uniform; cream to yellowish, often the dorsal portion is purplish. Reeve's BMNH ***M. vestita***, described from unknown locality, recognized as special by Fischer-Piette & Fischer (1941) fits well. It is possible, that Vietnamese "*meretrix*" are instead also referable to *vestita*.

M. casta is understood as solid, thick, comparatively heavy species. It is an Indian Ocean species only. The hinge plate is generally broader and thicker than in *meretrix*, the inflation is usually stronger and the pallial sinus smaller. Inside *meretrix* is usually all white, often purplish posteriorly, whereas *casta* has often a rosy or yellow hue. Posteriorly *meretrix* is usually somewhat angled, whereas *casta* is more rounded. Hornell (1917) gives good pictures of the typical forms and the varieties. ***M. ovum*** appears as variety in shape, intermediaries connect it well with the nominate form. Hornell is followed, who synonymized; Kumagai & Ozawa (2001) stated a close genetic relation as well. Hornell (1917) stated *casta* as highly variable species, whereas the variability in *meretrix* is largely limited to color designs. Lamarck's ***C. impudica*** with a correct type locality is a typical large, heavy *casta*, virtually identical specimens are well known from India.

M. astricta is morphologically, as stated by Reeve, very close to *casta*. However, Kumagai & Ozawa (2001) demonstrated it genetically distinct. The specimens obtained have all been comparatively small, found in E. Thailand, Songkhla in a mixed fresh-saltwater environment, muddy sand, intertidal, shallowly buried. Reeve's syntypes represent particularly large specimens. Most *astricta* are cream or tan, often with two brown radial bands and rusty-red blotches on the anterior periostracal part. Another lot studied came from Makassar Strait, SE. Malaysia. Beached valves have also been found in Phuket; however, they might have been discarded.

M. petechialis is well depicted in Grabau & King (1928) and a juvenile specimen also in Zhongyan (2004 pl. 166 fig. c as "*meretrix*"). Grabau & King even stated that Lamarck's species came originally from the Bay of Pechili (= Beidaihe) and Lamarck's name in error for *pechialis*. *M. petechialis* is known from the Yellow Sea to Guangdong/Hainan and Japan. Its **type locality** was clarified as Beidaihe by Grabau & King. True *M. meretrix* is not known from Chinese or Japanese waters.

M. aurora was described as *meretrix* variety by Hornell. However, in resembles *casta* in more features. It is a comparatively small species; the shells are somewhat less compact and less heavy than typical *casta*, the hinge plate comparatively broad. It is very round and strongly inflated, inside yellowish or reddish. It is only known from W. India and Sri Lanka. This might be the sp. of Kumagai & Ozawa (2001).

Cytherea fusca Koch in Philippi, 1845 is the brown colored variety of ***M. lamarckii*** Deshayes, 1853 found in China and Japan. Fortunately, Koch in Philippi's earlier name is preoccupied by Fabricius, 1805. The type of *lamarckii* is illustrated in HIG01 B1257. Sowerby II's "*morphina*" and Reeve's *lamarckii* illustrate different forms of the same species. Thus, *M. m. var. reevei* is an unnecessary nom. nov. *M. compressa* of Römer appears to be the same species as well.

M. lusoria is a characteristic oblique species, known from Japan and China. Lamarck's internally painted *lusoria* from China is in Geneva. Furthermore, the 38 mm syntypes of ***Cytherea graphica*** (MHNG 1084/2) proved to represent juvenile forms hereof. Fischer-Piette & Fischer (1941)'s synonymy with *petechialis* does not match. The indicated locality by Lamarck, 1818 Indian Ocean is erroneous; *lusoria* does not occur there.

Cytherea morphina Lamarck, 1818 is obviously also not present at MHNH, Paris. It was not accepted by Fischer-Piette & Fischer, 1941 " … un nom qui doit disparaître". Despite Lamarck's clear notation "Mon cabinet" they surprisingly stated the type not located. However, this name was validly proposed and is not preoccupied (SHE). Two small syntypes are unambiguously and were ever since present in Geneva MHNG 1084/13 ink marked 8. They represent a *Meretrix* as recognized by Lamarck and illustrated by CHENU pl. 2 fig. 2. The type locality "Ocean Indien" matches. Despite similar size, the shape is marked distinct from the Japanese *graphica*. The shape is particularly low elongate, the color whitish with a thin brownish periostracum and the internal and external dorsal portion deep purplish brown. Specimens very close are found in S. Mozambique, extending to Natal. Such specimens are usually misidentified as *meretrix* (e.g. Steyn & Lussy, 1998 sp. 992; BOS65). *Morphina* has been curated in Geneva as *impudica* (= *casta*) var. Indeed, before having studied Lamarck's types, I placed these SAF specimens in *casta* as well. However, reconsidering the disjunct biogeography and the morphological traits, it rather appears that two close, but today separate species are present. ***Meretrix morphina*** is here treated as valid species confined to the SW. Indian Ocean.

M. lyrata has been described from the Philippines, Negros Isl. The specimen originally illustrated by Sowerby II, 1851 and the one by HIG01 B1259 show lirae all over the surface. Juveniles from the Philippines are centrally glossy, the lirae confined to the anterior and posterior part. The color varies from cream to purplish, internally all white to purplish. The shape may be almost round to strongly rostrate. Lan (2002) characterized a new form of *M. lyrata* from Taiwan with posterior partly lacking lirae, in the same cream and purplish-brown colored varieties. This form is also found in Vietnam and in E. Thailand, but the "nominate" form occurs there as well (LAN021; Habe, 1971 pl. 58 fig. 8). As concluded by Fischer-Piette & Fischer (1941) *lyrata* is here understood as quite variable species in extent of liration, color and form, and distributed from E. Thailand, Philippines to Taiwan. Apart from *M. planisulcata*, which is smaller, flatter, and much more variable in colors, *lyrata* is the only *Meretrix* with a lirate sculpture.

M. planisulcata is mainly known from the South China Sea (E. Thailand, Vietnam, S. China, Beibu Gulf). Yoosukh & Matsukuma (2001) gave W. Thailand, Phuket as additional locality for *planisulcata*. This may be, however, none were seen or collected there, whereas in E. Thailand, Songkhla area, this is the most common beach shell, found by thousands. Further east, Vietnam and S. China *planisulcata* becomes much less common. *Planisulcata* was described from unknown locality. Its **type locality** is herein clarified as E. Thailand, Songkhla.

M. subtrigona is currently only known from very few specimens from New Guinea, Bougainvillea and the Solomon Isl. It is a comparatively small, elongated, moderately inflated species, with a comparatively deep pallial sinus and a quite strong microsculpture of fine transverse lines dorsally.

M. attenuata from the Andaman Sea is also uncommon and the most compressed species. Here this transverse microsculpture is much weaker, the pallial sinus smaller. This species is sometimes misidentified as ***Meretrix "zonalis"***. However, Lamarck's ***Cytherea zonaria*** is a ***Tivela*** and ***Cytherea zonaria*** var. 2 is a synonym of *M. meretrix*.

SF30: ***Tivela***: The high variability of *Tivela* in color, but also in shape is easily underestimated. Some species offer a stunning range.

Pachydesma and *Planitivela* are considered synonymous, following here Jukes-Browne (1913 p.272). Globally, too many intermediaries exist to keep clear borders. ***Eutivela*** on the other hand, is easily diagnosed by its unusual crenulated margins, only encountered in 2 American species. *Trigona* Megerle von Mühlfeld, 1811 is a synonym of *Gomphina*, not of *Tivela*.

Together with the late M. Pin, Senegal (pers. com. 2/88) in WAF *Tivela* is considered monospecific. ***T. bicolor*** Gray is a synonymous color form of the type species. Jukes-Browne (1913) could also not state differences in hinge or "nymph".

The northern ***T.*** (***Eutivela***) ***dentaria*** and the southern ***isabelleana*** differ at first sight in shape. Fischer-Piette & Fischer (1942) treated these as two species. However, their conclusion was based on very limited material. Rios (1994) with extended material synonymized. In addition, Cortés & Narosky (1997) have illustrated the typical equilateral Northern shape from Argentina. Rios is followed, and *T. dentaria* Lamarck, described from Bra, Rio is the valid name. *T.* (*Eutivela*) *dentaria* is a quite variable species, uniform white or brownish streaked equilateral to inequilateral. Characteristic is the name giving denticulate margin.

There is a second *Eutivela*, only known from two specimens from Caracas Bay, Manabi, Ecuador, intertidal, sand, 17.2 mm, apparently **undescribed**. However, too limited material prevents description at this point in time. It is similar to *delesserti* in color and shape, but unique with its denticulate ventral margin.

T. mactroides is a highly variable species. Dall (1902) synonymized many earlier names. Rios (1994) and Diaz & Puyana (1994) further synonymized Dall's *brasiliana*. *Tivela* (*mactroides var.?*) *nasuta* Dall, 1902 fits well into *mactroides* specimens from Venezuela and Honduras, and into the *mactroides* illustrated by Diaz & Puyana from Columbia.

I fail to recognize ***foresti*** distinct from ***fulminata***, which appears as quite variable in shape and color.

Lamarck, 1818 described his West Indian ***Cytherea trigonella*** as trigonal, whitish, with reddish streaks from the Dufresne collection, which was later partly bought by Delessert. The specimen illustrated by Chenu (1843 pl. 6 fig. 3) fits the OD well and might even have been Lamarck's original. Römer (1865 pl. 5 fig. 5-5g) elaborated the variability of this species. Sowerby II, 1851 described his ***Cytherea incerta*** from the Virgin Islands as whitish with brown zigzag marks considered the same by Römer (1865). Based on Sowerby's type material Fischer-Piette & Fischer (1942) confirmed identity of *incerta* with *trigonella* Lamarck. Dall described his ***abaconis*** from Bahamas as deep rose colored umbonally, whitish towards the margins, which fits Römer's fig. 5g. Warmke & Abbott (1962) illustrated *abaconis* from Puerto Rico rose at the umbones and with brown zigzag lines marginally, closely approaching typical *trigonella*. Diaz & Puyana (1994) illustrated a white *abaconis* with brown zigzag markings from Colombia. Redfern (2001 sp. 969) demonstrated variability in shape for *abaconis*. There is very little doubt that *Tivela abaconis* Dall, 1902 is only a color form of Lamarck's species. Furthermore, comparing specimens from Tobago with ***Tivela floridana*** Rehder, 1939 from Florida and considering the variability in *trigonella*, I see no convincing reasons to keep this "only Floridan *Tivela*" distinct. Not just shape, size, but also the small, rounded pallial sinus is virtually identical. Abbott (1974 fig. 5913 *floridana*) appears the same as Römer's fig. 5a. Consequently, all these forms are here synonymized. *Tivela trigonella* (Lamarck 1818) is a small polished species, usually approximately 12 mm, but exceptionally up to 18 mm, widely distributed, living subtidally between 1-20 m. It is quite variable in color and shape, as exemplified above.

The well known EAfr ***Cytherea polita*** Sowerby II is preoccupied by a fossil of Lamarck, 1805. Furthermore, as demonstrated by Fischer & Fischer-Piette (1938 and 1942) the older name for this EAfr species is ***Venus damaoides*** Wood, 1828. As such it is also illustrated by Reeve (1864 sp. 4a) and accepted as part of the SAF-fauna (KIL741). *Cytherea dolabella* Sowerby II, 1851 is a mere shape form. Oliver (1995) illustrated such specimens as *Tivela" rejecta"*. However, true *rejecta* is a much smaller species not known from Arabian waters. *Tivela damaoides* is a compressed, medium sized species, reaching exceptionally 46 mm. It is known from Durban area, Mozambique, Kenya, Gulf of Oman, but not from the Red Sea proper.

Very early, *T. damaoides* was confused with the much larger and heavier ***Tivela ponderosa*** which occurs partly in the same area. However, in comparing shells of the same size, *T. ponderosa* is rounded posteriorly not rostrate, more inflated, the posterodorsal line is slightly convex and not concave as in *damaoides*. Fischer & Fischer-Piette (1938) further mentioned the deeper pallial sinus of *ponderosa*, passing midline. *T. ponderosa* is usually found in cream colors with darker radial streaks, whereas *damaoides* is more variably colored. However, *Cytherea ponderosa* Koch in Philippi, 1844 (= *Tivela*), is preoccupied by *Cytherea ponderosa* Schumacher, 1817 (= *Meretrix*). Schumacher's name was recently used, e.g. Bernard (1983), though erroneously as Eastern Pacific *Dosinia*. The next available name is according to Dekker & Orlin (2000) *Grateloupia stefaninii* Nardini, 1933. Indeed, Nardini's large Pleistocene fossil from Somalia fits well and *ponderosa* was not accounted for by Nardini. ***Tivela stefaninii*** occurs in the S. part of the Red Sea, in Arabian waters, including Persian Gulf and the Northern part of E. Africa.

T. dunkeri is scarcely known. It occurs in Natal waters and up the East African coast (EAS141; Steyn & Lussi, 1998 sp. 917; KIL741). It is donaciform, similar to the Arabian *T. mulawana* Biggs, 1969. Kilburn (1974) demonstrated that the also uncommon ***T. lamyi*** is distinct.

The true identity of ***T. laevigata*** (Gray, 1838) syntypes BMNH and ***Tivela cora*** Römer, 1864 (just figure) could not be established. Both were described without locality, seem distinct form the known species, but remained enigmatic ever since. The same applies to ***Trigona dillwyni*** Deshayes, 1853. The BMNH syntypes have been analyzed by Fischer-Piette & Fischer (1941). They stated no difference to *mactroides*, except a more elongated shape, Dall had allocated it earlier towards *mactroides* as well. However, on reexamination of the type lot it rather appears that the type locality is correct. This is a solid, inflated, 42.7 mm species, with an ascending, short, rounded pallial sinus, radially brownish striate on a cream base color. Closest are indeed W. Indian Ocean forms. However, neither *lamyi*, nor *stefaninii*, or *damaoides* fit in shape and/or pallial sinus.

SF31: ***Sunetta***: 3 subgenera are established. Most species belong to ***Sunemeroe*** (syn. *Cyclosunetta*). 5 mainly Indian Ocean species are placed in ***Sunetta*** s.s. ***Sunettina*** Pfeiffer, 1869 is monospecific, encompasses a single strongly inflated, ovate Indian species. At present 15 ***Sunetta*** are recognized.

Iredale (1924) considered all 3 Australian *Sunetta* species (especially *vaginalis* and *adelinae*) as belonging to the genus *Sunettina* Jousseaume. Jousseaume, 1891 explicitly included in his *Sunettina* the Japanese *menstrualis* and the Australian *vaginalis*. Then Iredale learned that *Sunettina* Pfeiffer, 1869 precedes *Sunettina* of Jousseaume and his Australian species were without valid genus. Therefore, in 1930, Iredale proposed ***Sunemeroe*** as gen. nov., undoubtedly for all Australian species, naming *S. adelinae* as type. 9 years later, Fischer-Piette found Jousseaume's *Sunettina* also preoccupied, and renamed it *Cyclosunetta*. As such ***Sunemeroe*** Iredale, 1930 antedates ***Cyclosunetta*** Fischer-Piette, 1939 and has to be used for this group. The type species, ***S. adelinae*** is misunderstood. As clarified by Iredale (1924) this is the *S. truncata* of Australian authors (e.g. Hedley, 1918; Allan, 1962 p. 326; Lamprell & Whitehead, 1992 sp. 512) but not of Deshayes. The preoccupied *Cuneus truncatus* Deshayes, 1853 non da Costa, 1778 (= *concinna*) is a true *Sunetta* close to the type species, growing larger and occurring in Indonesia to the Philippines, but not in Australia. *S. adelinae*, as the two other Australian species, is a small, rather rare *Sunemeroe*. It is closest to *S. sunettina*, but less high and with a deeper, straighter pallial sinus. The juvenile, 16.5 mm, white *adelinae* holotype with its deep narrow pallial sinus is present in BMNH. As stated by Iredale & McMichael (1962) the type locality of *adelinae* (Sydney, Port Jackson) appears erroneous and *adelinae* seems just to occur in tropical Australia. Indeed Lamprell & Whitehead (1992) reported it from N. Qld and a specimen studied came from NWA.

S. contempta Smith was not published in June, 1891 as assumed by Fischer-Piette, but according to Duncan in October, 1891. Thus, ***S. sunettina*** of Jousseaume (Sept) has priority, as recognized by Dekker & Orlin (2000). *S. sunettina* is distributed mainly in the Indian Ocean and quite variable in colors.

Menke's two *Sunetta* types are illustrated in Philippi (1846 pl. 3 fig. 2 and 3). ***Cytherea menstrualis***, though described in Menke, 1843's Australian paper, was explicitly stated without locality. Only ***C. vaginalis*** has been described from Australia. The huge size of Menke's *menstrualis* (62 mm) is only found in Japanese specimens, but never matched by any Australian *Sunetta*. Undoubtedly, the *menstrualis* interpretation of Japanese authors is correct and the **type locality** of *menstrualis* is herein clarified as Honshu, Ibaraki Pref. where large numbers of storm-beached specimens have been personally collected.

S. subquadrata Sowerby II, 1851 was originally described without locality. It has subsequently been identified in Australia and was, despite Sowerby's objections, early synonymized with *excavata* (= *vaginalis*). The small

BMNH syntypes from M. C. have been reexamined. The label reads W. Australia. Neither size, or color, nor elongated shape matches *vaginalis*. Instead *S. subquadrata* proved to be the juvenile form and the earlier name for ***S. perexcavata*** Fulton, 1930 described from WA as well. Fulton's much larger holotype is also present in BMNH. As stated by Lamprell & Whitehead (1992) ***S. vaginalis*** is internally rose-red and *subquadrata* white. *Subquadrata* also grows larger and is generally less inflated. *Subquadrata* is illustrated as *S. contempta* by Wells & Bryce (1988 sp. 654 from WA) and as *S. vaginalis* by Abbott & Dance (1986 from WA).

Cytherea excavata Hanley, 1843 is preoccupied by Morton 1833 (= foss.). It was described without locality and attributed to the Australian *vaginalis* and the Japanese *menstrualis*. The type from the Stainforth collection seems lost. Smith (1891) and Lamprell & Whitehead (1992) synonymized it with *S. vaginalis*. This view appears most likely and is followed.

S. concinna Dunker, 1865 (DKR sp. 81) is the same as Deshayes' preoccupied *truncata* and a *Sunetta* s.s., as stated by Römer (1870), admitted by Dunker (1878 p.138) and confirmed by Fischer-Piette & Fischer (1939). Fischer-Piette & Fischer (1939) considered ***concinna*** even too close to Indian specimens and synonymized it with Linnaeus' ***S. scripta***. A weak decussate pattern is indeed also found in *scripta* and the posterior truncation is somewhat variable. However, I hesitate to follow. Without doubt, these two are close; but the distribution is disjunct and the higher and shorter shapes of Indonesia to Philippine *concinna* were not as yet seen in the many Indian Ocean *scripta* studied. Here genetic methods could easily answer the question. For the time being the Eastern *concinna* is considered a valid species, a true *Sunetta* s.s.

On the other hand, Japanese authors consistently misidentify an ovate-elongate, much smaller *Sunemeroe* from Japan as *concinna*, i.e. Kira (1972 pl. 58 fig. 14), Habe (1971, p. 189), Okutani (2000 pl. 507 sp. 72). This subgenerically distinct, smaller, trigonal ovate, inside purplish species is here renamed as ***Sunetta*** (***Sunemeroe***) ***kirai*** nom. nov. *Cyclosunetta concinna* "Dunker" Kira, 1972 non Dunker, 1865. Kira gave Central Honshu and southwards, Okutani added intertidal to 50 m and a maximum size of 25 mm. The easternmost material studied was from Kyushu. However, the small "*concinna*" of Chinese authors (ZHO, ZHU64) might represent ***kirai*** as well.

Another *Sunemeroe* was described as ***S. cumingii*** Smith, 1891 (p. 423) from Taiwan. Smith referred to a type series in BMNH and to Römer (1870 pl. 4 fig. 2e "*menstrualis*"). It may be that the specimen now labeled "possible syntype of *Sunetta contempta*" in BMNH was originally part of Smith Taiwanese *cumingii* series. Reference and wording refer to an ovate species higher than *kirai* with a radial pattern, similar to a small *menstrualis*. It appears that Kira (1972 pl. 58 fig. 15 "*subquadrata*") and Habe (1971 pl. 58 sp. 11 *cumingii*) reported this species also from Japan. Zhongyan (2004 "*Cyclosunetta menstrualis*" pl. 165 H) may instead also represent *cumingii*. Unfortunately, no material of this rare species was available.

S. donacina is highly variable in color, shape and sculpture. As Persian Gulf specimens (= typical *donacina*) are too close, Fischer-Piette & Fischer (1939) is followed in considering ***S. birmanica*** a synonym of *donacina*. As in *donacina* the sculpture may be smooth, partly or completely ridged. The internal purple mark of Crosse's ovate-elongate *roetersiana* is found in *donacina* as well. The unique BMNH holotype of ***Sunetta kurachensis*** Sowerby III proved to represent a huge *donacina* from Pakistan, as stated by many authors before.

As far as is known, only 1 ***Sunettina*** occurs. The type species, ***C. solanderii*** Gray, 1825 is reliably known from Indian waters. Wood's thick *Venus hians* erroneously from "China" is without doubt an Indian species and the same as *solanderii*. The **type locality** of *solanderii* is herein clarified as India.

The uncommon, smaller ***langfordi*** Habe, 1953 in Chinese and Japanese waters is not close to *solanderii* but fits instead the *Sunemeroe* condition and is placed there.

SF32: **CALLOCARDIINAE**: This is a large and highly complex group, with more than 150 species globally. No modern review is available. Some of Römer's old, mostly IND species, are not identified, but many new IND species have been recently described by Lamprell et al. Without doubt, this is the most difficult and least known group in venerids. Fischer-Piette did not dare to tackle it. The only monograph available is Römer's.

Close to *Pitar* and here included are the following genera:

- ***Callocardia***
- ***Veneriglossa***
- ***Aphrodora***
- ***Agriopoma***
- ***Pitarenus***
- ***Costellipitar***

CALLOCARDIINAE Dall, 1895 is older than PITARINAE Stewart, 1930. As the respective genera - *Callocardia* and *Pitar* - are close a subfamilial split seems not justified.

In future, the preoccupied CALLISTINAE Habe & Kosuge, 1967 non Laporte de Castelnau, 1834 (beetles) may be separated. Genetic data show distinctiveness for *Callista* and *Macrocallista* towards *Pitar*. However, many crucial genera (e.g. *Transennella*, *Transenpitar*, *Tinctora*, *Lepidocardia*) lack analyses, and only very few pitarids have been genetically analyzed as yet. A possible composition of the preoccupied CALLISTINAE is currently too little known to be renamed and applied.

SF32a: ***Callocardia*** *guttata* has a steep rounded pallial sinus, but the sinus is weakly impressed. The hinge with joined cardinals in both valves is comparable to *Agriopoma*, though the teeth are finer, the hinge plate narrower and the anterior lateral pointed and very approached. The valves are smooth, polished-glossy, not pitted, very fragile and very inflated. The ***C. guttata*** type is illustrated in HIG01 B1186. Specimens from the East China Sea and the Philippines attain the size of Australian specimens. Marked differences in hinge plate or pallial sinus between Chinese or Australian specimens were not detected. ***C. thorae*** (VOK85; WHITE) is undoubtedly the same and here synonymized. *C. guttata* is widely distributed, ranging from Japan (HAB77), through E. and S. China, Thailand, Phil, New Ireland to NE. Australia. It is a deeper water species, generally deeper than 100 m, but not uncommon. It may be all white, but is usually sprinkled with brown dots. *C. guttata* is unique and *Callocardia* is monospecific as stated by Jukes-Browne (1913).

C*. *hungerfordi is distinct, ovate and only moderately inflated, with a broader hinge plate the anterior lateral more remote, a weak, irregular commarginal sculpture and a deeper pallial sinus (SCO94 pl. 10 sp. A; probably Habe, 1971 pl. 58 sp. 20). *Hungerfordi* fits well to *Aphrodora*. The depicted specimen is assumed to represent a juvenile from the South China Sea. The BMNH type is 3 times this size and the umbones stronger developed.

SF32b: ***Veneriglossa vesica*** is superficially similar in shape to *Kelliella*. However, other than stated by Odhner (1960) the dentition is very close and almost identical to *Callocardia guttata* with united cardinals and an acute very close set anterior lateral. Jukes-Browne (1913 p. 340) stated this resemblance as well. Thus, *Veneriglossa* is removed from KELLIELLIDAE and placed in venerids adjacent to *Callocardia*. *Guttata* has also a broad lunule, but an ascending pallial sinus, which in *Veneriglossa* is only very weak. Furthermore, the surface sculpture in *guttata* is smooth, whereas *vesica* has a strong broad, somewhat irregular, low ribbed commarginal sculpture.

An apparently **unnamed** species, but very close in all respects to *vesica* is known from a single complete specimen from about 110 m, off W. Ireland, 2.6°S,150.6°E.

Okutani (1972) described the rare ***Callocardia nipponica*** from off Honshu Izu Isl. (OKU72 sp. 150; type HIG01 B1187). From commarginal sculpture, shape, dentition and indistinct pallial sinus it appears better placed here than in *Callocardia*.

SF32c: Jukes-Browne considered ***Aphrodora*** intermediate between *Callocardia* and *Pitar*, a view shared. However, other than diagnosed the hinge in *Aphrodora* is not understood close to *tumens*. Instead in *Aphrodora* the cardinals are also united in both valves, but the anterior lateral is remote and broader, compared to *Callocardia*. The BMNH type species ***A*. *birtsi*** from Sri Lanka is comparatively large, almost 35 mm, ovate, moderately inflated, white, much thinner than *tumens* with a moderate, slightly pointed pallial sinus. It has a commarginal sculpture of very weak and low somewhat irregular ridges, sparsely punctuate or pitted, where sand grains adhere when living. *Aphrodora* species are often covered with mud or mud-sand. Apparently *birtsi* is rare; only one other specimen from Indonesia, Alor Isl. from about 25 m has been perceived conspecific.

As stated by Jukes-Browne there is a small group of uncommon IND species referable to *Aphrodora*, i.e. ***crocea*** and ***yerburyi***. Also ***hungerfordi*** is in shape, sculpture and dentition much closer to *birtsi* than to *guttata* and placed here as indicated by Jukes-Browne. The type of Zorina's ***Pitar levis*** from the Gulf of Tonkin should be compared to *hungerfordi*.

Also the Japanese ***noguchii*** originally described as *Agriopoma* fits well. Very close to *noguchii* is *nipponica*. Inferring from the type pictures (HIG01 B1174 vs. B1172) *nipponica* is higher in shape and seems quite uncommon. *Japonica* has a hinge closer to *Pitar*, but fits in most other respects better into *Aphrodora* than in *Pitar*.

Lamprell et al. illustrated "these" Japanese species *e.g. noguchii*, *nipponica* and *japonica* also from tropical Australia. However, strong doubts persisted whether these are indeed conspecific. Unfortunately, no Australian material was available for firm conclusions. Lamprell & Whitehead (1992 sp. 522 "*japonica"*) should be compared to *yerburyi*; Lamprell & Healy (1998 sp. "*noguchii"*) is not perceived as particularly close to the Japanese species in shape or in size, but might represent an **undescribed** species. Whether the Australian *nipponica* is conspecific, needs also verification. This also applies to Poutiers (1981) *nipponica* record from the Philippines.

In addition, a further, **unnamed** group of IND deeper water species with a similar hinge, but smaller, ovate in shape, with a quite regular, non pitted commarginal sculpture exists. These are listed as ***Aphrodora* s.l**. In general these species are whitish with a quite shallow pallial sinus. A typical representative is ***P*. *sewelli***. Also here belongs the similar ***C*. *pudicissima***. Zorina's ***P*. *sulcata*** seems to be a further representative, as well as a larger, apparently undescribed species from off New Ireland. Sowerby's ***P*. *pygmaea*** is better placed in this group than in *Pitar*. However, all these species are only known from the types or from very limited material.

Overall, *Aphrodora* needs much more work to arrive at a firm picture.

SF32d: ***Agriopoma*** encompasses larger, ovate, chalky white American species with a hinge close to *Callocardia* (two cardinals dorsally connected and separated from the hinge margin) with commarginal sculpture and smooth margins. Dall included here also the Panamic forms, for which later *Pitarella* has been introduced. *Meretrix aresta* has been reclassified by Dall (1902) as *Agriopoma*, whereas *albida* with beaks more central, pallial sinus more elongate and virtually smooth surface is a *Pitar*.

The true affinities of ***morrhuanus*** are unknown. Biogeography, lunule and pallial impression approach it to this group. Dentition and shape are closer to *Pitar*. Inflation and habitat remove it from both. It is not excluded that *morrhuanus* represents a separate lineage as does *Pitarenus*.

Pitarenus is close to *Agriopoma* but with a crenulated margin. The maximum size studied in *P*. *cordatus* is 45.7 mm (Texas). Full adults are particularly heavy and inflated.

SF32e: ***Costellipitar*** have a pitarid hinge, but regular commarginal striae, and generally a trigonal form, the umbones are generally acute and the pallial sinus rather deep. Most members are small, rather fragile and all white. The habitat of this group is often deeper water, they are rarely found beached. Some authors separate it generically (e.g. Oliver & Zuschin, 2000; or Japanese authors, e.g. Higo et al., 1999). This course is here followed, although much more work is necessary to fully elucidate this group.

The type and the variability of ***Costellipitar manillae*** are illustrated by Lamprell & Kilburn (1999). Obviously, this is a highly variable species in shape, with a characteristic comparatively short ascending pallial sinus. It is widely distributed from Transkei to at least Philippines. In addition, Oliver & Zuschin (2000) mentioned a significant change in shape during its growth from rounded to trigonal. Inferring from these examples the number of 8 IND *Costellipitar* may be overstated, especially *C*. *tumidus* appears close to *acuminatus*. However, the scarce material at hand does not allow substantial progress.

From WAF 2 species referable to *Costellipitar* are known.

One is rather compressed with a very deep pallial sinus, passing midline. This fits Philippi's ***Venus tellinaeformis*** well. This species is usually termed ***Pitar tellinoidea***. However, from the wording in Sowerby's OD and from the single holotype in BMNH there remains no doubt that the same species has been named twice. First, by Hanley, 1844 as ***Cytherea cor*** from Africa and later by Sowerby II, 1851, based on the same shell from Hanley's collection as ***Cytherea tellinoidea***, but this time without locality. Hanley (1856) stated synonymy of *tellinoidea* and *cor*. The holotype of *cor* has the same shape and the identical very deep pallial sinus as Philippi's *tellinaeformis* and is undoubtedly the earlier, valid name for this species. Indeed, Deshayes (1854) synonymized *tellinoidea* with *tellinaeformis* and placed both in Senegal. The other WAF species is growing larger, has a shorter pallial sinus and usually a more irregular sculpture. This species has been recently described as ***P. peliferus*** by Cosel, 1995. Ardovini & Cossignani (2004)'s large 45 mm "*tellinoidea"* from Guinea-Bissau is in shape closer to *peliferus*. However, the position of the pallial sinus is unknown.

Comparing ***Pitar perfragilis*** specimens from W. Mexico and Chiriqui Bay, W. Panama with the fragile, pure white, 23.4 mm BMNH syntypes of ***Dione pura*** Deshayes, 1853, then I was unable to detect substantial differences. The latter was described from Peru, Callao. This location was already doubted by Römer (1869) and, as far as is known, *perfragilis* is not known from Peru and nothing close was reported from there by modern authors. All evidence points that *Costellipitar pura* is a misplaced Panamic species and the valid earlier name for *perfragilis*.

SF32f: **Pitar**: A close comparison of the type species ***Pitar***, i.e. *tumens* (WAF) and ***Pitarina***, i.e. *citrina* (WA) did not reveal any substantial differences in hinge or pallial sinus for a useful subgeneric distinction. Furthermore, the solid and rather heavy *P. citrinus* is even closer to some WAF pitarids, e.g. *P. elatus*, than is the more ovate and fragile *P. tumens*. Both type species involved are extremes, and both are not typical for the majority of pitarids. Thus, Tremlett (1953) is followed, who could not "find sufficient justification" for a subgenus *Pitarina*.

The **WAF** pitarids are difficult and not well known. ***P. tumens*** is common, but quite variable in shape (elongate-almost ovate), in convexity (rather compressed to moderately inflated) and in color (usually ochre, but all white, white-yellowish, orange-white and reddish-white specimens occur); characteristic is a deep, somewhat pointed pallial sinus. The specimen illustrated in Ardovini et al. (2004 pl. 191) as *P. virgo* from Senegal seems instead *tumens* as well.

The BMNH holotype of Gray's ***virgo*** clearly represent a distinct species. It is more tumid-ovate and stronger inflated, with a broader lunule, outside whitish with rose umbones, internally white and rose red in the umbonal area. It also has a stronger commarginal sculpture compared to the virtually smooth *tumens*. *Virgo* was originally described without locality. Later, Sierra Leone has been added to the label. It is undoubtedly of WAF origin and specimens collected in Ghana are virtually identical. The labeled, nearby Sierra Leone location is understood as accurate. The ovate rose *Caryatis belcheri* "Sowerby" Römer, 1867 is not the same as Sowerby's whitish, smaller *Cytherea belcheri* which Kilburn (2000) placed in South-East Asia. Römer's species has been renamed ***Pitaria roemeri*** by Tomlin & Shackleford, 1913. However, *roemeri* appears in all respects only to represent a fresh *virgo* and is here synonymized.

Nicklès (1955) indicated ***Cytherea erubescens*** Dunker, 1853 from Angola as probable synonym of *tumens*. However, the OD clearly points into a distinct, valid species. *P. erubescens* is similar to *virgo*, but stronger rosy outside, less inflated and more elongate. The sculpture of somewhat irregular commarginal ridges is much finer and the ridges approximately double in number than found in *virgo*. *Erubescens* occurs in the Southern part, Congo, Point Noir and Angola. The strongly immersed ligament and a clearly incised lunule are typically found in *erubescens*.

Dunker (1853 figs. 23-25) further illustrated a comparatively high, yellowish *Cytherea*"*tumens*" with golden commarginal bands. However, *tumens* based on Adanson's *Chama pitar* from Senegal is more ovate and typically in light brown colors. Dunker's figure instead conforms well to Gray's *Chione striata*. Based on Hidalgo's erroneous reference, and Reeve's erroneous location I long considered Gray's ***Chione striata*** (= Reeve, 1863 fig. 44) as Philippine species. *Striata* was originally doubtfully described from Australia and later doubtfully placed in the Philippines by Reeve. The 3 ovate, solid, yellowish BMNH syntypes show a very characteristic acute, narrow pallial sinus, a condition not found in Australian or Philippine pitarids. Nicklès (1955) placed *striata* in WAF close to *tumens*. Indeed, Dunker's description fits well and ***Chione striata*** Gray, 1838 is understood as Angolan species, close to *tumens*.

According to Sowerby II, 1854's emendations, which based on Hanley's advice, his *Cytherea tellinoidea*, 1851 is the same as earlier described by Hanley, 1844 as *Cytherea cor* from WA and referable to *Costellipitar*. However, Römer, 1867 illustrated a much larger species as *Caryatis cor*. This inflated species was later described by Sowerby III, 1908 as ***Pitaria elata*** from Sierra Leone. *Elata* is stronger inflated, thicker and more tumid than *tumens*. In *elata* the lunule is slightly immersed, in *virgo* not, *elata* is all white, whereas *virgo* has umbonally rose red colors, the pallial sinus in *elata* is more horizontal and narrower.

A difficult **IND** complex centers on ***P. citrinus***. Lamarck's *citrinus* is a solid, heavy, trigonal species, inside deep purplish, mainly known from NW. Australia (Chenu pl. 6 fig. 4) but not from the Philippines. Following Lamy & Fischer-Piette (1937) another species occurs in the Philippines extending into the China Sea, termed also *Cytherea citrina* by Sowerby II (1851 fig. 117). Sowerby (1851 fig. 117 and 118) further characterize the variability of this pure yellow to yellow dorsally purplish- brown species and Reeve (1863 fig. 19, non fig. 44) illustrated the colored form erroneously as Gray's *striata* also from the Philippines. Hidalgo (1903) recognized Sowerby's and Reeve's errors and renamed this Philippine species ***Caryatis reeveana***. His reference to Reeve fig. 44 = *striata*, Gray is in error for fig. 19 "*striata*" non Gray. *P. reeveana* is found in Indonesia, the Philippines, and E. Thailand to Okinawa. It is less solid, more rounded with a clearly incised white lunule, a broader pallial sinus, and a smaller hinge plate compared to true *citrinus* from Australia. However, much earlier Linnaeus, 1758 described ***Venus laeta***. This species is present in London, Linnean Society; box 108, a single valve, inside ink marked 104, representing, without doubt, the holotype. This specimen has been illustrated by Hanley (1855), but was not recognized since. Linnaeus' *laeta* is a *Pitar* and conforms precisely to the yellow brown *reeveana*. It is the same as Reeve (1863 fig. 19 "*Dione striata*") or Sowerby (1851 fig. 118 "*Cytherea citrina*") and is here reinstated as valid *Pitar*. The original type locality "Mare Mediterraneo et Indico" is here corrected to the Philippines, which is the centre of its distribution. In addition, there is no doubt that Healy & Lamprell, 1992 described this species again as ***Pitar marrowae*** from Qld and reported it in 1997 also from the Philippines, Singapore and Indonesia. They well elaborated the differences to Lamarck's often confounded *P. citrinus*.

Somewhat similar in color but smaller is ***Pitar sulfureus***. It has been described from Kyushu and is well known from Japanese and Chinese waters, but not as yet reliably reported from the Philippines. On the other hand, Lamprell & Whitehead (1992 sp. 532) illustrated a "*sulfureus*" specimen from Qld. It could not be verified if the Australian form is conspecific. A species very close and eventually conspecific could be ***Caryatis alcyone*** Römer, 1869 (ROE690sp. 8). However, it was described without locality and the Stettin type appears lost.

A special group is centered on ***Pitar prora*** and its congeners. This group is composed of elongated, polished species, usually whitish colored, with a characteristic strong anterior expansion, giving a pointed appearance; or, in the words of Conrad (1837 p. 253) "anterior side subcuneiform, sharply angulated at the extremity". At least in some species (i.e. *affinis*, *obliquata*) the periostracum is thick and white as found in certain *Lioconcha*. This Pacific group of at least 6 pitarids is here subgenerically separated as ***Prorapitar***. Conrad's *Cytherea prora* is designated as **type species**. Conrad's *prora* has been described from the "Pacific, probably towards the coast of New Holland". As indicated by Lamprell & Kilburn (1999) Australian specimens are indeed closest to Conrad's OD. These represent comparatively inflated, solid, posteriorly truncate forms externally and internally cream as illustrated in Lamprell & Whitehead (1992 pl. 66 fig. 513). Such specimens are found in E. Australia, Melanesia and Polynesia. Here NE. Australia, Qld is clarified as **type locality** for *P. prora*. Another form is found in the Philippines, the Marianas, China Seas to Amami. For these specimens ***P. obliquatus*** Hanley, 1844 has been correctly applied by Sowerby II (1851 fig. 125 and 126) and Habe (1971 pl. 58 fig. 21). Hanley, 1844 described his species against "*laeta*" (= *affinis*), but gave originally no location, but in (1856 p. 355) he added Philippines. Such specimens are flatter, marked longer than high, often with brownish patterns. Hanley's type appears to be lost. At least the specimen in the BMNH type collection labeled "type *obliquata* Hanley" does not match Hanley's original measurements. Instead, and most confusingly, it exactly represents the compared shorter "*laeta*" (= *affinis*"). This third *Prorapitar* is found in the SW. Indian Ocean. As well demonstrated by Lamy & Fischer-Piette (1937) this old species is ***Venus laeta*** of Chemnitz 6 34 353-4 and Lamarck, 1818 (CHENU pl. 14 fig. 3) but not of Linnaeus, 1758. *Venus affinis* Gmelin, 1791 is the oldest name for this species, originating from Mauritius. It is well depicted in Sowerby (1851 pl. 133 fig. 123) though erroneously from the Philippines. This is a large, highly inflated, short form, cream with a variety of brownish patterns. It is *Cytherea cordiformis* Dunker, 1849 (Zanzibar), *Pitar "prora"* Lamprell & Kilburn, 1999 (Mozambique) non Conrad, 1837 and *Pitar "obliquata"* Oliver et al., 2004 (Rodrigues Isl.) non Hanley, 1844. ***P. affinis*** does not occur in the Philippines or in Australia. Instead, the large, rounded, smooth *Pitar* named "*affinis*" by most authors (e.g. Lamprell & Whitehead, 1992 sp. 514) is instead *Cytherea* ***inflata*** Sowerby II, 1851. True *P.* (*Prorapitar*) *affinis* has the subcuneiform, sharply angulated prorapitarid shape; *P. inflata* is just a large, anteriorly rounded *Pitar*, highly variable in patterns and color. An **undescribed** *Prorapitar* is known from New Caledonia, Noumea. It is even comparatively more elongate than *obliquata*, more inflated and yellowish. Further referable to *Prorapitar* is the stunning ***P. kathiewayae*** from E. Africa and Madagascar. In addition, an uncommon, obviously **undescribed** species is known from the Gulf of California. It is close in color to *pollicaris*, but without the hyphantosomid sculpture and somewhat approaches *obliquata* in color and shape, but the anterior portion is more rounded.

Pitar abbreviatus is considered a synonym of *hebraeus*. *P. hebraeus* is a quite variable species in form and some specimen from the Red Sea and Oman are indistinguishable from SAF, W. Cape and Mozambique specimens, the largest specimen from Oman is more than 36 mm, equaling *abbreviatus* also in size. *P. hebraeus* appears restricted to SAF and the Indian Ocean. ***P. medipictus*** is a quite distinct, smaller, deeper water species from SAF. *P. hebraeus* was reported from the Philippines (Smith, Hidalgo). However, Lamprell & Healy (1997) clarified, that this is ***P. sophiae***. It differs by its more elongated shape, more rounded, smaller size. The largest specimen seen is 24.9 mm (Phil, Mactan Isl,). In color *hebraeus* is also easily confounded with *nancyae*, but the hyphantosomid sculpture in the latter distinguishes them at once.

A special pair of small ovate, strongly sculptured species consists of ***P. belcheri*** and ***P. regularis***. *P. regularis* seems even finer sculptured and less high. The latter is illustrated in Lamprell & Whitehead (1992 sp. 528). The former was described from unknown locality and recently identified from Southeast Asia by Kilburn (2000). Definitely these two are not typical pitarids and are for the time being placed ***Pitar*** **s.l**. Römer's ***Caryatis phoenicopterus*** described from unknown locality, but placed by Martens (1894) in N. Qld may possibly belong here as well. All three species are insufficiently known.

Also the W. Atlantic species are quite difficult. Comparatively well known are ***albidus***, ***fulminatus*** and ***palmeri***. However, Römer's ***mundus*** from Virgin Isl., Dall's ***subarestus*** from Panama, or Macsotay & Campos ***bermudezi*** from Venezuela are all rather enigmatic species. *Bermudezi* should be compared to Dall's type series of *subarestus*. In addition, various authors included distinct species in *albidus*. Gmelin's species is understood as elongate-rounded, moderately inflated, solid whitish to yellowish, comparatively large as depicted by REV631 fig. 39 or DIA94 sp. 182. In addition, also large, but shorter, more quadrate forms are known from the lower West Indies (e.g. Aruba) and Venezuela. These surpass the variability of *albidus*. The pallial sinus is broader, deeper and horizontal compared to *bermudezi* and *subarestus*. *Mundus* is a smaller species with a distinct shape. Lamarck, 1818 described a still unplaced ***Cytherea albina***, doubtfully from the Indian Ocean. The 41 mm holotype ink marked 25 is present MHNG 1084/26. The sculpture is somewhat irregularly commarginal with weak low ridges; the lunule is very elongate, very weakly incised. In whitish color, texture and hinge configuration it much closer approaches Caribbean forms with extended dorsal laterals than Indo-Pacific specimens. Very similar is Römer (1867 pl. 24 fig. 4, 4a-b "*albida*"), whereas his fig. 4c-d represents *albidus* as understood by most Caribbean authors. *Pitar albinus* (Lamarck, 1818) is here recognized as valid W. Atlantic species, living at least in Aruba and Venezuela.

Menke (1858 p. 15) recognized that ***Venus holosericea*** Gmelin, 1791, based on Buonanni's figures is the same as his *Cytherea fulminata* and concluded " … meine *Cytherea fulminata* Syn. meth. Moll., die also künftighin *Cytherea holoserica* [sic] wird heissen müssen". Despite this clear statement by the author of *fulminata* himself, his correction was forgotten, and in none of the venerid or American literature consulted this species was ever named *holosericea*. It was not found mentioned as valid name after 1899 in Dall & Simpson (1901, *Meretrix hebraea*), Dall (1902, *Pitaria fulminata*), Peile (1926), Altena (1971), Abbott (1974), Fischer-Piette (1975), Fischer-Piette & Vukadinovic (1977), Rios, (1994), Dias & Puyana (1994), Redfern (2001) or Rosenberg (2006, MALAC); furthermore, not even Römer (1867, *Caryatis*) referred to Gmelin's name. Based on ICZN Art. 23.9.2. ***Cytherea fulminata*** Menke, 1828 is here declared valid and **nomen protectum** and the older *Venus holosericea* Gmelin, 1791 is declared a nomen oblitum.

Venus patagonica was described by Orbigny, 1842 and erroneously replaced by him later by *tehuelcha*; but no such Lamarckian name is available. *Pitar patagonicus* stands. Orbigny (1846) synonymized Koch's ***Cytherea rostrata***. It appears that also Römer's *Caryatis rustica* from S. America is within the variability of *patagonicus*, somewhat closer to Argentina specimens.

Sowerby II 1851 and 1854 twice described a ***Cytherea simplex***. The latter *simplex* was renamed *C. sowerbyi* by Römer, 1867. However, these were described from unknown locality, the generic attribution is not unambiguous and no type could be located in 3/09 at BMNH for either. Both are considered nom. dub.

SF33: Superficially, ***Hyphantosoma*** is easily confounded with *Pitar*, but it may even belong to GOULDIINAE. This group is here at least generically separated. *Hyphantosoma* have a unique zigzag sculpture on the surface, strongest anteriorly. The members have comparatively light, elongate-ovate valves and smooth margins. Extant specimens are only known from the West and East Pacific.

Currently, 9 species are recognized. However, the relations between *festoui* and *healyi* are not well established and the latter may eventually prove synonymous. Lamprell & Stanisic did not compare these two. The types were not traced and just limited material was available.

SF34: Following Römer, ***Hysteroconcha*** and ***Lamelliconcha*** are separated from *Pitar*. Most species have large, robust and solid shells, the pallial sinus is generally very deep and the surface sculpture distinct from *Pitar* as well. Furthermore, *Hysteroconcha* is American only; Fischer-Piette (1969) applied *Hysteroconcha* also as full genus.

The 14 members are quite well known.

Chione badia Gray, 1838 is an accepted synonym of *C. unicolor* Sowerby I, 1835 (DES1; ROE690; TOM23; 27). However, there is a much older, still unresolved ***Venus badia*** Holten, 1802, based on Chemnitz 11 202 1978 *Venus brunnea seu badia*. The type from Chemnitz' personal collection might be at St. Petersburg and should be compared with the Panamic *unicolor*.

SF35: ***Transennella***: Small, solid, ovate specimens with a characteristic undulate-striate margin are easily identified as *Transennella*. The specific attribution is more difficult. Furthermore, a couple of neglected BMNH-types are available, undoubtedly belonging to this exclusively American genus:

The 11.2 mm holotype of ***Tapes hanleyi*** Sowerby II, 1852 from Brazil, Rio is still present in the BMNH type collection; the outer color is now bleached, but internally still well preserved deep purple. Characteristic is the fine, dense commarginal sculpture, an ovate elongate, somewhat rostrate shape and the broad, ascending rounded pallial sinus. Fischer-Piette saw the BMNH type, wrote in sched. "not a *Tapes*" and reported it in Fischer-Piette & Métivier (1971 p. 103) as non TAPETINAE. Indeed ***hanleyi*** is without doubt a *Transennella*. From shape, color, size and pallial sinus it fits precisely ***stimpsoni***, as illustrated by Brazilian authors. *Stimpsoni* is known to occur in Rio and to grow up to 15 mm in Brazil (BRASIL). *T. cubaniana*, also known from Brasil is more rounded and grows smaller.

Furthermore, the depicted, 14.4 mm and a smaller 10.5 mm syntype of ***Cytherea angulifera*** Sowerby II, 1851 are present in the BMNH type collection. As noted by Jukes-Browne (1913) this proved to represent a further *Transennella* from Museum Cuming, but described and labelled without locality. It is similarly shaped as *hanleyi* and also finely commarginally ridged. The color is white with red-brown tented blotches, inside white. The pallial sinus extends about as far as midline, ascending and rounded. This species was treated by various authors, nobody gave a locality. From all *Transennella* studied *angulifera* most closely resembles *hanleyi*. This is also the only Caribbean species known to reach the size of *angulifera*. Furthermore, internally all white *stimpsoni* are known from Rio de Janeiro. As finally a 14.4 mm specimen from Rio is available which closely approaches the larger *angulifera* syntype in size, shape and sculpture, *angulifera* is understood as the even earlier name for ***hanleyi***. The **type locality** of *angulifera* is here clarified as Rio de Janeiro State. *T. stimpsoni* is a junior synonym.

From the *T. angulifera* studied, and the variability in shape and color encountered, it should be verified that ***T. gerrardi*** is indeed distinct and a valid species.

The 8.4 mm type of ***Cytherea albocincta*** Sowerby II, 1851 from unknown locality is present in the BMNH type collection. Thanks to the generosity of K. Way the solid specimen could be opened for the first time. The margin proved without any doubt transennellid. This is a particularly solid, comparatively inflated, trigonal species, yellowish white somewhat glossy with irregular commarginal ridges, a broad lunule, inside white with a rounded, broad, ascending pallial sinus. Going through the known American *Transennella*, then the Panamic *galapagana* appears closest. ***T. galapagana*** is quite similar to *modesta*, but more inflated, shorter and higher, and the pallial sinus is somewhat steeper ascending and shorter. The largest specimen from the Galapagos seen is 14.6 mm, it is here illustrated in a dorsal view and approaches *albocincta* in inflation and color closely. Most likely *Transennella albocincta* is the earlier name. However, as only limited Galapagos material is available, a comparison with equal sized Panamic specimens should be undertaken for a firm confirmation by local experts.

Following Keen (1971) ***T. omissa***, also found in Mexico, Jalisco, is perceived as true *Transennella*. The ventral undulations are weak and usually hidden under the periostracum. It is an uncommon, glossy species with a brownish zigzag pattern, smaller and more trigonal than *puella*.

Caryatis porrecta Römer, 1867 described without locality might well have been a juvenile *T. modesta*. Although it shares some features with the Caribbean type species, the much deeper pallial sinus excludes *Transennella conradina*. However, the unknown locality and the missing type recommend treating it as nom. dub.

On the other hand, ***Cytherea*** **(*Callista*)** ***pumila*** Römer, 1861 bears a clear locality N. Chile, Copiapo. Römer compared and considered it distinct from *pannosa*. It is currently unknown whether in Chile indeed a second, smaller, more solid, smooth species occurs. For the time being *T. pumila* is treated as possible synonym of *pannosa*.

SF36: ***Callpita***: Two uncommon species are known from American waters: The Panamic *Pitar* (*Lamelliconcha*) ***frizzelli*** Hertlein & Strong 1948 and the Caribbean *Cytherea* ***eucymata*** Dall, 1890.

Both have an ovate to ovate-elongate, moderately thin, inflated shape, slightly angulate posteriorly and broadly rounded anteriorly. The surface sculpture in small *eucymata* from Florida is the same as in *frizzelli* from the Gulf of California: regular dense, rounded ribs with narrow interspaces. They share the same callistid hinge, and a deep broad, rounded, ascending pallial sinus. The lunule is well demarcated, lamellate and brownish, an escutcheon is absent. Both share a waxen tan outside with brownish maculation or chevrons, often arranged in two darker radial bands. The inside in both is white with a rose-purplish flush umbonally, the inner ventral margin smooth. Both share the uncommon to rare occurrence and the same deeper water habitat. They are considered cognate.

By various authors these have been placed in *Pitar*, *Lamelliconcha*, *Callista*, or *Costacallista*. However, neither texture, nor shape, or pallial sinus is callistid. Neither is the shape, nor the sculpture, or the pallial sinus pitarid. Dall (1890) stated: "It is like none other on the east coast of America". Keen (1971) stated: "The rich color marking and heavy commarginal ribbing are unique among West American Pitars". As no genus fitting was found, here ***Callpita*** is proposed; meaning in between *Callista* and *Pitar*. As **type species** the better known *Cytherea eucymata* Dall, 1890 is here selected. The new genus is treated as feminine.

Whereas US *eucymata* are quite close to *frizzelli* in sculpture, the Brazilian specimens are glossier and may have a sculpture which is superficially reminiscent of *Costacallista*. However, the top part is still almost smooth, whereas in *Costacallista* it is equally strongly ribbed. Dall (1890) considered them conspecific and gave a range for *eucymata* from Cape Hatteras to N. Brazil. All modern authors followed his view.

SF37 ***Callista***: ***Megapitaria*** is morphologically synonymous to *Callista*, with an identical horizontal pointed pallial sinus; Grant & Gale, 1931 just compared their new subgenus with the marked distinct Caribbean *Macrocallista*. Furthermore, the definitions of ***Costacallista***, ***Striacallista*** and ***Notocallista*** are slim (see also Marwick, 1938).

For the time being all 4 are here still used as weak subgenera; possibly phylogenetic data may reveal additional information, otherwise synonymy is indicated. *Megapitaria* is applied for Panamic, *Costacallista* for tropical IND, *Notocallista* for Australian and *Striacalllista* for SA and NZ colder water callistids.

The monospecific ***Macrocallista*** is considered generically distinct in its elongated shape and its unique dentition, whereas *C. maculata* is a typical *Callista* as well recognized by Diaz & Puyana (1994). The monospecific ***Ezocallista*** is even more remote from *Callista* and regarding dentition, pallial sinus, and sculpture not closely related. It was originally described as *Saxidomus* and is indeed in between *Callista* and *Saxidomus*. Both, *Macrocallista* and *Ezocallista* contain huge species, with more than 150 mm among the largest venerids.

There is little doubt that the large ***Cytherea livida*** Philippi, 1845 from the "Pacific", very close to *C. chione* and with a star sculpture umbonally, is a further synonym of *C. aurantiaca*.

The **IND** *Callista* are numerous and difficult. "***Amiantis***" ***umbonella*** does not fit into the American *Amiantis*. Pallial sinus, shape, and dentition do not match the two American species. Instead *umbonella* is closely related to *Notocallista*, e.g. *semisulcata* and *impar* and placed within *Callista*, as concluded by Abbott & Dance (1986 pl. 358 sp. 8). Jukes-Browne (1913) also restricted *Amiantis* to two species *callosa* and *purpurata*.

Callista festiva also occurs in W. Australia, at least Shark Bay. Abbott & Dance (1986 pl. 358 sp. 6) illustrate a large specimen. *Festiva* is not a form of *chinensis*, not even close, but as originally described, close to *impar*. Compared to the latter, it is elongate-ovate, lighter and yellowish purple in color, the pallial sinus is smaller.

Callista diemenensis was neither recognized by Römer, Sowerby II, nor by Reeve. Instead *Cytherea innocens* Sowerby II, 1853 represents this species. Subsequently, *C. innocens* was synonymized by Smith (1885). Whereas Tenison-Woods (1878) stated locality error and did not accept *candida*, the somewhat worn and discolored BMNH syntypes of Deshayes' ***Dione candida*** from Tasmania proved identical to small *diemenensis* from Victoria and Tasmania. *C. diemenensis* is quite variable in coloring and changes shape during its growth. Hanley's simple mark with the purplish-brown streak internally beneath the umbones is still useful for most specimens. The striation is finer and more regular than in *disrupta*. Marwick (1938) moved ***diemenensis*** to *Striacallista* and Cotton (1961) confirmed this decision.

Smith (1885 p. 135) illustrated a strange specimen as ***C. disrupta*** from SE. Australia. He stated finely commarginally striate and internally deep purple. The specimen depicted appears quite compressed. A specimen well fitting has been found E. Mooloolaba, Caloundra, S. Qld. in 80 m. Instead of *disrupta*, this appears as deeper water end of range form of *diemenensis* enlarging the distribution range further north. The BMNH syntypes of *C. disrupta* are present, originally described from NZ, now correctly labeled Port Jackson.

At first, Lamprell & Whitehead (1992 sp. 533) illustrated a characteristic whitish, solid species as ***Callista*** (***Callista***) ***cf. semisulcata***. In the corrections Lamprell & Healy (1998 p. 256) confirmed *Callista* (*Callista*) *semisulcata* (Sowerby, 1851) and synonymized *Cytherea piperita* Sowerby, 1851. However, *Cytherea semisulcata* Sowerby II, 1851 is preoccupied by Lamarck, 1805 using *Cytherea semisulcata* for a French fossil. Instead, Tomlin (1923) also based on BMNH type material, earlier synonymized Sowerby's *piperita* from the Philippines with Lamarck's *florida*, whereas *Cytherea semisulcata* Sowerby II, 1851 from Australia was synonymized by Römer (1867) with *florida*. In addition, a closely related enigmatic species is Sowerby's *Cytherea obesa*, described without locality. All three BMNH-types ***-piperita***, ***semisulcata*** and ***obesa-*** are present and have been reexamined. *C. semisulcata* proved to be a large unique, elongate, anteriorly strongly sulcate specimen, labeled Australia. The type lot of *piperita*, labeled Island of Burias, Philippines, as originally described, consists of 6 specimens. At least 4 of the 6 specimens are found in Qld, but not in the Philippines. These conform to the depicted specimen of ***Cytherea piperita*** Sowerby II, 1851 sp. 51 pl. 136 fig. 175 and to Lamprell & Whitehead (1992 sp. 533). Here the largest specimen of the type lot is selected **lectotype** and the **type locality** of *C. piperita* is corrected to NE. Australia, Qld. From material studied from various Qld and GBR locations, Lamprell & Healy's view is shared and *C. piperita* and *C. semisulcata* are perceived conspecific. Obviously, this is a highly variable species in color, whitish with brownish marks, or with darker radial streaks, elongate to almost ovate in shape and in extent of sulcations; some specimens studied are completely smooth, others have strong anterior sulcations. The holotype of *C. obesa* consists of a broad, short, glossy specimen from unknown locality, smooth without any sulcations. It is likely that also *C. obesa* is only a special form. ***C. piperita*** represents specimens usually found around NE. Australia best and is here, against page priority chosen to represent. All located *piperita* seen so far came from NE. Australian waters.

The holotype of ***Chione apicalis*** Gray, 1838 described from unknown location is present in the BMNH type collection. It is not preoccupied by *Cytherea apicalis* Philippi, 1836 (= *Gouldia*) and was therefore unnecessarily renamed ***Dione grayi*** by Deshayes, 1853. The front side of the box reads now *Dione lamarckii*, Australia. This identification is perceived correct, making the all white *apicalis* a further synonym of the comparatively large, solid, glossy, but in color highly variable SAU ***Callista kingii***. The colored beaks of *apicalis* have been identically found in brownish streaked *kingii* from Port Lincoln. As concluded by Iredale (1924) ***C. rutila***, originally described from unknown locality, falls also into *kingii*.

The large, strongly ridged, trigonal ovate, orange type species of *Costacallista*, Linnaeus' ***C. erycina*** is usually misidentified. It is currently only known from India and Sri Lanka. The original European **type locality** is herein corrected to India. Most other species named so in modern literature are either *C. spuma* (syn. *lilacina*) with the lilac lunule from Australia and Indonesia, or then *grata* from the Philippines and China. Additionally, in the S. Red Sea, Aden, EAfr to Kenya and Arabian waters an elongate, almost smooth, large, more inflated species occurs, illustrated as *Callista "erycina"* by Oliver (1992 and 1995). However, this species has been correctly recognized as distinct and named ***Cytherea multiradiata*** by Sowerby II, 1851, though erroneously from the Philippines. Abbott & Dance (1986 pl. 358 sp. 12) illustrated it well from the Western Indian Ocean; the syntypes are present in BMNH. *Multiradiata* is a large species, measuring 100 mm in Arabian waters. It has been collected in limited numbers in UAE, Gulf of Oman, Khor Kalba. One specimen, undoubtedly conspecific, though somewhat paler in colors, was said to originate from NW. Austr., Monte Belo Isl. However, this find needs confirmation.

Cytherea lilacina Lamarck, 1818 is based on Chemnitz 6 32 338 and 339. Röding, 1798 based his ***Venus spuma*** on fig. 338. Both authors correctly concluded that Chemnitz had combined distinct species as *erycina*. Röding's name is an objective synonym and the older name. Römer (1866) stated this identity, but still used *lilacina*. However, *Venus spuma* has been recently used as valid name (e.g. Higo et al., 1999, B1192). Abbott & Dance (1986, pl. 357 sp. 9) placed *spuma* erroneously as synonym of *erycina* (which is Chemnitz 337). Thus, a reversal procedure is not possible and *Callista spuma* (Röding 1798) has to be used for the well known Lamarckian *lilacina*.

Tomlin (1923) further synonymized Deshayes' ***grata*** from China and the Philippines. However, this view is not shared. The Australian/Indonesian *spuma* stays smaller, has a much finer ribbing and is quite uniform in lilac-brownish color. *C. grata* grows much larger, is rougher ridged and more variable in color, brownish to white. The whitish form was presumably the base for Lutaenko (2000)'s erroneous *costata* record from Vietnam. *Grata* is well known from the Philippines, China to Okinawa and counts for most *erycina* records outside the Indian Ocean. Compared to *erycina* the shape is more elongate, less ovate, the lunule is purple-lilac and not yellow-orange. The ribbing is comparable, rougher than in *spuma*. 3 large syntypes are present in BMNH.

The old, uncommon whitish ***Callista costata*** "Chemnitz" Dillwyn, 1817 non Gmelin, 1791 is known from the SW. Indian Ocean (e.g. Mozambique, Reunion, Seychelles). Dillwyn, 1817 mentioned Sri Lanka, and Kirtisinghe's *C. chinensis* may be this species. It was renamed by Clench & McLean, 1936 as ***nioba***. As type they selected Chemnitz's figures. However, they overlooked Lamarck's *erycinella*. In their revision of Lamarck's *Callista* Lamy & Fischer-Piette (1937) demonstrated that Lamarck, 1818 named this white species ***Cytherea erycinella*** and confirmed Hanley (1843)'s earlier conclusion. The MNHN type specimen is illustrated in Fischer-Piette (1974 pl. 4 figs. 43-45).

A quite similar species occurs in W. Australia. This was named by Clench & McLean, 1936 ***bardwelli***, but as stated by Lamy & Fischer-Piette (1937) and accepted by Lamprell & Whitehead (1992) here Lamarck's ***planatella*** precedes. As pointed out by Clench & McLean *C. erycinella* Lamarck (*syn. nioba*) is more inflated and more elongate than *C. planatella* Lamarck (syn. *bardwelli*). Usually the former is whitish and the latter is darker colored.

Callista accincta Römer, 1864 was recognized by Hidalgo (1905) from the Philippines, by Kilburn (2000) from SE. Asia and found off N. Borneo in the South China Sea. It is an uncommon, comparatively small species, flesh colored with darker radial streaks, sometimes white dorsally. It is a typical *Costacallista* regularly densely ridged, also classified so by Kilburn. On the other hand, Lamprell & Stanisic (1996) illustrated a smooth, rather compressed true *Callista* with twice this size from New Caledonia as *accincta*. Their species is distinct. If it is not Kuroda's rare *politissima* then it is **undescribed**. Unfortunately, no material was available.

Callista pilsbry has been described from W. Kyushu. However, it appears much wider distributed and specimens from the Philippines and N. Borneo are perceived conspecific. It is small, glossy, rather compressed, elongate, whitish, variously sculptured with darker radials or marks. The largest specimens seen are 18.1 mm (Japan, Kii) and 23.9 mm (Philippines).

Callista roseotincta, originally described from the Philippines, but also much wider distributed, is similar, but shorter and somewhat more inflated.

Callista gotthardi Dunker is a rare species. It was originally described from Samoa, a location which could as yet not be verified. However, it has recently been rediscovered in the Andaman Sea, off W. Thailand. It appears to represent a deeper living *Callista*. The largest specimen studied measures more than 77 mm.

C. hagenowi is a valid species, neither a synonym of *florida* (Oliver), nor of *erycina* (Fischer-Piette). However, the type locality is erroneous, this species does not occur in the Red Sea. It is known from Mozambique and from the Andaman Sea, W. Thailand, also reported from other Indian Ocean localities. Spry's *Callista chinensis* from Tanzania may be this species. ***Cytherea spathulata*** Sowerby II, 1851 erroneously described from Australia and later even more remotely placed in China was synonymized by Deshayes (1853) and Reeve (1863). Their view is followed. *C. hagenowi* is quite close to the type species of *Callista*, though less heavy and more rostrate and with a special dark purple-brown radial streak at the posterior edge.

Callista pectoralis Lamarck, 1818 was identified by Deshayes (1835) as variety of *lilacina*. However, the MNHN-type (Fischer-Piette, 1974 pl. 4 fig. 46-47) closely resembles ***C. florida*** specimens found in the Gulf of Oman, UAE, Dibba. This special "lie de vin" color is not found in *lilacina*, rib sculpture, size and shape fit *florida* also much better. The top specimen in Oliver (1995 *C. florida* sp. 1207) matches *pectoralis* quite well. Thus, *Cytherea pectoralis* Lamarck, 1818 from unknown locality is synonymized with Lamarck's *C. florida*. Against page priority, the better known *C. florida* Lamarck, 1818 is here selected to represent this predominantly Indian Ocean species.

SF37a: **GEMMINAE**: The genetic analysis of Mikkelsen et al. (2006) demonstrated a close relation among ***Gemma/ Parastarte*** and ***Nutricola***. In addition, all three genera contain small and brooding species. Furthermore, all three genera only occur in a very restricted biogeography in American waters. All three are here placed within GEMMINAE.

Within a lot from Catalina Isl. (= type locality of *ovalis*) some specimens are more trigonal, some more oval, some ovate-trigonal, some are all white inside, some strongly purplish posteriorly and some white with a purplish streak. ***N. tantilla*** and ***N. ovalis*** are perceived intergrading and consequently synonymous.

SF38: ***Dosinia***: 2 revisions are available, Römer (1862) and Fischer-Piette & Delmas (1967). The latter is important, as many types are depicted. However, in some instances Fischer-Piette & Delmas over-synonymized (e.g. *tumida*, *incisa*, *histrio*, *exoleta*, and Iredale's subgenera). With more than 100 species, DOSINIINAE is still one of the most complex groups in venerids and many IND *Asa* are not well known. With a few exceptions (WAF, MED, PAN and CAR), *Dosinia* is Indo-Pacific, and adjacent waters (SAF, NZ and JAP).

Subgenera are considered essential to reveal relations and master complexity. Many authors hesitated in doing so or lumped all groups in *Dosinia*. Vaught (1989) even considered all 5 subgenera of Iredale synonymous to *Dosinia*, which they are not. Beu (2006) set this issue right. Here, all of Iredale's subgenera, except *Meridosinia* (= *Asa*) are recognized.

The approach most fitting is found in Fischer-Piette & Delmas (1967). It is here applied with the following additions: ***Kereia*** (MARW27), ***Fallartemis*** (IRE301), ***Semelartemis*** (IRE301), ***Pardosinia*** (IRE29), and ***Bonartemis*** (IRE29; Japanese authors). These are considered valid subgenera as well. All except *Bonartemis* are monospecific or contain just very few extant species.

Furthermore, ***Pectunculus*** is used instead of the junior *Orbiculus* (BEU06) and ***Pelecyora*** instead of the junior *Sinodia* (Keen in Moore, 1969).

Cyclinella is also placed in DOSINIINAE, following here the treatment of Coan (2001).

Pelecyora (syn. *Sinodia*) live in the Indo-Pacific, predominantly around Malaysia, *Sinodiella* also in WAF. *Sinodia* has been recognized as particular by Jukes-Browne and Fischer-Piette & Delmas. *Pelecyora* has been given full generic rank by Keen in Moore (1969), an action here followed.

All other groupings are considered subgenera of *Dosinia* following here Beu (2006).

Dosinia encompasses *Dosinisca* and *Dosinidia* of Dall and 5 American species. The crucial issue was the interpretation of the type species which is the Caribbean *concentrica* (true "Chama Dosin" of Adanson, with Senegal as erroneous type locality); the common West African *D. africana* is a typical *Asa*.

Surprisingly, the large ***D. incisa*** from Australia closest approaches this otherwise exclusively American *Dosinia* s.s., notably the type species *concentrica*. Römer noted this affinity as well, whereas Fischer-Piette & Testud misplaced *incisa* in *Orbiculus* (= *Pectunculus*). However, the genetic affinities are unknown. *Incisa* is tentatively placed here.

Dosinorbis is monospecific with a large, double lunuled Japanese species.

Kereia is monospecific, encompassing a rare, inflated NZ species with high spaced lamellae and divergent teeth. In addition, many NZ fossils are known.

Dosinella is accepted by both, Jukes-Browne and Fischer-Piette as distinct. It encompasses mostly uncommon, quadrate, usually flat, and light species, with weak to strong lirae, the pallial sinus is usually deep. Often irregular incised radial striae and a strongly developed, often expressed lunule are found. Most species are centered on Malaysia. They usually live subtidal in soft substrates. *Lamellidosinia* Zhuang, 1964 was based on *Artemis laminata* "Reeve" Zhuang, 1964 non Reeve, 1850. However, Zhuang's large ovate Chinese specimen is not Reeve's *Bonartemis*, but a true *Dosinella*, most likely Reeve's *corrugata*. His other *Lamellidosinia* are *Dosinella* as well, but most appear misidentified. *Lamellidosinia* is understood as synonym of *Dosinella*.

Pectunculus da Costa 1778: *Orbiculus* Megerle von Mühlfeld, 1811 is an objective synonym, sharing the same type species (JUK12). *Arthemis* Poli, 1791 is also the same. 3 robust, brownish-white species in MED and adjacent waters (WAF, Red) constitute *Pectunculus*.

Beu (2006) placed here ***maoriana***. However, this NZ species does not match this small group. It appears related to *incisa* and is tentatively also placed in *Dosinia* s.s. Genetic analysis is necessary to elucidate its relations.

Pardosinia was included by Fischer-Piette & Delmas in *Orbiculus* (= *Pectunculus*) However, Iredale's *Pardosinia colorata* (= *amphidesmoides*) characterizes a quite distinct, smaller, fragile, circular, compressed species, umbonally brightly colored, with a very deep, ascending pallial sinus. *D. amphidesmoides* is mainly known from Philippine and tropical Australian waters. *Pardosinia* is understood monospecific.

Semelartemis Iredale, 1930 was included by Fischer-Piette & Delmas in *Dosinella*. However, *Semelartemis* encompasses a unique fragile, elongate, strongly lamellate Australian species with a semelid texture. Lamprell & Whitehead (1992) did not mention the Australian type species *Semelartemis aetha* Iredale, 1930. From the OD, *D. mira* Smith, 1885 is the same and the earlier, valid name. It fits in elongated shape, thin fragile texture, and finely lamellate sculpture. Size, locality and color match as well.

Austrodosinia is restricted to New Zealand's heavy and coarsely ridged *anus*, with a small horizontal pallial sinus and a strongly striate anterior lateral.

Bonartemis is instead used for the colorful, lamellate IND species, centered on *histrio* and *juvenilis*. Here Japanese authors are followed. *Bonartemis* is based on *stabilis* Iredale, 1929 from Caloundra. *D. stabilis* is a valid Australian species (Lamprell & Whitehead, 1992 sp. 571), neither a synonym of the glossier *juvenilis* (as proposed by Lamprell & Whitehead), nor of *histrio* (as proposed by Fischer-Piette & Delmas). Whereas *stabilis* is heavy, coarsely lamellate and dull, *juvenilis* has the lamellae centrally depressed and is glossy. However, many *Bonartemis* species intermediate these two extremes (e.g. *amamiensis*, *cingulifera*, *histrio*, *extranea*). Often, *Bonartemis* have a commarginal interrib sculpture.

Fallartemis characterizes 2 predominantly Australian species with a unique sculpture. Fischer-Piette & Delmas included these either in *Pectunculus* (*sculpta*, *amina*) or in *Dosinella* (*conglobata*). However, the type species *amina* is a fragile, rounded species with a long hinge plate and a very deep, ascending pallial sinus. The sculpture is unique, fine commarginal ridges which become lamellate at both ends, strong radials posteriorly and anteriorly, give an almost cancellate sculpture. *D. sculpta* is closely related, the umbones stronger and anterior. Römer recognized this sculpture in two species, *sculpta* and his *conglobata*. As Römer's OD of *conglobata* fits *amina* well (sculpture, color, central umbones, pallial sinus) *conglobata* is understood as valid earlier name. *D.* (*Fallartemis*) *conglobata* has been recognized by Prashad also from Indonesian waters, whereas *sculpta* is currently only known from tropical Australia. Beu (2006) included here also the NZ *D. lambata*. Though similar in hinge and texture ***lambata*** has a quite distinct commarginal sculpture, but, it fits even less in *Asa*, as proposed by Fischer-Piette & Delmas. Iredale would have created a **new subgenus** for this silky, fragile species. It is here placed **s.l.**, awaiting further genetic results.

Asa: *Asa* equals Dall's *Dosinia*, but not Scopoli's. Dall based on a misinterpretation of the type species *Chama dosin*. A crucial issue is the synonymy of Jukes-Browne's *Phacosoma* with the older *Asa*, as proposed by Fischer-Piette & Delmas. Bastérot, 1825 p. 90 mentioned *Asa* just under *C. lincta*, which he understood as "testa suborbiculari, obliqua, inaequilatera, striis concentricis, confertis, tenuissimis, laevibus". Jukes-Browne split into the *africana*-group and the *japonica*-group. However, the definition of Jukes-Browne for his ***Phacosoma*** is weak. Marwick (1927) came to a similar conclusion comparing New Zealand and WAF species. Kilburn (2000) used *Asa* widely for SE. Asian species (also *tumida*) and Lutaenko (2005) for *japonica*. A comparison of the type species *D. lincta* (= *lupinus*) (i.e. *Asa*) and *D. japonica* (i.e. *Phacosoma*) did not reveal sufficient differences. Thus, Fischer-Piette & Delmas (1967), Kilburn (2000) and Lutaenko (2005) are followed and *Phacosoma* is considered synonymous with *Asa*. Furthermore, Iredale created ***Meridosinia*** for the NE. Australian *nedigna* which is subgenerically indistinguishable from *Asa*. *Meridosinia* is here synonymized. *Asa* is by far the largest dosinid subgenus and encompasses almost half of the extant *Dosinia*. Most are white, finely striate and ovate-trigonal; the pallial sinus is generally quite deep, the shells usually robust, and the differences among valid species often subtle. Approximately a dozen IND/JAP *Asa* are not properly understood as yet.

Dosinia (***Asa***) ***afra*** has been variously treated. Some authors consider it synonymous to ***lupinus*** (e.g. Fischer-Piette & Delmas), some as subspecies (e.g. Ardovini & Cossignani), and some as valid species (Römer, 1862; implicitly also CLEMAM, in not including the *afra* synonymy). These are without doubt related, but recognizably distinct. Very large specimens form Italy (30.2 mm) or Great Britain (32 mm) compared to very large specimens from WAF, Senegal (51.6 mm), show a much smaller maximum size and a trigonal ovate form, whereas the WAF ones reach almost twice this size and are consistently broader, posteriorly expanded. This is also well visible in Adanson's *Le Gordet*. The umbones in *afra* are more central and less pointed. These differences even led Römer to place them in different groups. The sculpture in Med *lupinus* is generally finer, sometimes almost smooth, whereas N. Atlantic *lupinus* (i.e. *lincta*) are usually stronger inflated. The type of Reeve's ***Artemis***

ferruginea from unknown locality was not located. It was variously interpreted, but remains a nom. dub.

Whether the SAF ***D. orbignyi*** is indeed the same as Dunker's true WAF species is doubtful. The SAF specimens grow larger, have a shorter pallial sinus and the pallial line is markedly removed from the ventral border. More material is needed from Namibia and N. Cape for a firm conclusion.

D. contracta is somewhat shaky. The specimens identified so by Fischer-Piette & Delmas (1967) and Oliver (1995) are all about 15 mm, whereas Chemnitz' specimen 7 38 403 appears larger, also Philippi mentioned a larger size.

D. tumida is often misunderstood and was heavily overloaded by Fischer-Piette & Delmas (1967), who confused here at least 4 species, some subgenerically distinct. The possible syntype of *tumida* is depicted in HIG01 B1206. This is an uncommon, large, ovate, strongly ridged species; the ridges are divided by grooves. This fits Lamprell & Whitehead (1992 sp. 560) and Allan's *lamellata* well. Gray's *tumida* was neither recognized by Reeve, nor by Sowerby II. Instead, as stated by Deshayes (1853), their *duplicata*, *lamellata* and *semilamellata* represent this species. Furthermore, whenever a locality was given, it was Australia. It appears that true *tumida* is confined to tropical Australia. ***D. labiosa*** from the Red Sea and Arabia with the heavy broad hinge is quite distinct; Fischer-Piette (1967 and 1974) corrected Römer's erroneous Australian type locality. The Japanese ***japonica*** with its ovate-elongated shape, a distinct pallial sinus and a much finer sculpture is not even closely related. This has been recognized by virtually all Japanese authors, whereas Russian authors (e.g. KAF97) often confounded it with the Australian species. However, Lutaenko (2005) set the issue right and reported this N. Pacific species from PGB as *Dosinia* (*Asa*) *japonica*.

D. roemeri is not a synonym of *tumida*, neither is ***D. exasperata*** (= *Dosinella*), nor ***D. troscheli***.

D. pubescens appears to be an uncommon *Dosinella*, not close to *tumida*, but easily confounded with the smaller *caelata*. According to Tomlin (1923), *D. eunice* and *D. ovalis* are synonyms. Both types are depicted in Fischer-Piette & Delmas (1967). *D. pubescens* was originally described as ovate, almost 40 mm species, with a strongly impressed rounded lunule, a deep, ascending pallial sinus and a prominent posterodorsal ridge. Neither for *pubescen*s, nor for *eunice*, or for *ovalis* was a location given. However, *pubescens* has been reported from the Philippines, Samar and Mindanao by Hidalgo (1905). As Hidalgo correctly referred to Philippi only and reported neither *tumida*, nor *japonica*, *pubescens* appears indeed to be an uncommon Philippine species. The whereabouts of the type is unknown.

Artemis calculus Reeve, 1850 described from the Philippines was allocated by Fischer-Piette to the NZ *subrosea*. However, concluding from OD and locality an *amphidesmoides* form with purplish umbones is more likely. The 3 specimens now present in the BMNH type collection as "*calculus"* are not close to the well known NZ species. However, none is close to Reeve's figure and OD either. Thus, *calculus* is treated as nom. dub.

D. scabriuscula appears to be the IND *D. "tumida"* of authors. It is as high as broad, rather solid. *D. specularis* Römer from Malaysia (type in Fischer-Piette & Delmas, 1967 pl. 8) appears the same.

D. roemeri has been depicted by Dunker, 1863 in Novitates sp. 42 from ?Guinea as white specimen with brownish-orange escutcheon and dark brown lunule. However, nothing close is known from WAF; instead in IND very similar forms occur. ***D. cumingii*** was earlier described by Reeve, 1850 from the Philippines, brownish streaked with a white lunule. *D. roemeri* and *cumingii* are comparatively thin, ovate-elongate in shape and have a fine commarginal sculpture, and a deep trigonal, moderately ascending pallial sinus. In Taiwan in the same lot brownish streaked specimens occur with brown or white lunule. In Japan, Honshu, Sagami Bay specimens have been found in various colors, all white, brownish streaked, even rose umbonally, lunule white or brown. *D. roemeri* and *cumingii* are perceived as color forms of the same species and here synonymized. *D. cumingii* is the earlier and valid name. *D. cumingii* is distributed at least from the Philippines through Taiwan to Honshu. ***D. malecocta*** nom. nov. *D. biscocta* Römer, 1862 non Reeve, 1850 though erroneously indicated from Japan is a distinct, more inflated, shorter and higher species from still unknown origin.

A small *Asa* is known from the Philippines, E. Malaysia and E. Thailand closely resembling *lupinus*. Reeve, 1850 described it as ***glauca*** and Sowerby II (1852) even synonymized it with Lovén's *comta*. ***D.*** (***Asa***) ***brevilunulata*** from the Philippines is perceived the same. The specimens studied are glossy, when fresh, whitish to slightly yellowish with a narrow, deep, ascending pallial sinus. The convexity increases during its growth. The maximum size seen is 24 mm, Swennen et al. reported it as of 27 mm from E. Thailand and the type *brevilunulata* is even slightly larger.

Dosinia circularis Römer, 1862 originally described from unknown locality, has a very small, narrow, trigonal, horizontal pallial sinus and a rougher sculpture than *fibula*. Fischer-Piette & Delmas, 1967 described a closely resembling species as *D.* (*Asa*) *altenai* from Sumatra and stated slight differences in shape, and pallial sinus. However, specimens found in W. Thailand are intermediate, whitish yellow in color. The differences between these two species appear too slim to keep them apart. *D. circularis* is currently known from a narrow area in the S. Andaman Sea. Kilburn (2000) reported *altenai* as *Asa* from SE. Asia as well.

D. laminata is a small, white *Bonartemis* described and known form the Philippines, also recognized by Römer (1862). It is close in shape to *juvenilis*, but not glossy and the fine lamellae erect. On the other hand, Lamprell & Whitehead (1992 sp. 554) depicted a quite distinct, elongated brownish species as "*D. laminata"* from NT. *D. contusa* Römer, 1862 non Reeve, 1850 from Port Cunningham appeared close, and might have been Lamprell & Whitehead's species. However, Fischer-Piette, 1974 renamed Römer's preoccupied species as *sanata* and designated a neotype from Madagascar. Therefore *Dosinia laminata* "Reeve" Lamprell & Whitehead, 1992 sp. 554 non Reeve, 1850 is here renamed ***Dosinia*** (***Bonartemis***) ***cunninghami***. Type locality as stated by Lamprell & Whitehead is Northern Territory. *D.* (*B.*) *cunninghami* is a common shallow water species around Darwin's shores. It is solid, posteriorly more expanded than *juvenilis* as adult. The sculpture is comparatively sharp and not centrally flat as usually in *juvenilis*. Reeve's *D. contusa* is also rounded; but the lunule is generally purplish and the pallial sinus is broader. Usually *D. cunninghami* is found all white, but light brownish specimens occur, often with a purple blotch beneath the umbones. A growth series demonstrates that the shape evolves, from rounded ovate to posteriorly extended in adults, and the pallial sinus as well: from broadly-rounded (as in Lamprell's figure) to elongate-pointed in adults. The maximum size seen is 35 mm (Darwin). This species is also known from N. Qld, Sarina Beach, near Mackay and might therefore represent *juvenilis* records from NE. Australia. True *juvenilis* is not known from Australia.

The somewhat similar ***D. eburnea***, 37 mm from Sri Lanka has been synonymized by Fischer-Piette with *juvenilis*. Based on the BMNH-syntypes, this view is shared.

D.* (*Bonartemis*) *cingulifera is depicted in Römer's Monograph, pl. 12. Fischer-Piette & Delmas (1967) classified it as *Austrodosinia*, i.e. *Bonartemis*. It is an uncommon white, deeper water species, strongly and sharply lamellate, with a trigonal pallial sinus. It is well illustrated in Swennen et al. (2001 sp. 202) as *juvenilis* or in Lamprell & Whitehead (1992 sp. 565 also as *juvenilis*). However, true *juvenilis* is a quite distinct glossy species with a broader pallial sinus. Above locations indicate that *cingulifera* may also be found in Indonesia. It slightly changes shape during its growth, from almost ovate (Römer's juv.) to higher than long. The largest *cingulifera* seen came from E. Australia, 38.9 mm.

Okutani, 2005 described ***Bonartemis amamiensis*** from a single specimen and a single valve off Amami, 107-126 m. This is an inflated, thin, deeper water *Bonartemis* with sharply edged commarginal lamellation. A lot with about a dozen single valves was recently dredged off New Ireland, 108-110 m. These resemble *amamiensis* closely except that the white base color is additionally sculptured with a tented brownish pattern. Nonetheless, these specimens are perceived conspecific, widening the known distribution and color range. The largest valve measures 25 mm.

A unique Australian species merits a further remark. ***D. levissima*** Fischer-Piette & Testud, 1967 described from Australia is the same as erroneously figured as *Dosinia "exasperata"* Lamprell & Whitehead (1992 sp. 573, NW.-N. Austr.). It was originally described as *Dosinella*. However, the unique shape and sculpture do not fit well into this group. It is placed as **s.l**. waiting for genetic results.

SF38a: ***Pelecyora***: Römer (1860) understood ***Artemis nana*** of Reeve, 1850 described from unknown locality as identical to the Panamic *Dosinia annae* Carpenter, 1857. Instead, Römer described ***D. derupta*** from Malaysia (type in Fischer-Piette & Delmas, 1967 pl. 1; BMNH seen). Zhongyan (2004 164 fig. C) used *derupta* for the same species from China. Scott (1994) illustrated Reeve's *nana*; he designated Hong Kong as type locality. I fail to perceive *derupta* distinct from the earlier *nana*. Furthermore, A. Adams, 1869 described ***gibba*** from Honshu, Boso Peninsula. *Gibba* appears to represent this species as well (DKR82 pl. 8 fig. 4-6). *P. nana* is a comparatively small *Pelecyora*, solid, rounded trigonal ovate, white, moderately inflated, strongly ribbed, sinus ascending and the broad, large incised lunule as typically found in *Pelecyora*.

Usually, related specimens from the Northern Yellow Sea are synonymized with *derupta* (e.g. Grabau & King, 1928). However, *derupta* was described by Römer, 1860 from tropical waters and fits instead *nana*. As illustrated and characterized by Grabau & King (1928 sp. 30), the Yellow Sea species is shorter, more inflated and more pronounced anteriorly. The lunule is large, broader and incised by a sharp line. As such this Yellow Sea species matches precisely the conditions described by Römer, 1870 for his ***D. corculum*** from China. Also the size fits, Römer gave 25 mm, Grabau & King stated "rarely reaching an inch" and the largest studied from there is 24.5 mm. Römer (1870) placed *corculum* between *derupta* and ***sphaericula***. The latter, even more inflated with reddish umbones has not been localized as yet.

Sowerby's BMNH type lot of ***Cytherea fluctuata*** originally described from Panamic waters contains 3 specimens and 2 distinct species. However, Reeve (1863 sp. 36) acted as first reviser and selected the larger, umbonally colored species to represent (= SOW510 pl. 136 fig. 185). This species is not a *Circe* but instead leans towards the IND *Pelecyora*. Closest appear Römer's *corculum* and *sphaericula*. Keen (1971 sp. 400) from Panama Bay is not related to either specimen of the type lot.

On the other hand, ***P. eudeli***, which is close in size, lunule, and shape to *nana*, has a much finer sculpture and appears distinct. It has been described from China, Xiamen. Robba et al. (2002 pl. 19. fig. 3 "*derupta*") reported it from Gulf of Thailand. Later, Fischer-Piette identified also Indian species as *eudeli*, enlarging its range.

Reeve, 1864, while describing his ***Cytherea gouldii*** from Malaysia did not recognize Römer's ***tripla***. Neither was Römer aware, that *gouldii* is a *Pelecyora*. Both have been described from the Cumingian collection, both from Malaysia, both types are depicted in Fischer-Piette & Delmas (1967). Specimens found in Malaysia are trigonal, rather fragile comparatively compressed, with a weak sculpture and a comparatively small ascending pallial sinus. The later described *D. gouldii* Reeve, 1864 is considered the juvenile of *D. tripla* Römer, 1860 and these two are synonymized. Even earlier Sowerby II, 1852 described ***Artemis subtrigona***. The OD points to *gouldii*. However, no locality was given and the type seems lost. *A. subtrigona* is best considered a nom. dub.

P. ceylonica is a highly variable species in shape and color. In the Gulf of Oman, side aside, all white, purplish, and yellowish specimens are found. The shape is orbicular, almost quadrate to ovate, often somewhat distorted. The pallial sinus is quite variable, but generally moderately to sharply ascending. The ridges are sharp and limited in number, the lunule comparatively small and often weakly marked. Fischer-Piette & Delmas synonymized *globa* and the BMNH type did not oppose.

Fischer-Piette & Delmas (1967) depicted the syntype of Reeve's ***Artemis trigona***, erroneously described from the Red Sea. The type species OD of ***Sinodia*** is a comparatively broad form, with a particular steeply ascending pointed condition of the pallial sinus. It is rather large, inflated, trigonal, and anteriorly subtruncate, with a broad lunule. Fischer-Piette & Delmas (1967) could not locate it. However, specimens collected in NE. Malaysia, intertidal, muddy area, are virtually identical, also in size. Here E. Malaysia, Pahang Pref. is corrected as **type locality** for

Pelecyora trigona (Reeve 1850). Robba et al. (2002) illustrated the same species from the N. Gulf of Thailand.

D*. (*S*.) *insularum Fischer-Piette & Delmas described from Batavia is distinct in somewhat broader shape, finer sculpture and more horizontal position of the pallial sinus. A specimen from the 80 mile beach near Port Hedland is perceived too close to be separated.

Cytherea bullata Sowerby II, 1851 described from unknown locality is usually placed as *Pitar* (e.g. Lamprell & Whitehead, 1992 sp. 527). However, specimens analysed from Qld instead recommend placement in *Pelecyora*. Neither sculpture, nor shape, or huge lunule, or pallial sinus, or dentition fit *Pitar* well.

Fischer-Piette's Indian species, usually described from single beached valves are difficult. ***D*. (*S*.) *katiawarensis*** might be valid, despite sharing some traits with *nana*. ***D*. (*S*.) *rajagopali*** Fischer-Piette, 1976 is quite pointed, the pallial sinus differs from *trigona*, however, Preston earlier described also from India his pointed ***Sinodia jukesbrowniana*** and Römer, 1870 even earlier ***Dosinia nuculoides***. Based on sufficient material these 3 should be compared. Furthermore, a series of ***D* (*S*.) *jousseaumiana*** should be compared to *ceylonica* to verify distinctiveness. Much more work is necessary to achieve a satisfying picture of these Indian forms.

SF39: ***Cyclina***: Many authors only list one species. Römer (1860) saw 7 species, Deshayes (1853), Jukes-Browne (1914) and Kilburn (2000) recognized 3 species.

Here, 3 species are recognized and biogeographically restricted. The only difference to Deshayes (1853) is the correction of the type locality of *orientalis*.

The type species ***C*. *sinensis*** is by far the most common, quite variably in shape and moderately also in color. It has a radial sculpture, and is usually purplish at the finely denticulate margin. It is known from S. China to Japan and also occurs in the Yellow Sea. It is the smallest species, generally 30-40 mm. However, a huge specimen from S. China, Beibu Gulf, broader than high, reached exceptionally 70.6 mm. Römer's *bombycina*, *pectunculus* and *intumescens* seem to belong here. The latter was originally described from unknown locality and then placed in New Caledonia (DKR sp. 51). As far as is known, *Cyclina* only occurs from Japan to the S. China Sea.

Artemis orientalis Sowerby II, 1852 has been accepted as distinct by the above mentioned authors. The type is depicted in HIG01 B1260s. It was originally described from Japan. However, neither texture, shape, huge size, the narrow trigonal pallial sinus nor the characteristic orange periostracum are found in any Japanese specimens. It was erroneously described from there, but has recently been rediscovered in NE. Borneo, Kudat. Further specimens are known from the Philippines, Palawan. The largest specimen seen is 72 mm. The **type locality** of *Cyclina orientalis* is here corrected to NE. Borneo, Kudat.

Kilburn (2000) recognized *A. inflata* Sowerby II, 1852 as the third species. However, Sowerby II stated for his *inflata* "without the crenulations on the inner edge" which excludes *Cyclina*. As Sowerby II saw in the other *Cyclinella* no lunule either, *Artemis inflata* seem to belong into *Cyclinella*. However, no locality was given and no type material was found, *inflata* was considered nom. dub. by Fischer-Piette and Vukadinovic (1972), confirmed by Coan (2001). Instead, Deshayes and Jukes-Browne recognized ***C*. *flavida*** as third species. *Flavida* is distinct, white, without purplish traces, inflated, with a yellowish periostracum in juveniles and dark brown in adults. It has a strongly ribbed commarginal sculpture, radials are weak or absent. In shape it is quadrate to slightly higher. *C. flavida* has been described from China. Currently it is reliably known from the Yellow Sea; but it may also occur in Korean waters. It is not common, and lives in 15-20 m in fine sandy and muddy bottoms. The species illustrated in Zhongyan (2004 pl. 169 fig. K "*sinensis*") said to reach 59 mm is instead *flavida*. The largest *flavida* seen is 56.8 mm. ***Cyclina spendendida*** Römer is considered the same as *flavida*, but with an erroneous type locality. *Flavida* is currently not known from mainland Japan, where only *sinensis* has been locally commonly found.

SF40: **CLEMENTIINAE**:

4 genera are placed here. Except *C. papyracea* and *K. ponsonbyi* all species are scarce and not well known.

Clementia: Despite more than a dozen available names, I fail to recognize more than one large IND species. Habe (1971 pl. 59 sp. 19) synonymized ***C*. *vatheliti*** Mabille, 1901 from Japan and this course is followed. ***C*. *papyracea*** is generally a thin, comparatively fragile, white species, but highly variable in extent of surface sculpture and shape. Weakly ribbed forms are known from Qld, Phil and Japan, strongly ribbed forms as well. The maximum sizes of Japanese, Philippine and Australian specimens are almost the same. The shape is usually trigonal-ovate, but almost quadrate (i.e. ***similis***) to short, tumid forms (i.e. ***annandalei***) occur. *Papyracea* is found in silty muddy bottoms, usually subtidal. Meanwhile, it ranges from the Med through Australia to Japan.

According to Oliver (1995) ***C*. *asiatica*** is a distinct, small species, occurring in Arabian waters. I have seen too little material for a firm opinion on validity.

Egesta: This rare American group with one large, rather solid and much heavier extant Panamic species is perceived as only superficially similar to *Clementia* and here generically separated.

The monospecific ***Compsomyax*** has been well treated by Coan et al. (2000).

Kyrina: 3 congeneric, rare species were described in 3 distinct genera/families, namely the NW. Indian Ocean *kyrina* in the earliest ***Kyrina***, the Philippine *granulifera* in the later ***Terentia*** and the Australian *rubiginosa* in the youngest ***Velargilla***. Obviously, all 3 genera have been created for small, whitish, fragile, elongate clementinids with a divaricate sculpture. Their muddy habitat is shared with *Clementia*.

K*. *kyrina is known from the Red Sea and the S. Persian Gulf and has been personally collected in the Gulf of Oman, UAE, Dibba. ***K*. *granulifera*** has originally been described from the Philippines. Fischer-Piette (1974) stated that the Philippine species is only known from the Cumingian collection. These two are close. However, concluding from the broader and very deep pallial sinus, extending about 2/3 of shell lengths in *kyrina*, and barely midline in the BMNH *granulifera* type, they represent distinct species. *Granulifera* is with 23.3 mm also larger than *kyrina*, with slightly less than 16 mm and seems higher in shape. Both species are all white, rosy-yellow colored on the beaks.

The Australian ***K. rubiginosa*** is similar in size and shape to *granulifera*, but with a rose umbonal portion and with an even shorter pallial sinus. As indicated by Lamprell & Whitehead (1992 sp. 615) there is very little doubt that ***Petricola parvita*** from SA is the same. Other than stated by Cotton (1961), the shape is the same, the sculpture as well, the color is found very similarly in the BMNH *rubiginosa* type. Unless the not mentioned pallial sinus would prove marked distinct, these two are considered conspecific. Brazier in Lamy (1923) had earlier synonymized Petterd's *tasmanica*, intermediate biogeographically and in size (15 mm) and as such connecting *rubiginosa* and *parvita*.

Quite similar to *rubiginosa* are juvenile ***P. ponsonbyi*** from S. Natal. They share shape, colors and dentition, but the sculpture is rougher and the pallial sinus deeper and as such closer to the *kyrina*-condition. Adult *ponsonbyi* share some superficial features with *Petricola*, but not dentition and habitat. Small, conjoint specimens have been found beached in Park Rynie, a larger 25.7 mm complete specimen in Knysna, at low tide on sand flats. *K. ponsonbyi* does not appear as petricolid borer, but a sand and mudflat *Kyrina*.

Another species which belongs here seems to be ***Venerupis texta*** Deshayes, 1853 from Australia, depicted by Sowerby II (1874 sp. 9). Sowerby indicated NE. Australia. Inferring from his picture, this species grows larger than 30 mm. The type was described from a BMNH specimen. However, this species is not isolated, but it was not yet traced in the general collection. Concluding from the large pallial sinus and the huge size, *texta* may be distinct from *rubiginosa*. Thiele (1930)'s 9 mm *texta* record from SWA, Cockburn Sound may instead be referable to *rubiginosa*. The material at MfN should be reexamined.

Finally, ***P. pseudolima*** Souverbie & Montrouzier, 1862 from New Caledonia, also a large 31.5 mm species seems to belong here. The type may be in Bordeaux.

Needless to say that most *Kyrina* species are only known from type material or from very few specimens and that much more work is necessary to elucidate this group of currently up to 6 mostly rare venerids.

In placement of *Kyrina* within CLEMENTIINAE, Oliver (1995) is followed. He based on three cardinals in both valves. Phylogenetic data is not known.

SF41: **TAPETINAE**: This is another large subfamily. Many species display a stunning variability and 5 to 10 synonyms per recognized species are not uncommon.

Two revisions are available: Römer (1870-72) and Fischer-Piette & Métivier (1971). The latter is important as many types are depicted.

Many genera placed here follow convention. Their affinities with TAPETINAE are unconfirmed. This affects in particular ***Jukesena***, ***Gomphina*** and ***Gomphinella***, but also ***Notopaphia***, ***Paphonotia*** and ***Irusella***.

Tapes has recently been reviewed by Matsukuma (1986). He accepted 8 species, a view largely followed. However, *Tapes deshayesii* is considered indistinguishable from *T. sulcarius*. *T. araneosus* Philippi is a valid Australian species, not a synonym of the European *virgineus*. *Tapes conspersus* is the earlier name of *T. turgidus* (syn. *T. dorsatus*), not a synonym or *literatus*; *Paphia guttulata* is an objective synonym of *conspersus*. The range of *T. platyptycha* is enlarged to include Mozambique, Nacala Bay and Israel, Eilat. Finally, the European *virgineus* is removed from *Tapes* and placed in *Polititapes*. Thus, 7 *Tapes* are recognized from IND and adjacent JAP. *Tapes* is an exclusively Pacific genus.

T. literatus has many color forms (e.g. *radiata*, *nebulosa*, *punctata*), but all share the same shape, a compressed, posteriorly rounded form and the similar fine sculpture. However, ***T. conspersus*** Gmelin, 1791 (= *Venus adspersa* Chemnitz 7 42 438, = ***guttulata*** Röding, 1798; Fischer-Piette & Métivier, 1971 pl. 4 figs. 1-3 (type), plus 4-8 (Trincomalee), non 9 (= *literatus*)) is a distinct species, well characterized by Chemnitz. It has an almost quadrate shape, truncate posterior, strongly attenuate anteriorly. It is more inflated and has a much rougher, lamellate sculpture compared to *literatus*. Inside, as stated by Chemnitz it is usually yellow. *Tapes turgidus* is not distinguishable. Lamarck, 1818 did not correctly interpret Chemnitz' *adspersa*; as demonstrated by Lamy & Fischer-Piette (1939). Both specimens of Lamarck's *adspersa* are instead *literatus*. Instead, Lamarck created for Chemnitz' misunderstood species *V. turgida* and *dorsata*. These two are conspecific and here synonymized with Gmelin's earliest name. *Tapes conspersus* is well known from Australia (as *dorsatus*) and the Philippines (as *turgidula*). ***Tapes watlingi*** from Sydney is a huge, elongate, rather inflated species. It was synonymized by Fischer-Piette and Lamprell & Whitehead (1992). It shares indeed many features with the moderately variable *conspersus* throughout its range and seems too close to be separated.

Whereas Fischer-Piette synonymized ***T. platyptycha*** with *literatus*, Matsukuma removed it from this unwarranted synonymy and considered it a valid species (type HIG01 B1225). *T. platyptycha* is, in general, smaller, shorter and higher than *sulcarius* with a shallower, more rounded pallial sinus. The coloring is more uniform, paler than in *sulcarius*, the umbones often reddish. *T. platyptycha* is widely distributed from Japan, Philippines, Indonesia to EAfr, Mozambique, Nacala Bay into the Red Sea, Eilat, but is not reliably known from Australia. *T. platyptycha* is less common than *sulcarius*.

Lamarck's 65.6 mm type of ***T. sulcarius*** is present in MNHN. Lamarck's specimen most likely originated from the W. Indian Ocean. The specimen illustrated, which closely resembles the MNHN type in size, color and sculpture was collected in the Gulf of Oman. Consequently, Oman is here clarified as **type locality**. Very close is also Oliver (1992 pl. 43 fig. 1, BMNH). Hanley's ***deshayesii*** has been described from smaller, stronger colored Philippine specimens. However, *sulcarius* is highly variable in shape, color and density of ribbing. No consistent differences were found to allow recognition of *deshayesii* as valid species. It is here synonymized. As illustrated, virtually the same specimens were found in the Red Sea/Oman as in Borneo/Philippines. *T. sulcarius* is less widely distributed than *platyptycha*. It is mainly known from the Indian Ocean, extending to Australia and the Philippines. ***T. rodatzi*** (DKR sp.13) is well within its variability as concluded by Matsukuma (1986).

Matsukuma recognized that Römer's *Venus araneosa* is not identical to Philippi's earlier species and renamed it *sericeus*. As characteristic for ***sericeus*** he stated a quadrate form.

On the other hand, Philippi's more ovate *araneosa* was synonymized with the European *aurea*. However, Philippi's *Venus araneosa* has been described as larger than 40 mm, all white with a characteristic spiderweb pattern. Furthermore, Philippi stated a clear sculpture, with rather deep sulci and a deep escutcheon. All these traits are not typical for the European *Polititapes aureus*. Lamprell & Whitehead (1992 sp. 584) illustrated *"platyptycha"* from Australia which instead fits the quadrate true *sericeus* of Matsukuma. On the other hand, their "*sericeus"* sp. 587 is distinct. It is an uncommon, large, rounded-ovate species, with a typical spiderweb sculpture, currently only known from tropical Australia. It is considered to be the true ***Tapes araneosus*** (Philippi 1847). It fits Philippi's OD in pattern and size, has the lanceolate lunule, and especially also the narrow, deep escutcheon not found in *aureus*. Smith (1884 p. 97) obviously came to the same conclusion and reported *T. araneosus* from Darwin, 8-12 fms.

SF42: ***Polititapes***: Some MED/WAF species (*rhomboides* and *virginea*, *aurea* and *lucens* as well as *dura* and *rufiscescens*) were desperately placed in *Tapes*, in *Venerupis*, or in *Paphia*. However, they fit nowhere properly. On the other hand, Chiamenti, 1900 created a neglected genus *Polititapes*, type *Venus aurea*, SD Dall, 1900. As stated by Jukes-Browne (1914), *Polititapes* fits above mentioned, closely related, rather dull, predominantly commarginally ribbed species with a rounded horizontal pallial sinus well. The few radials are weak to vanishing. Jukes-Browne mentioned that in *Polititapes* the siphons are united for half their length, whereas in *Tapes*, *Paphia*, *Ruditapes decussatus* these are entirely separate; the foot in *Polititapes* is comparatively small, whereas in *Paphia* and *Tapes* they are large. Whereas *Tapes* and *Paphia* are Indo-Pacific, *Polititapes* is Atlantic only. *Venerupis* has a distinct, often wrinkled, irregular sculpture, a much stronger nymphal ridge and a deeper pallial sinus. Furthermore, *Venerupis* has a distinct dentition and is in general elongate, whereas *Polititapes* encompasses rounded-ovate species, with a well marked lunule. Genetic data for the WAF *Polititapes durus* show either equal distance to *Ruditapes* and to *Paphia* (but no *Tapes* included, KAPP06), or a closer relation to *Ruditapes* (but no *Venerupis* or *Tapes* included, MIK06). Here *Polititapes* is recognized as **valid E. Atlantic genus** with 3 highly variable species.

The type species, SD Dall, 1900 ***Polititapes aureus*** is profusely variable in color, pattern and shape. It received approximately 50 specific and varietal names. The new French school headed by Locard and Bucquoy, Dautzenberg, & Dollfus excelled (CLEMAM lists many of these unnecessary names). One form merits attention: *Tapes* (Locard, 1886) or *Venerupis* (CLEMAM) or *Paphia* (Repetto et al., 2005; Poppe et al., 1998) *lucens*. ***Polititapes lucens*** is tempting; it is in extremis glossy, the commarginal sculpture lost. However, neither shape, nor dentition, or pallial sinus differs and a gradual series from sculptured to smooth forms is available. Thus, *lucens* is here considered a synonymous form. In addition, *Tapes acuminata* Sowerby II, 1852 is another smooth form and was later considered as juvenile of *floridella* (= *aureus*) by Sowerby II.

Dodge (1952) revised the Linnean species. For *Venus virginea*, he selected a specimen from the Linnean collection, agreeing with the OD Linnaeus, 1767, identified it with Reeve (1864 pl. 4 sp. 17a) *Tapes virginea*, and corrected the type locality to the British Isles. Reeve's picture is unanimously considered identical to *Venus rhomboides* Pennant, 1767 and *Venus edulis* "Chemnitz". I see no reason why Dodge's action should not be valid, ending 250 years of fruitless discussion. Thus, ***Polititapes virgineus*** (Linnaeus 1767) is accepted here as valid name for this well known European species. *V. rhomboides* is a junior synonym.

Venus dura Gmelin, 1791 is close to *virgineus*. Though somewhat glossier, it has a similar surface sculpture, escutcheon, lunule, and pallial sinus. As in the type species *aureus* and in *virgineus*, the two larger cardinals in the right valve and the central cardinal in the left valve are strongly split. Thus, it is placed here, well recognized by Nicklès (1955) as *Polititapes*. Having studied many WAF specimens, I fail to recognize *Venerupis rufiscescens* from Senegal as distinct. Thus, Sowerby II (1852 figs. 3-5), Reeve (1864 figs. 13a-b), Nicklès (1955), Bernard (1984) and Gofas et al. (1986) are followed in recognizing only one variable *Polititapes* along the WAF coast. *Polititapes durus* is highly variable in shape, convexity, somewhat less in ribbing (considered decisive by Fischer-Piette), but usually yellowish with brownish spots or rays. ***Tapes alba*** Deshayes was originally described from SWA, Perth (type Fischer-Piette & Métivier, 1971 pl. 2. and 3), but not found there again nor reliably reported from anywhere else. From the OD it is a true *Polititapes* commarginally ribbed, with an elongated lunule and a rounded horizontal pallial sinus. Both, Römer and Fischer-Piette placed it close to *durus*, but considered it valid. Instead, the smaller of the two BMNH syntypes still bears traces of a brown-yellowish pattern on its side and traces of yellow colored umbones. *T. alba*, erroneously localized, with a misleading name is instead a larger, bleached *Polititapes durus* from WAF.

SF43: ***Paphia***: The type species ***P. rotundata*** (Linnaeus 1758) has been described from the Indian Ocean. It is known from India, extending to Mauritius and W. Thailand. True *rotundata* (syn. *alapapilionis* and *papilionacea*) does neither occur in Australia, nor in China.

P. exarata and *lirata* are sometimes confounded. However, ***P. lirata*** is a much larger, glossier, rougher lirate species, whereas *exarata* is smaller, thin, inflated, with very fine, sharp lirae, with a reddish flush internally beneath the umbones. Both are uncommon. *P. lirata* reaches almost 85 mm (China, Fujian), but does not occur in mainland Japan waters. *P. papilionacea* Zhongyan (2004 pl. 170F) is this species as well as is *P. alapapilionis* (Zhuang 1964). Philippi gave no type locality. The specimen depicted, though smaller, closely resembling Philippi's type in sculpture and colors and originated from Taiwan, which is here clarified as **type locality**. Recognition of this species is not easy, as a remarkable change in shape is found during growth. The illustrated larger specimen from China, Fujian is with 84.9 mm the currently largest known species and witnesses.

P. exarata is an untypical *Paphia*, even close to certain *Protapes* in liration. It seems confined to Chinese and Japanese waters, reaching 47 mm (Zhejiang); the type locality Red Sea is erroneous. However, Bory de Saint-Vincent, 1827 earlier validly proposed ***Venus exarata*** based on Enc. Meth, p. 152, pl. 264 fig. 4a-b. This species is not a *Paphia* but qualifies as nom. dub. However, it is by no means a nom. nud. Thus, ***Venus exarata*** Philippi, 1846 non Bory de Saint-Vincent, 1827 is here renamed as ***Paphia*** (***Paphia***) ***philippiana***. Philippi's misleading **type locality** Red Sea is here corrected to Japan, Kochi Pref., Tosa, from where specimens have been studied.

On the other hand, *Paphia lirata* of Zhuang (1964 pl. 8 fig. 5-6) and Zhongyan (2004 pl. 170 H) is a distinct, unnamed *Paphia* known from the South and East China Sea. *Paphia lirata* "Philippi" Zhongyan, 2004 non Philippi, 1847 is here renamed ***Paphia*** (***Paphia***) ***kreipli***. Zhongyan gives EChi, Fujian and SChi, Guangdong and Hainan, whereas Zhuang states East and South China Sea. Specimens have been studied from Guangdong, Zhuhai and from Beibu Gulf; the largest is 67.8 mm. Characteristic, as stated by Zhongyan, is a comparatively short pallial sinus, and an ovate, comparatively high shape. Often the inside and the lunular area are purplish tinged. Compared to its closest relative, *P. euglypta*, *P. kreipli* is comparatively higher in shape, the liration is finer, and the ascending pallial sinus is with only about 2/3 of length significantly shorter. True *P. lirata*, illustrated by both Chinese authors under *alapapilionis* respectively *papilionacea*, has an even finer sculpture, the position of the umbones is more anterior and less central; *P. lirata* also grows larger and reaches 85 mm (Fujian). True *P. rotundata* (syn. *alapapilionis*) is an Indian species and does not occur in China. The new name honours Kurt Kreipl, an appreciated friend with a marvellous and educative shell museum in Germany, open to the public. He procured the first specimens and therefore launched the inquiries into this difficult complex.

P. lirata is reported from the Philippines. It is therefore not excluded that *P. "exarata"* Lamprell & Healy (1998 sp. 772), which is not close to Philippi's true *exarata*, represents instead *lirata*. However, an undescribed Australian *Paphia* can not be ruled out. Unfortunately, no material of this uncommon Australian form was available.

Fischer-Piette & Métivier (1971) confused 3 distinct species under ***Paphia semirugata*** Philippi. Only their pictures pl. 10 figs. 6-10 are understood to represent true *semirugata*. Such shells are known from Guangdong (63.8 mm, coll. auth.), Vietnam (HYL03), Philippines, Camotes Isl., from E. Thailand (LYN09; Swennen et al., 2001) and from Indonesia, Makassar Strait, but not from Australia. As stated by Philippi, *semirugata* is comparable to *rotundata* but shorter and more inflated. As in some specimens the posterior part is almost smooth, it is quite likely that *Tapes vernicosa* Reeve, 1864 non Gould is indeed the same, also living in Seto Inland Sea Japan as stated by Fischer-Piette & Métivier (1971) and Higo et al. (2001); definitely, Tomlin (1923)'s *undulata* synonymy does not match. Philippi did not give a type locality for *semirugata*, the specimens most closely resembling Philippi's fig. 4 were found in E. Thailand, Gulf of Thailand which is here clarified as **type locality**. Furthermore, Fischer-Piette & Métivier confounded also ***Tapes declivis*** Sowerby II, 1852 with *semirugata*. They stated not having found the types in the BMNH; however, their pl. 10 figs. 11-15 (coll. Cuming, Philippines) represent this species, well depicted also by Reeve (1864 sp. 23). *T. declivis* is distinct in shape, higher and more rounded ventrally. It has been described from the Philippines and is also found there (Springsteen & Leobrera, 1986 pl. 85 sp. 3 erroneously as *schnelliana* throughout the Philippines, stating a maximum size of 100 mm). However, all *declivis* seen so far have been less than 70 mm. Finally, Fischer-Piette & Métivier confounded also ***Tapes polita*** from Australia with *semirugata*. Here also, they stated not having found the type. However, their pl. 10 figs. 1-5 represent precisely Sowerby's Australian species. This species is not found in Sydney, as originally indicated by Sowerby II, but is known from NW. Australia. Allan (1962), added N. Qld and NT and illustrated it in color pl. 39 fig. 8 as ***wellsi***, whereas this species is lacking in Lamprell & Whitehead (1992). ***Paphia wellsi*** Iredale, 1958 based on Allan's pl. 39 fig. 8 is a synonym of *polita*, but not of *semirugata*. All specimens seen are glossy, only moderately inflated, trigonal-elongate, cream-white with the special brownish pattern. Also in *polita* some specimens are almost smooth. The general appearance is, as stated by Reeve (1864 sp. 49) quite similar to *textile* and thus distinct from true *semirugata*. *Tapes polita* Sowerby II, 1852 is not preoccupied as erroneously stated by Iredale (1936). *Venus polita* Lightfoot, 1786 is a nom. nud. (SHE). *Venus polita* Röding, 1798 is instead a valid *Lioconcha*.

In addition to *P. polita*, in Australia two other, larger *Paphia* occur, variously named. Whereas Allan used *sulcosa* and *transfusa*, Lamprell & Whitehead used *semirugata* and *crassisulca* and Fischer-Piette used *crassisulca* and *inflata*. This latter view is followed. True *semirugata* is not known from Australia, but is centered on the Philippines. The compressed Australian species similar to Philippi's *semirugata* is in fact Lamarck's ***crassisulca***, described originally from Shark Bay, WA and also found there. The type is depicted in Fischer-Piette & Métivier (1971 pl. 9). It is elongate, more trigonal, posteriorly short, subangulate and not broadly rounded as Philippi's *semirugata*. It is more compressed than *inflata* (syn. *transfusa*). *Crassisulca* is Lamprell & Whitehead (1992 sp. 606 "*semirugata*"). Thus, the well known NW. Australian "*semirugata"* is instead Lamarck's *crassisulca*. ***Tapes meroaeformis*** Sowerby II, 1853 from Australia was synonymized by Fischer-Piette. The BMNH syntypes confirmed their view.

The other large Australian *Paphia*, comparatively shorter, higher and notably more inflated, is widely distributed, from SWA through NT to NSW. It is "*crassisulca"* of Lamprell & Whitehead (1992 sp. 607) and Wells & Bryce (1988 sp. 638), but not of Lamarck. Fischer-Piette & Métivier (1971 pl. 9 figs. 2-6) depicted it as *inflata*. Earlier Angas, followed by Hedley (1918) identified this species also as *inflata*. This was not accepted by Iredale (1936) who created a new species and even a new genus ***Acritopaphia transfusa***. However, as Deshayes OD matches quite well, the views of earlier Australian authors and Fischer-Piette are here confirmed. ***Paphia inflata*** is considered the valid name for this second inflated Australian *Paphia*, which reaches 78.4 mm (SWA, Rockingham). *Acritopaphia* is, without doubt, a mere synonym of *Paphia*.

Philippi, 1847 described and 1848 (PHIL3 pl. 7 fig. 1) depicted a large ***Venus sulcosa*** from unknown locality. This species is misunderstood. It is usually located in Australia and was even synonymized with Lamarck's *crassisulca*. However, Australian *crassisulca* are not known to reach Philippi's size of almost 65 mm. Their shape is posteriorly more compressed and the ribs are less and rougher. On the other hand, specimens are known from the Philippines which even surpass Philippi's size. Significantly distinct from the Australian species is also the lunular area, which is clearly delineated. Philippi's *sulcosa* is here reinstated. The largest Philippine specimen seen is 66.5 mm. *Sulcosa* appears as quite uncommon species, the exact habitat and its distribution, except Philippines, are as yet unknown.

P*. *undulata and ***P*. *textile*** are sometimes confounded (e.g. Iredale, 1936; Oliver, 1992 Red Sea, corrected by Dekker & Orlin, 2000). However, *P. undulata* has an undulated sculpture, whereas *textile* is smooth as adult. Both may have the same yellowish color and tented pattern. *P. textile*, as stated by Römer (1870) is less common, grows larger, up to 75.8 mm (Gulf of Oman) and is somewhat heavier and more inflated. It rarely occurs also in Japan (Yamaguchi Pref.). Kuroda & Habe, 1971 created ***Neotapes***, type OD *Venus undulata* Born, 1778. As the irregular, wavy, undulated sculpture is indeed unique in *Paphia*, *Neotapes* is here applied as weak subgenus. Exactly this sculpture was described by Iredale, 1936 for his ***scordalus*** from Sydney, whereas he erroneously considered *textile* and *undulata* the same. Undoubtedly *scordalus* is a synonym as concluded by authors. For the smooth *textrix* (= *textile*) some authors use ***Paratapes*** subgenerically (e.g. OLI96). However, as *P. polita*, *semirugata* and small *inflata* may also be partially smooth *Paratapes* is considered synonymous to *Paphia*, based on intergrading characters. Furthermore, Römer's *Textrix* which was the base for Stoliczka's *Paratapes* meant originally *Paphia* as a whole, including even *Protapes*.

Bory's ***Venus reticulina*** is based on Enc. Meth. 283 fig. 1a-b. There is little doubt that *reticulina* is a further synonym of *textile*.

SF44: ***Protapes***: *Protapes* has clear characteristics and encompasses a small group of uncommon, poorly known IND species. Whereas in most tapetinid genera far too many names exist, here too little are available. Fischer-Piette & Métivier (1971) recognized 2 species, mixing most with *malabarica* Chemn. (= *gallus*), whereas Römer (1870) recognized 4 species/ varieties. Oliver & Glover, 1996 treated this group, described some new species and recognized Lamarck's *sinuosa*. Here 8 *Protapes* are recognized, of which 2 are renamed.

The type species ***P*. *gallus*** originally described from E. India is quite variable in shape, almost trigonal to strongly attenuate anteriorly. However, it is moderately compressed, with a quite regular, dense sculpture and rounded ribs. It extends from India through Thailand into Chinese waters (SCO94; ZHO). The species illustrated in Oliver (1992 pl. 43 fig. 7) from the "Red Sea" is indeed *P. gallus*, but this species is not known living in this area (DEK00). Reeve, 1864's ***Tapes lentiginosa*** described from China, now labelled Sri Lanka in BMNH, as well as his *Tapes malabarica* represent the variability found in *gallus* and are synonyms.

Following Oliver & Glover (1996) ***Venus "sinuosa"*** Lamarck, 1818 from Arabia is distinct. They based on "syntypes" from MHNH, Paris. However, Lamarck did not indicate any *sinuosa* material in Paris. The species present in Geneva was earlier illustrated by Fischer-Piette & Métivier (1971 pl. 9 figs. 7-10) and was declared "type". This MHNG specimen has recently been restudied. Surprisingly, this proved to represent instead the Australian, much smaller and sharper ridged species, here renamed *roemeri*. It has nothing to do with the much larger Arabian species. Furthermore, this MHNG specimen is not accompanied by an original Lamarckian label, nor does it bear an ink mark. Its origin is highly doubtful and it is not recognized as Lamarck's type. Furthermore, Lamarck's name is preoccupied by *Venus sinuosa* Pennant, 1777. Pennant's species has been validly proposed, according to Sherborn, and is a synonym of the European *Mysia undata*, according to Sowerby II (1852, *Lucinopsis*). *Venus sinuosa* Turton, 1822 non Pennant, 1777 is according to CLEMAM a synonym of *Polititapes aurea* and *Venus sinuosa* Donovan, 1801 non Pennant, 1777 might be a synonym of *Thracia distorta* (LAM31; OLI02). Consequently, ***Venus sinuosa*** Lamarck, 1818 non Pennant, 1777 without locality, without type material and variously interpreted is here declared a **preoccupied nom**. **dub**.

Oliver & Glover (1996) demonstrated that their "*sinuosa*" is a large uncommon *Protapes* from the Western Indian Ocean. However, their Philippine and Chinese records are not shared and refer to distinct species. Fortunately, the holotype of ***Venus ziczac*** Linnaeus, 1758 (Uppsala, Museum of Evolution, No. 1351) could be studied. This 22 mm specimen originally described from "M. L. U." and from the Indian Ocean matches Linnaeus' OD well. It is without doubt a juvenile *Protapes*. The name giving zigzag pattern is still weakly visible. Position of the umbones, moderate number of ribs and the comparatively broad posterior portion, make it closer to Oliver & Glover's "*sinuosa"* than to Gmelin's *gallus*. ***Protapes zizac*** (Linnaeus 1758) is here reinstated as valid species. It is known from the Red Sea (rare, Mienis, 2001), Aden, Somalia, Mozambique, Maputo, Inhambane and Nacala Bay, further from Natal, Richards Bay, Gulf of Oman and Persian Gulf. *P. ziczac* is an uncommon, inflated *Protapes* with the roughest sculpture among *Protapes*, and among the largest, reaching 76.3 mm (Mozambique). It is the same as *Tapes inflata* Römer, 1870 non Deshayes, 1853, conformingly, but likely erroneously indicated from Sri Lanka.

On the other hand, *Tapes sinuosa* "Lamarck" Römer, 1870 non Lamarck, 1818 nec Pennant, 1777 is a distinct, well known Australian species. Römer based on Sowerby II (1852 sp. 14), who depicted the same as *Tapes sinuosa* "Lamarck" from Australia. This species has been variously named by Australian authors as *Paphia subrugata* Allan (1961 pl. 39 fig. 11, = err. for *semirugata* non Philippi, 1847) and as *Paphia* (*Protapes*) *gallus* by Lamprell & Whitehead (1992 sp. 608). Römer characterized this species best and clearly differentiated it from *gallus*. It is here renamed ***Protapes roemeri*** nom. nov. *Tapes sinuosa* Römer, 1870 non Lamarck, 1818 nec Pennant, 1777. It is smaller, shorter and more inflated than *gallus* and has very sharp, thin, dense ridges, leaving large interspaces. Often it is deep red inside. It is currently only known from NW.-NE. Australia. In addition to the type locality Australia, Römer also mentioned China.

However, the Chinese species is distinct. It is well characterized and depicted in Swennen et al. (2001 sp. 197) as *Paphia sinuosa* "Lamarck". It is here renamed as ***Protapes swenneni*** nom. nov. *Paphia sinuosa* "Lamarck" Swennen et al., 2001 non Lamarck, 1818 nec Pennant, 1777. The type locality as stated by Swennen is SChi, Gulf of Thailand, off Pattani. It is also known from nearby Ko Samui and a few further E. Thailand localities. *P. swenneni* is a rare species, deeper living. The maximum size known is 39 mm. As *roemeri*, also *swenneni* has very sharp commarginal lirae, these, as stated by Swennen also on the lunule and the escutcheon. The pallial sinus is ascending rounded, but deeper than in *roemeri*. It is quite fragile, less solid than *roemeri*. Significantly distinct is the low, elongated shape, strongly attenuated anteriorly and also so posteriorly. *P. swenneni* shows paler colors than *roemeri*, with four weak darker radials, internally white, yellowish umbonally. Lynge (1909) based on Römer's concept of *sinuosa* reported this species as *Tapes* (*Protapes*) *sinuosus* from a few Gulf of Thailand localities as well. He gave the depth as 16-55 m and the maximum size as 36 mm. However, the W. Indian Ocean *ziczac* grows much larger and higher, is more solid and has rougher, rounded not sharply lamellate ribs.

Preston, 1906 described an exceedingly rare species as ***Tapes browniana*** from the Philippines. The whereabouts of Preston's type are unknown. From the Philippines no *Protapes* have been collected or seen as yet. Nevertheless, the original locality is perceived correct, but the original habitat, Manila Bay, seems now polluted and destroyed. From nearby Brunei a specimen was recently studied which conforms quite well to Preston's OD. As such *P. brownianus* seems to be a small species. It is comparable to *roemeri*, but stronger colored outside and more inflated. It may remain shorter in shape.

Another rare *Protapes* is known from Pakistan, Karachi, W. India, Mumbai, also Goa (coll. auth.) and NE. Sumatra, Belawan (coll. auth.). Reeve (1864) recorded it as *Tapes turgidula* from the Philippines. However, this species is not known to live there. Reeve's locality is considered erroneous and erected in conformity with Deshayes (true *turgidula* is known from the Philippines). Römer, 1870 recognized that Reeve's species is distinct from Deshayes' and renamed *Tapes turgidula* "Deshayes" Reeve, 1864 non Deshayes, 1853 as ***Tapes*** (***Textrix***) ***malabarica var. monstrosa***. Römer characterized this species and depicted it on pl. 17 fig. 1-1a. Without doubt, *Protapes monstrosus* is not a variety but a significantly distinct, valid species. Römer had two specimens, but gave no precise locality. Later, this species has been described again as ***Paphia*** (***Protapes***) ***gallus bombayana*** Oliver & Glover, 1996 (Karachi, Mumbai). In all specimens seen, a consistently distinct shape and a strong inflation were encountered. Furthermore, the pallial sinus is very broad and the dentition strong with a quite broad hinge plate. As no intermediaries to true *gallus* were found, this rare ***Protapes monstrosus*** is here considered as valid species. The earliest name is Römer's.

P. rhamphodes and, finally, *Venus cor* Sowerby II, 1853 are the two other *Protapes*, mentioned or described by Oliver & Glover, 1996. However, there is an earlier ***Venus cor*** Bory de Saint-Vincent, 1827 (Enc. Meth. p. 153 n. & f. for pl. 277 fig. 2). Although validly proposed, it was not even listed by Sherborn and, as far as is known, never used. Neither Fischer-Piette & Vukadinovic (1977) mentioned it and considered Sowerby's *cor* valid, and listed 5 usages after 1853. Oliver & Glover (1996) did not recognize it either. Thus, Bory's *cor* is a true nom. obl., whereas *Venus cor* has been sparsely but consistently used in the last 150 years for an uncommon, large Indian *Protapes*. Based on ICZN, Art 23.9.2 *Venus cor* of Bory de Saint-Vincent, 1827 is here declared nom. obl. and ***Venus cor*** Sowerby II, 1853 a **nomen protectum**.

SF45: ***Gomphina***: The position of ***Gomphina*** within TRAPETINAE is open. The genetic results of Matsumoto (2003) indicate that a positioning close to *Meretrix* should be further analyzed.

As stated by Jukes-Browne (1909), Mörch, 1853 mentioned in his new *Gomphina* just two species, ***undulosa*** Lam. and ***donacina*** Chemn. Mörch did not select a type. H. & A. Adams (1857) used *Gomphina* next and just included *V. donacina* making this group monotypic. Thus, the type *Gomphina*, by subsequent monotypy H. & A. Adams, 1857 is Chemnitz's *donacina* and not Lamarck's *undulosa*. Dall, 1902 created ***Macridiscus*** for "*Venus aequilatera* Sowerby"; this based on the erroneous assumption that the type species of *Gomphina* is Lamarck's *undulosa*. As *donacina* and *aequilatera* are congeneric, *Macridiscus* is a synonym of *Gomphina*.

For ***Trigona*** Megerle von Mühlfeld, 1811 only two species are possible as types: *Trigona radiata* and *Trigona donacina*. *Trigona radiata* (= Chemnitz 6 31 326) is a synonym of *Venus mactroides* Born as stated by Megerle himself. Gray, 1847 explicitly designated *Trigona* as typified by *donacina*. ***Trigona donacina*** "Chemn." Megerle von Mühlfeld, 1811 (= Chemnitz 11 202 1983-4, Südsee) is a *Gomphina*. Megerle von Mühlfeld referenced in his new system all new genera to Chemnitz' and/or Gmelin's species, except *Fistulana annulata*, which he depicted. In addition, in Vienna a specimen of *V. donacina* has been found which was also exposed in the old NHMW "Schausammlung" curated by Megerle from 1790 to 1850. Furthermore, as base of his system Megerle had an own large collection, with more than 1000 bivalve species, which was sold in 1800 to Graf Franz Joseph von Hohenwarth zu Laibach. This collection was later donated to the museum of Laibach (Ljubljana) and seems still intact. There, further specimens of *Trigona donacina* might be expected.

Gray's SD type designation makes the preoccupied *Trigona* Megerle a synonym of *Gomphina* but not of *Tivela* as usually listed. *Trigona donacina* "Chemn." Megerle von Mühlfeld, 1811 (not preoccupied by *Venus donacina* Gmelin, 1791, = *Sunetta*) is the oldest valid name for the Chinese species. *Donacina* has been used, e.g. as *Venus donacina* Sowerby II (1853 from Japan), H. & A. Adams (1857) and Jukes-Browne (1909) as *Gomphina donacina* (Chemn.), or recently by Lutaenko (2001). Following Lutaenko, ***Venus semicancellata*** is synonymous. Gray's ***Donax veneroidea*** is also placed in synonymy. ***Gomphina donacina*** (Megerle von Mühlfeld 1811) certainly occurs in Vietnam and S. China. Localities further west could not be confirmed and the type locality of *semicancellata*, Java, appears erroneous.

Whereas some authors (e.g. Fischer-Piette & Métivier, 1971, including views of Schrenck and Lischke; Koyama et al., 1981; Higo et al., 1999) considered *Gomphina* monospecific, Lutaenko (2001) recognized 3 species. His opinion has been carefully compared to available material from various locations (many Japanese localities, Taiwan, S. China Sea and Vietnam). The South China/Vietnamese *donacina* offers recognizable diagnostic features: trigonal shape and pallial sinus extending to almost midline. These specimens also grow smaller than the Northern species. The Taiwanese, Japanese, and Russian species are less clear. There, instead of 2 consistent forms, only one highly variable species in shape, thickness, color, and ribbing has been encountered, but the pallial sinus always shorter than the Vietnamese. The best argument for this view was given in 2002 by Lutaenko himself: "Shells of *G. melanaegis* collected during this study [i.e. E. Korea] bear some morphological intermediate features between typical *G. melanaegis* and *G. aequilatera* auctt …". Thus, the above mentioned Japanese authors are followed and only one variable *Gomphina* in and around Japanese waters is recognized. Whereas Lutaenko (2001) considered ***Donax aequilatera*** Sowerby I, 1825 as lost, Higo et al. (2001 B1243s) depicted a specimen, marked 39 from the Tankerville collection, which is distinct from Mühlfeld' species. This represents a small Japanese *Gomphina*, 23.1 mm and presents indeed similarities to *Donax*. Thus, *G. aequilatera* Sowerby I, 1825 is applied for the Japanese species (syn. *Gomphina melanaegis*, Römer, 1861). *D. aequilatera* has recently been used by Evseev & Yakovlev (2006) for Russian specimens.

A highly enigmatic species was described by Reeve, 1864 as ***Venus sallei***. It was precisely located Caribbean Sea, Bird's Island. Indeed, a Birds Island exists in the Caribbean Sea. The BMNH holotype is present and shows a small, 20.2 mm species, with a somewhat trigonal shape and a weak short, rounded pallial sinus. As originally stated by Reeve *sallei* has the general aspect of a *Donax*. Unique is the commarginally ridged sculpture with strong radials on the anterior third. At first, I was unable to attribute any genus. Finally, after many comparisons, it transpired that *Venus sallei* was erroneously located and is instead a juvenile *Gomphina donacina* from China.

SF46: ***Gomphinella*** was created by Marwick, 1927 for ***maorum*** as subgenus of *Gomphina* under the correct assumption that the type species of *Gomphina* is "*Venus veneriformis* Lamk. (= *donacina* Chemnitz)". Lamarck's true *veneriformis* is a *Donax*, but *donacina* is a *Gomphina*. Marwick also considered the Japanese *neastartoides* as rather belonging to *Gomphinella*, than to *Gomphina*.

Whether *Gomphinella* is correctly placed here is also open. Unfortunately, no sufficient molecular data is available. The only record found is Mikkelsen et al. (2006), where *G. undulosa* appeared closer to *Callista* than to *Tapes*. However, more data, including other species and closely related tapetinid genera are necessary to base a possible subfamilial change.

The NZ *maorum* is not closely related to the large Chinese/Japanese *Gomphina*. *Gomphina* and *Gomphinella* are superficially close, but the pallial sinus is quite distinct. In all *Gomphina* seen, the pallial sinus is much larger than in *Gomphinella*. Also the size differs significantly and the sculpture in *Gomphinella* is more regular, occasionally almost smooth.

Fischer-Piette & Métivier (1971) synonymized *G. moerchi* with *G. undulosa*. However, Smith (1902) stated ***G. moerchi*** distinct, more inflated and triangular. The BMNH syntype clearly confirmed Smith's view. Instead, *G. moerchi* is exactly the species illustrated as "*maorum*" from Zanzibar by Fischer-Piette & Métivier (1971 pl. 15 figs. 4-5). In addition, Smith (1902) and Viader (1951) reported *G. moerchi* from Mauritius. Viader (1951) reported 8 living specimens dredged at 60 ft in Mauritius. Originally, ***G. moerchi*** was described without locality; here Mauritius is designated as **type locality**. Currently, *G. moerchi* is only known from the W. Indian Ocean.

A close analysis of the nymphal cardinal in the left valve of *Gomphinella* revealed fine grooves. Thus, it is not excluded that ***Venus exilis*** "Chemnitz" Dillwyn, 1817 (= ***Venus contemta*** Gmelin, 1791) described from Malabar, S. India is eventually a further *Gomphinella* or even the earlier name for *moerchi*. The type was from Chemnitz' own collection, now likely in Russia. Without the original specimen a firm identification is not possible and further *Gomphinella* specimens from India are not known as yet. Römer's *Meretrix exilis* is rather a juvenile *Meretrix*, as stated by Fischer-Piette & Fischer (1941 p. 342).

G. "moerchi" was also illustrated and well characterized from Queensland, offshore islands and GBR by Lamprell & Whitehead (1992 sp. 592). However, identical specimens from Qld, Magnetic Isl. proved quite distinct from true Indian Ocean *G. moerchi*. This tropical East Australian species is here renamed as ***Gomphinella queenslandica*** nom. nov. *Gomphina moerchi* "Angas" Lamprell & Whitehead, 1992 non Angas, 1872. Lamprell & Whitehead gave a maximum size of 40 mm and 0-10 m in sand as habitat. *G. queenslandica* is a higher and shorter species. It has a distinct, quite consistently tented pattern, whereas true *moerchi* has usually two reddish radial bands, well visible in the above mentioned Zanzibar specimen and still discernible in the somewhat polished BMNH type. The posteroventral undulation is weaker and the texture in *queenslandica* somewhat less solid. At least from the specimens seen so far, the Australian species grows much larger than the Indian Ocean *moerchi*.

A further uncommon *Gomphinella* occurs in Japanese waters, illustrated from Kyushu and also known from Okinawa. Higo et al. (1999) reported it from Hachijo Isl. (Izu group) and further localities in the EChi Sea. However, their Australian record refers to true *undulosa*, whereas their Philippine record is currently unresolved. This Japanese species was first identified as *G. undulosa* by Habe (1951 p. 178). In his Vol. II, Shells of the Western Pacific in color, pl. 59 fig. 10 it is well illustrated, wrongly spelled as *G. nudulosa* (Lamarck). However, neither the less solid texture, especially not the central position of the beaks, nor the smaller size fits true Western Australian *undulosa*. This well known Japanese species is here renamed ***Gomphinella habei*** nom. nov. *Gomphina undulosa* "Lamarck" Habe, 1951 non Lamarck, 1818. The type locality given by Habe is Kyushu. *G. habei* is a small species; the maximum size seen is 20.4 mm (Okinawa). It is closer to *G. queenslandica* than to *G. undulosa*, but it is less high, more trigonal in form, the beaks about central, with posterior and anterior expansion about equal, the central cardinal is broader and stronger, especially in the left valve, the nymphal cardinal appears almost smooth. Both species share the very small, rounded pallial sinus, typical for *Gomphinella* and structurally the same dentition with three cardinals in each valve.

G. neastartoides, the second Japanese species, is even smaller, less high, more elongate, has a different pattern, often with two complete or broken radials, whereas dentition and pallial sinus are quite similar. The largest specimen studied is 13.4 mm (Okinawa). *G. neastartoides* is also known from off S. Korea, 16 mm.

Fischer-Piette & Métivier (1971) synonymized the Australian *G. fulgida* with ***G. undulosa***, whereas most

Australian authors split. ***G. fulgida*** was very briefly introduced by Hedley, 1918 from NSW "distinguished from *G. undulosa* Lamarck by form and by wider spaced and more jagged color lines". These two are very close and *fulgida* is considered a rounded variety in shape, found identically in Albany and in Perth. May's Tasmanian species pl. 10 fig. 12, as well as Cotton's SA species fig. 280 illustrate rather ovate *fulgida* than the typical trigonal *undulosa*.

Thus, currently 6 *Gomphinella* are recognized. However, the true identity of Philippine and possibly Indian specimens is as yet unknown.

SF47: ***Katelysia***: Lamarck's types are depicted in Fischer-Piette & Métivier (1971). Lamy (1937) characterized all of Lamarck's *Katelysia*. Finally, Roberts (1984) and Lamprell & Whitehead (1992) recognized 3 distinct Australian *Katelysia*, a view here shared.

Crucial is the identity of ***Tapes victoriae*** Tenison-Woods, 1878, originally described from Melbourne, Hobson's Bay. The type from the National Museum Victoria is depicted in Fischer-Piette & Métivier (1971 pl. 14 figs. 10-11). This shows an ovate, quite regularly, densely ribbed small species with brownish zigzag pattern, well fitting the OD. Neither this sculpture, nor this pattern is found in juvenile *peronii*. These are whitish and have depressed ribs, as also stated by Lamy (1937) based on the type material. Specimens in various sizes from Victoria demonstrate that this juvenile *victoriae* grows into *rhytiphora*, but not into *peronii*. Lamprell & Whitehead (1992 sp. 600 *rhytiphora*) depicts this form, presumably even originating from Victoria; Cotton, sp. 277 depicts a fully adult specimen from SA, very close to the type of Lamarck's *corrugata*. Therefore ***Marcia*** (***K.***) ***rhytiphora*** Lamy, 1935, the replacement name for Lamarck's preoccupied *Venus corrugata* has to cede the juvenile, but older *Tapes victoriae* Tenison-Woods, 1878. Following Allan (1962 p. 331), but not Lamprell & Whitehead, Iredale's ***enigma*** from Sydney is considered a further synonym. From SA even larger specimens are known. Jansen (1995) recorded only *rhytiphora* from Sydney.

Venus aphrodinoides *Lamarck*, 1818 (Fischer-Piette & Métivier, 1971 pl.13 fig. 18-23) is a species not mentioned by Lamprell & Whitehead (1992). It has been variously treated over the centuries. However, it seems composite. Of the two MNHN-specimens, the larger elongate appears to be *scalarina*, the smaller, ovate a gerontic *peronii*. Lamarck treated this issue with utmost elegance: "Elle tient de la *V. peronii* et de la *V. aphrodina*,…". As he gave Geneva and Paris, the larger elongated MNHN-species illustrated by Fischer-Piette & Métivier (1971 pl. 13 fig. 18, 20-21) is here selected as **lectotype**. This specimen is quite close to high *scalarina* forms, known from Tasmania (May pl. 10, fig. 15). Thus, as understood by Fischer-Piette & Métivier (1971) *Venus aphrodinoides* remains a synonym of *scalarina*.

Venus cuneiformis Reeve, 1864 described from unknown locality was not treated by Fischer-Piette & Métivier (1971) and is not found in Australian literature. However, in BMNH two syntypes, up to 38.1 mm, without locality are present, labeled "*scalarina* Lam." by a former curator. This identification is perceived fitting and *cuneiformis* is here declared a further synonym of this well known SA species.

SF48: ***Marcia***: The roughly ribbed forms are recognized by some authors as distinct (e.g. Jukes-Browne, 1909; Lamprell & Whitehead, 1992) from the smooth, inflated type species *opima*, by others, however, not (e.g. Fischer-Piette & Métivier, 1971; Oliver, 1992).

Römer divided his *Hemitapes* along these lines, as b. testa laevigata. Jukes-Browne, 1909 separated *Hemitapes* from *Marcia* and designated *Venus rimularis* Lam. as type, SD of the former. However, Stoliczka, 1871 p. xvii had earlier designated *Hemitapes* typified by *Tapes pinguis* (Chemn.). As Römer included *pinguis* in *Hemitapes*, this action cannot be classified as erroneous as done by Jukes-Browne (1909). Stoliczka's action makes *Hemitapes* an objective synonym of *Marcia* as recognized by Keen in Moore (1969). Thus, *Hemitapes* is not available for the ribbed forms. Considering the few species involved, a new subgenus does not seem necessary and smooth and ribbed forms are treated as *Marcia*.

Fischer-Piette & Métivier (1971) differentiated 4 ribbed forms: *hiantina*, *japonica*, *recens* and *flammea*. This view is largely shared. All *Marcia* are locally common and most display a stunning variability in color, shape and even inflation. Thus, many synonyms for every valid species are found.

M. hiantina is a larger, quite variable species in color and shape. Variously treated is ***Venus flammiculata*** Lamarck, 1818 from Australia. Fischer-Piette & Métivier (1971) declared it synonymous to *hiantina*, a view followed by Lamprell & Whitehead (1992 sp. 602-3). Lamarck's MNHN holotype is 34.7 mm, uniform cream white outside, whitish inside darker colored in the hinge area. In rather rough commarginal sculpture, hinge constellation and pallial sinus it matches indeed Lamarck's *hiantina*. I see no justification for separation as proposed by modern authors.

The common *Marcia* from the Red Sea and Arabia, usually called ***V. flammea*** Gmelin, 1791, was synonymized (see *Circenita* above) with the earlier ***Marcia cordata*** (Forsskål in Niebuhr, 1775).

Fischer-Piette & Métivier differentiated the related ***M. recens*** (syn. *marmorata*) as less inflated, more elongate, lesser and irregularly ribbed, with a weaker dentition. *M. recens* is mainly found in India, W.-E. Thailand and the Philippines. Whereas *cordata* is usually cream, *recens* displays a wider color variety, cream, red, white, dark brown. The MHNG holotype of ***Venus marmorata*** Lamarck, 1818 supports Fischer-Piette & Métivier's view and synonymy.

Tapes tenuistriata Sowerby II, 1852 was variously treated. Whereas Tomlin (1923) considered it a synonym of *Marcia marmorata*, Fischer-Piette & Métivier (1971) considered Tomlin's view erroneous and regarded it instead as European *Polititapes aurea*. The BMNH type lot contains two distinct species. The smaller, 29.6 mm specimen though faded in color is in shape identical to Sowerby's pl. 158 fig. 78. The larger specimen, 33.8 mm does not match fig. 79, but instead represents fig. 76 (*Tapes laterisulca*), which is indeed the same as *marmorata* (= *recens*). Here, the smaller specimen is selected **lectotype**. However, the shorter and higher shape and the moderately ascending and shorter pallial sinus, together with the stronger sculpture exclude *Polititapes aureus* as labeled on the wood board. Instead *tenuistriata* is an IND *Marcia* similar, but especially in the position of the pallial sinus, not identical to *hiantina*. However, there is an even older species, rarely treated, namely ***Venus carneola*** Lamarck, 1818. The unique, beautifully preserved holotype with the original label is present MHNG 1085/25 and conforms well to the OD of Venus sp. 65. It is a rather small, fragile, ovate species, flesh colored with deeply purplish-blue umbones. Lamarck did not give a locality. Fischer-Piette did not recognize it as *Marcia*, but Sowerby II (1852 p. 686) did. Indeed, Lamarck's *carneola* fits *Marcia* well and proved, except for the moderately variable colors, too close to *tenuistriata* to be separated. The **type locality** of ***Marcia carneola*** (Lamarck, 1818) is here clarified as Philippines, Cebu, Mactan, where such specimens have been personally collected. However, as neither *carneola* nor *tenuistriata* are well known, this uncommon *Marcia* may be wider distributed.

Whereas ***V. interrupta*** Koch in Philippi from Indo-Pacific, ***H. dohrni*** Römer from the Philippines and ***H. exserta*** Römer, said from New Caledonia, appear as *recens* varieties, ***Hemitapes apaturia*** Römer, 1864 from the Philippines is perceived as distinct. This is a solid species, but with a very small, horizontal pallial sinus. Whereas Fischer-Piette & Métivier (1971) synonymized it with reservation with *scalarina*, Hidalgo listed it as valid from the Philippines. This latter view seems correct and *apaturia* appears to represent an uncommon, ribbed *Marcia*, related to *flammea*.

SF50: ***Venerupis***: The type, SD Children, 1823 is *Venus perforans* Montagu, 1803. *Venus saxatilis* Fleuriau de Bellevue, 1802 is the same, according to Lamy (1922). This is typically an elongate-ovate species with a very deep, broad, rounded, horizontal pallial sinus. It has a strong, straight nymphal ridge. It is externally uniform white, occasionally slightly brownish, and internally white usually purplish-brown posteriorly. The sculpture is irregular commarginal, often wrinkled, with weak radials. The name originates from its habitat, found nestling in stones with the outer layer often partly eroded. *Saxatilis* is variously treated. Tebble considered it distinct from the larger, colored *pullastra*, followed by Hayward & Ryland (1990). Poppe & Goto (1993) illustrated a glossy, juvenile Med form pl. 22 fig. 8a (= *geographica* Gmelin), the dull adult form as fig. 8c (= *pullastra*) and a strongly undulated form fig. 8b (close to the typical *corrugata*) and considered them varieties. Based on many hundred specimens analyzed Jeffreys (1881) earlier synonymized *pullastra* and *geographica*. Lamy & Fischer-Piette (1939) considered *saxatilis* as *pullastra* form living in a special habitat and *geographica* a mere variety.

Furthermore, Nicklès (1955) stated in Senegal two distinct true *Venerupis*. One he identified as Adanson's *Le Lunot* named *Venus senegalensis* by Gmelin, 1791. Adanson's OD and picture leave no doubt, that *senegalensis*, is the same as *geographica* found in the Mediterranean as well. Same sized specimens from Brittany and Italy fit Senegalese specimens precisely. The other, rougher undulate ribbed species has been identified by Nicklès (1955) as *corrugata*. *Venus corrugata* Gmelin, 1791 is based on Chemnitz's *obsoleta*. This is typically a large, heavy, ovate species as typically found in SW. Africa, inside deep purple, well depicted by Römer (1871) as *Venus obsoleta*. In Senegal somewhat smaller forms occur, but these Senegalese *corrugata* are very close to typical *perforans* from Brittany. Furthermore, a close comparison of many Senegalese specimens from the same locality, some typical *corrugata*, some typical *senegalensis*, did not leave any consistent mark to differentiate two species. Barnard (1964) stated these differences in sculpture also in SAF specimens and gave different microhabitats as main reason.

As indicated by Lamy & Fischer-Piette (1939), Barnard (1964), Fischer-Piette & Métivier (1971), it finally transpired that indeed only one species with an extreme variability seems present. Thus, *Venus corrugata*, *senegalensis* and *geographica* Gmelin, 1791, as well as *pullastra*, *perforans* and *saxatilis* and approximately 20 additional names are perceived to describe the same species. 3 genera – *Venerupis*, *Pullastra* and *Myrsus* – have been created for just this single species. Peñas et al. (2006) came to a similar conclusion and used *corrugata* as valid name, though still with some reservation. Thus, unless clear genetic data would reveal otherwise, only the earliest name *Venerupis corrugata* (Gmelin 1791) is recognized. ***V. corrugata*** extends from Norway, into the Med and along WAF down to SAF, reaching 60 mm (Med) and 77 mm (SAF) and occupies a variety of habitats.

In Eastern S. Africa and the Indian Ocean a species closely related occurs, but it is generally smaller, and has an even rougher, stronger undulate sculpture. The pallial sinus is less deep and rather broad, slightly ascending, the shape is highly variable. Oliver (1992 pl. 44. sp. 2) has it as *Tapes* (*Venerupis*) *rugosa*, confirmed as *Venerupis rugosa* by Dekker & Orlin (2000) from the Red Sea. ***Venerupis rugosa*** has originally been described by Sowerby II, 1854 from SWA, Perth. It was not found there, but in the more northern Shark Bay. W. Australian specimens are indistinguishable from those found in SAF (Durban) or in the Red Sea. Fischer Piette & Métivier (1971) reported *rugosa* as *Irus* from Aden, Bahrein, Karachi and S. Africa and Fischer-Piette (1968) depicted it as *corrugata* from Mozambique.

Venus glandina Lamarck, 1818 was originally described from Australia. Lamy & Fischer-Piette (1939) followed Deshayes (1835) and concluded the MNHN-type specimens being a *geographica* variety with an erroneous type locality. However, Römer (1871 pl. 31 fig. 3-3c) depicted *glandina* from the Philippines, Manila. Indeed, closely resembling specimens have been personally collected in the Gulf of Thailand, Pattaya and also studied from the Northern Indian Ocean in London. Lamarck's 4 syntypes are present in MNHN. *Glandina* is superficially similar to European forms, but as stated by Römer, distinct in shape, less high and more elongate, with the umbones very anterior; the pallial sinus is somewhat more ascending; the sculpture is usually finer and more regular and the coloring whitish-brown. Without doubt, this is one of the few true *Venerupis*. All evidence points that *glandina* is a valid IND species. Whether it occurs in tropical Australia, could not be verified, but is not excluded. *V. glandina* is a rather small species, Lamarck's largest specimen is 23.5 mm, Römer gave 25.5 mm and the largest specimen from Thailand, here illustrated, measures 29.2 mm.

The 4th true *Venerupis* is a rather large, rare species. It has been described as ***cumingii*** by Sowerby II from the Philippines. Except the type material, none was as yet seen.

Finlay, 1926 created ***Paphirus*** for the NZ *V. largillierti*; the S. Australian *V. anomala* is considered congeneric. *Paphirus* has been synonymized by NZ authors (e.g. Otago) with *Ruditapes*. However, shape, the predominantly commarginal, somewhat irregular sculpture, the pallial sinus and color set these two closer to *Venerupis* than to the colored, strongly radially ribbed *Ruditapes*. The quite distinct biogeography, together with lacking phylogenetic data recommends recognition, at least subgenerically.

The larger SA ***V. galactites*** has a distinct strongly radial sculpture and is better placed in *Ruditapes*. It is similar to ***bruguieri*** as recognized by Sowerby II (1852). The type of *Ruditapes* is ***decussata***, SD Dall, 1902. Römer's preoccupied *Amygdala* is an objective synonym, Stoliczka selected here as type, SD also *decussata*. The European *decussata* is typically a quite inflated, robust species with commarginal and radial sculpture, giving the characteristic cancellate sculpture. Considering the variability in shape and sculpture within *Venerupis*, more than subgeneric distinction for *Ruditapes* appears currently overstated. Thus, Coan et al. (2000) is followed.

Despite the many ***philippinarum*** records throughout the IND, also in most recent literature, ***philippinarum*** is a temperate Japanese and Chinese species, introduced now in various other parts of the world, and also globally commercially sold as food. As stated by Higo et al. (1999) the original type locality "Philippine Archipelago" could never be verified and is erroneous. No true *philippinarum* was found on the many Philippine Islands visited, nor were any seen reliably from there. Many of these *philippinarum* records represent instead the tropical *aspera*.

The well known ***Venus variegata*** Sowerby II, 1852 from the Philippines is preoccupied by *Venus variegata* Gmelin, 1791 which represents according to Römer (1871) and CLEMAM the European *Ruditapes*. Whereas Sowerby II, 1852 considered all Philippine specimens on his pl. 151 figs. 133-138 as belonging to his *variegata*, Deshayes, 1853 artificially split 134-5 into his *punicea*. As stated by Reeve (1864) this action was based on the somewhat broader shape. The dividing features between *punicea* and *variegata* are in reality intergrading and these two extremes are in a larger series not separable, as also recognized by Römer. Finally, Fischer-Piette & Métivier (1971) synonymized these two. Furthermore, Fischer-Piette & Lamy (1943) analyzed the unique type of *Venus aspera* Quoy & Gaimard, 1835 from New Guinea and stated it the same as *R. punicea* (referring to Römer, pl. 76 fig. 2c). As such the valid earliest name for this well known, but preoccupied *variegata* is ***Venerupis*** (***Ruditapes***) ***aspera*** (Quoy & Gaimard 1835).

R. bruguieri is a distinct *Ruditapes*. It appears restricted to the Indian Ocean. The pallial sinus is generally deeper than in *aspera*, extending to or surpassing midline; the shell is generally more elongate. From Japan and Australia only *R. aspera* is known, whereas in India both species occur.

An **undescribed** *Ruditapes* is known from N. Borneo. However, limited material hinders here progress.

SF51: ***Irus*** has a radial sculpture in between the lamellae; ***Notirus*** has a commarginal sculpture in between. *Notirus* is mainly known from the colder waters of NZ and SA, whereas *Irus* is widespread. However, an undescribed tropical *Notirus* is known from N. Borneo, 60-70 m.

As stated by many authors, morphologically no consistent differences can be construed among ***Irus irus*** and ***I. macerophylla***. Biogeographically, WAF, SAF and Red Sea connect the Med with the Indo-Pacific specimens. Unless genetic data would prove otherwise, these two are considered conspecific. *Irus irus*, by its nestling habitat, is extremely variable in shape. Although usually white, in colors a high variability occurs and brownish dorsal parts are commonly found, occasionally also rose or yellowish specimens are found. Many of Deshayes Philippine species are only based on minor variations and have been synonymized by earlier authors. In addition, also the BMNH type of ***Venerupis digona*** Deshayes, 1854 from Sri Lanka has been studied. The commarginal lamellae, an at least umbonally well visible radial sculpture, the white color and the position of the pallial sinus leave no doubt that *digona* is a further *irus* form. The BMNH type lot of ***Venerupis chinensis*** Deshayes, 1854 from China contains a small rose and a huge, 28.6 mm rather solid, white specimen. However, from texture, sculpture and position of the pallial sinus I fail to recognize *chinensis* other than representing the largest *irus* currently known.

A growth series of ***Irus carditoides*** from SA shows all white, posteriorly brown or brownish lined and blotched specimens, the convexity varies from flat to moderately inflated; the posterior lamellation may be quite weak or strongly expressed. The posterior shape may be rounded or straight and subtruncate. Inside, *carditoides* is usually white, occasionally brownish lined or blotched. The umbones are often brownish-red tinged, sometime cream as the surface. The largest *carditoides* are found in Tasmania, 50.8 mm. ***Venerupis hanleyi*** Lamy, 1922, the replacement name for Hanley's ***exotica*** was not treated by Lamprell & Whitehead (1992), but illustrated by Cotton (1961 sp. 282), though erroneously as of Lamarck. However, Hanley's *exotica* represents the same species as *carditoides*. Lamarck's ***distans*** (type in Lamy, 1922, pl. 3) is a strongly lamellate juvenile *carditoides*, synonymized by Lamprell & Whitehead (1992). Furthermore, the white *Venerupis* (*Venerupis*) *obesa* Lamprell & Whitehead (1992 sp. 611) white with brown blotches posteriorly does not match Deshayes' type of *obesa*. Instead it is perceived as further *Irus* (*I.*) *carditoides*, somewhat humped in shape. Fischer-Piette & Métivier (1971) considered ***Venerupis planicosta*** Deshayes, 1854 described from SWA, Perth synonymous to *irus*. Lamprell & Whitehead, 1992 (sp. 610) considered it valid and illustrated a small specimen. Specimens closely fitting Deshayes' OD from SWA have been studied. However, I fail to recognize distinctive characters to juvenile *Irus carditoides*. Thus, *planicosta* is considered a further synonym of this quite variable and common SAU species.

Irus crebrelamellatus (Tate 1887) (type Fischer-Piette & Métivier, 1971 pl. 16 figs. 4-10) and ***Irus crenatus*** (Lamarck 1819) (type Lamy, 1922 pl. 3 figs. 1-2) are sometime confounded. However, the former is generally smaller, usually purplish-white, the pallial sinus narrow, elongate-trigonal. The latter grows larger, is typically purplish-orange, the pallial sinus is broader; *crenatus* also seems to occur more commonly. Lamprell & Whitehead (1992 figs. 594 and 595) illustrated two *crenatus* forms, but not *crebrelamellatus*. Cotton (1961 fig. 286) has *crebrelamellatus* well. ***Venerupis obesa*** Deshayes, 1854 from Victoria, Port Phillip has been described as inflated, densely sculptured, purplish inside and at the umbones. This does not match Lamprell & Whitehead (1992 fig. 611) but instead true *crebrelamellatus*. Indeed, the BMNH *obesa* holotype proved to be a small, 18.9 mm *crebrelamellatus*. Furthermore, the beautifully preserved 3 BMNH syntypes of ***Venerupis cumingii*** Deshayes, 1854 up to 31 mm described from unknown locality proved to represent the same species, only larger. *V. cumingii* was recognized from S. Australia by subsequent authors. In fact, the specimen illustrated by Lamprell & Whitehead (1992 sp. 593 *cumingii*) is close to the medium sized of the 3 *cumingii* syntypes. *Venerupis obesa* and *cumingii* represent the same species and both names are older than Tate's *crebrelamellata*. Here the better known ***Irus cumingii*** with a syntypic growth series is selected to represent this S. Australian species; the **type locality** of *Irus cumingii* (Deshayes 1854) is here clarified as for *obesa*, namely Victoria, Port Phillip. It can not be excluded that an even earlier name for *cumingii* might have been ***Venerupis brevis*** Quoy & Gaimard, 1835 from Tasmania, Hobart Town. However, the type is lost (FIP431) and *brevis* is best considered a nom. dub.

Venerupis iridescens Tate, 1889 is neither a *Venerupis*, nor an *Irus*, but matches the *Notirus* condition. ***Venerupis interstriata*** Sowerby II, 1854 (inside: Fischer-Piette & Métivier, 1971 pl. 16 fig. 11) is a larger, true *Notirus* described from unknown locality. However, neither shape, nor the rougher ribbing, or the broad pallial sinus, or the brownish posterior color conforms to the NZ *reflexus*, as proposed by Fischer-Piette & Métivier (1971). Instead it characterizes the S. Australian ***iridescens*** with the porcellaneous interior well. Thus, ***Irus*** (***Notirus***) ***interstriatus*** (Sowerby II, 1854) is considered the valid, earlier name for *Venerupis iridescens* Tate, 1889.

Venerupis exotica Lamarck, 1818 has been depicted and discussed by Lamy (1922). This is a small Australian *Notirus* with a commarginal interrib sculpture, lacking in Lamprell & Whitehead (1992). Also Cotton (1961) only illustrated Hanley's *exotica* which is *Irus carditoides*. Neither the small size of Lamarck's *exotica*, the anteriorly not expanded, quadrate shape, the quite regular, comparatively strong ribbing, nor the white color fit *Notirus interstriatus*. In SWA, specimens have been collected fitting Lamarck's species well. Whereas some are quadrate as Lamarck's type, others extend posteriorly to a subquadrate form, much broader posteriorly than anteriorly. As such they also closely resemble Deshayes' *Venerupis interjecta*, originally described from SWA, Perth. Its shape and sculpture is not identical to NZ *reflexus*, where *interjecta* was synonymized by Fischer-Piette & Métivier (1971). Instead, *Venerupis interjecta* Deshayes, 1853 is here considered a synonym of *Irus* (*Notirus*) *exoticus* (Lamarck 1818) with a correct type locality. The largest ***Irus*** (***Notirus***) ***exotica*** (Lamarck 1818) studied is 18.5 mm (Shark Bay), the currently known range is Shark Bay, S. Passage to Woodman Pt., S. Perth.

Venerupis dashami described from Chennai (RAY48) is an *Irus* and does not differ in surface sculpture, or pallial sinus from the earlier ***vertumnalium*** from the Persian Gulf. The different shapes are due to the nestling habitat. *I.* (*I.*) *vertumnalium* is an uncommon species.

Consequently, at present, only 7 *Irus* and 4 *Notirus* are globally recognized. Unresolved is a tropical *Irus "crenatus"* recorded by various authors from New Caledonia to Polynesia.

SF52: ***Irusella***, ***Paphonotia*** and ***Notopaphia*** are variously placed. No phylogenetic data is available to clarify. In gross morphology these are closest to *Irus* (lamellation, strong to weak radial interrib sculpture, trigonal-elongate pallial sinus). The nestling habitat is similar as well. However, *Irus* as other tapetinids have smooth margin, whereas *Paphonoti*a, *Notopaphia* and *Irusella* have variously crenulated margins. Fischer-Piette & Métivier (1971) placed all under the oldest available genus, other authors divide.

Taking, in addition to texture, also the quite distinct biogeography in account, I am not convinced that these are indeed congeneric and divide generically. Further findings are awaited.

SF53: ***Petricola rugosa*** Menke, 1829 has been validly proposed, according to Sherborn, describing a species of the Malsburg'sche Sammlung. According to Mörch (1871 p. 127) this is a small *Venus obsoleta* Chemnitz (= *Venerupis corrugata* (Gmelin 1791)). Menke's name would invalidate two well known species; first as an earlier homonym *Petricola rugosa* Sowerby I, 1834 from Peru and Chile, which is a true *Petricola* (COA97), second the congeneric *Venerupis rugosa* Sowerby II, 1854 which is a true *Venerupis* (DEK00). As far as could be ascertained, Menke's name has never been used. It was not mentioned by Sowerby II (1874, Reeve's Icon. *Petricola*), nor by Lamy (1922, *Petricola* revision), Fischer-Piette & Métivier (1971, TAPETINAE revision), Coan (1997, E. Pacific *Petricola*), and is also not listed in CLEMAM.

Based on ICZN Art. 23.9.2. ***Petricola rugosa*** Sowerby I, 1834 and ***Venerupis rugosa*** Sowerby II, 1854 are here declared valid and **nomina protecta** and the older *Petricola rugosa* Menke, 1829 a **nomen oblitum**.

6.55 PETRICOLIDAE

SI1: This is a difficult, not well known family. Lamy (1923) reviewed this group and Coan (1997) analyzed the E. Pacific petricolids.

Following Coan *Petricolaria* and *Choristodon* are generically separated from *Petricola*. Except for shell sculpture, *Cooperella* is close to *Petricola* and has been included within PETRICOLIDAE by Coan et al. (2000). *Velargilla* has been removed from petricolids and included in CLEMENTIINAE as synonym of *Kyrina*.

Just in the Eastern Pacific Coan (1997) recognized 16 species. Inferring from that figure, the current number of globally less than 50 petricolids seems conservative.

5 petricolids have been declared nom. dub. by Coan (1997). Here, *P. incerta* Sowerby II, 1874 from unknown locality and with missing type material is added.

S12: ***Petricola***: Cosel, 1995 described ***P. angolensis*** from Angola. Unfortunately, he did not compare with the closely related ***bicolor*** from SAF, which is indicated by Steyn & Lussi (1998) to Oranjemund. Both species are similar, but perceived distinct. From the material at hand, *angolensis* is usually snowy white, with a longer, elongated pallial sinus, the valves with somewhat coarser and fewer ribs. *Bicolor* is dirty white, often mixed with yellowish or brownish, the pallial sinus round, broad and shorter, the valves finer ribbed. Specimens from WAF and Namibia, Bosluis Bay and Walvis Bay are attributed to *angolensis*; SAF-specimens to *bicolor*. Here an in-depth genetic analysis is indicated to fully elucidate its relations.

Coan (1997 type fig. 9) demonstrated that ***Venerupis mirabilis*** Deshayes, 1853 described from Monterey is indeed living in California and a synonym of *P. carditoides* and stated the Japanese species distinct. Coan also considered ***Pseudoirus*** a synonym of *Petricola*. On the other hand, Japanese authors, following Lischke (1871) consistently use this name for an uncommon Japanese *Petricola* (e.g. Koyama et al., 1981 and earlier Japanese records; Higo et al., 1999; Okutani, 2000). Habe, 1951 characterized this species well and made it the type species of his new genus *Pseudoirus*. *Pseudoirus mirabilis* „Deshayes" Habe, 1951 non Deshayes, 1853 is here renamed ***Petricola*** (***Petricola***) ***habei***. The type locality as given by Habe is Suiken, Wakayama Pref. Habe gave a distribution from Kyushu, Shikoku to Honshu and a maximum size of 19.6 mm. Okutani (2000) stated 25 mm and added Hokkaido. The largest specimen studied from Honshu, Nobi from dead coralline debris is 21.6 mm. Together with ***Gomphinella habei*** this new name honours a pre-eminent Japanese author, who contributed formative for 50 years to the better understanding of the rich Japanese bivalve fauna.

Venerupis insignis has been described and well depicted by Deshayes, 1854. This is a marvellous petricolid, outside cream, inside with deep purple-brown borders, the inner portion orange-white with a very broad, rounded pallial sinus. The 3 BMNH syntypes are large, up to 34.5 mm. Deshayes gave New Zealand as type locality. However, from there nothing similar is known and *insignis* was not accepted by any modern NZ author. *Insignis* was later reported by various authors from Japan (e.g. Dunker, 1882; Yokoyama, 1920). Yokoyama accepted a distribution Central Japan and New Zealand and depicted specimens. However, modern Japanese authors recognized that *insignis* is not from Japan. Japanese "*insignis*" records are mostly referable to *habei*, which does not nearly reach the size of true *insignis* and differs in colors and sculpture. On the other hand, an uncommon specimen personally collected in Guaymas, W. Mexico conformed precisely to the *insignis* type series. There is no doubt that ***Petricola*** (***P***) ***insignis*** (Deshayes 1854) is the same and the valid earlier name for ***Petricola*** (***P***) ***lucasana*** Hertlein & Strong, 1948. The type locality of *insignis* is here corrected to Cabo San Lucas. According to Coan (1997) *insignis* grows to 43.5 mm and is found from the Gulf of California to Ecuador.

True ***P***. (***Rupellaria***) ***fabagella*** obviously occurs in Japan. Following Habe (1951), subsequently Koyama et al. (1981 pl. 7 fig. 4) well illustrated a specimen from Honshu, fitting Lamarck's type (LAM23 pl. 3 fig. 9). *Fabagella* has also been personally collected in Honshu, Chiba and in Kanagawa Pref. Otherwise, *fabagella* is widely distributed throughout the IND and also well known from the Red Sea (as *hemprichii*). It is usually whitish, solid, radially ribbed. It grows larger than 20 mm; the maximum size is 30 mm.

However, in Japan a second *Rupellaria* quite commonly occurs. It stays smaller, less than 20 mm, is much more fragile, it is usually brownish white and irregular commarginal lamellae are added to the radial sculpture. The radial sculpture is finer and the weaker ribs more numerous; it closely resembles the Panamic *olssoni*. On the other hand, *P. chinensis* Deshayes (SOW541 fig. 16), *Naranio radiata* Gray (type HIG01 B1265s), *P. hemprichii* Issel and *P. cyclus* Pilsbry (type HIG01 B1270s) are all synonyms of *fabagella* and do not match. *Rupellaria pechiliensis* Grabau & King, 1928 is distinct with stronger, regular lamellae and does not fit either. *Pechiliensis* closely resembles *Irus mitis* and may be this species. This second Japanese *Rupellaria* appears **undescribed**.

It can not be excluded that ***Rupellaria amplectens***, originally from New Guinea is the earlier name for the rare ***P***. ***quadrasi***, originally from the Philippines. The type material should be compared.

The large, ascending pallial sinus of ***Pleiorytis venezuelensis*** Weisbord, 1964 together with the threaded surface seems to exclude synonymy with *Petricola lapicida*, as proposed by authors. Small, less than 8 mm petricolids from Brazil and Argentina are usually identified as *lapicida*. However, they share some features with *venezuelensis*. Whether, on the other hand, *venezuelensis* is indeed a *Pleiorytis* is open. This complex needs additional work. For the time being these consistently small and lamellate **southern "*lapicida*"** with a weaker dentition are perceived as generically and specifically indeterminate. Definitely, they do not conform to similar sized juvenile *lapicida*. Redfern's *Petricola* sp. from Bahamas is distinct, but Diaz & Puyana (1994)'s minute *lapicida* needs comparison.

SI3: Oliver (1992) reported *madreporica*, originally described by Jousseaume from Aden, from the Red Sea and (1995) from Oman. Whereas Keen in Moore (1969) considered ***Asaphinoides*** a subgenus of *Asaphis* in PSAMMOBIIDAE, Oliver identified ***madreporicus*** as *Asaphinoides* and placed it as petricolid genus. This action has been confirmed by Dekker & Orlin (2000) and is here followed. This uncommon species has been collected in the Persian Gulf, Dubai, completely embedded in calcareous, solid coral blocks. Thus, it is not excluded that *madreporicus* is a chemical borer.

SI4: ***Choristodon***: Coan (1997) treated the position of this genus and synonymized the type species, the Caribbean *typicum*, with the earlier Panamic *robustus*.

Macsotay & Campos (2001) illustrated two enigmatic specimens from Venezuela, "*Petricola* (*Rupellaria*)" *typica* and the newly described ***Petricola*** (***Rupellaria***) ***inversa***. "*Typica"* has been illustrated with an as yet unknown anterior position of the pallial sinus, *inversa* with the common posterior position. Before, Weisbord (1964) depicted extant *typica* with the typical posterior position of the pallial sinus. Thus, normal ***Choristodon robustus*** are found in Venezuela. Whereas for Macsotay's inverse *typica* a normal boring habitat is given, the habitat of *inversa*, nestling among coarse sand in 6-16 m is quite untypical for a *Petricola*. The true identity of Macsotay & Campos specimens is unknown, *Rupellaria* being unlikely. Scott et al., 2004's **unnamed** *Choristodon* sp. from Florida is not close either.

SI5: ***Petricolaria***: At least from morphology, also in WAF, the originally American species, ***P***. ***pholadiformis*** and ***P***. ***stellae*** occur. Whereas specimens from Ghana are very close to *pholadiformis* from E. USA, specimens from

Congo and Namibia are very close to *stellae* from Uruguay. Main differences in *stellae* compared to *pholadiformis* are the straighter, less broad shape and a strong commarginal sculpture. Furthermore, the dentition in *stellae* is much stronger with a prominent hooked anterior lateral, *stellae* does not nearly reach the size of *pholadiformis* Thus, it appears that *pholadiformis* occurs in the northern WAF part and *stellae* in the southern WAF part. In N. Brazil, Ceará *P. pholadiformis* occurs as well, whereas *stellae* is confined to S. Brazil and Uruguay.

However, there is an old unresolved species. ***P. serrata*** (type DES541 pl. 18 fig. 11) was originally described from New Zealand. This locality has never been confirmed and no *Petricola* is known from these colder waters. Coan (1997) considered *serrata* as closest to WAF material. The BMNH type lot is now labeled "W. Africa", the largest syntype is 30.4 mm. Indeed, specimens from Congo, formerly identified as *stellae*, have been compared and proved conspecific. As such, *P. serrata* is understood as the earlier name for *stellae*. Its **type locality** is here clarified as WAF, Congo, Pointe Noire.

In Japan a true *Petricolaria* has been found at two localities in Chiba Pref., boring in soft stones. The largest specimen measured 14 mm. On the other hand, no fitting record in Japanese literature is available. ***P. gracilis***, as illustrated by Oliver (1992 pl. 44 fig. 7) from Aden, has also a fine sculpture, but seems to grow larger, is more elongate and slender-attenuate and distinct in color. Petuch's ***P. donnae*** from Nicaragua is also distinct with an even finer sculpture and a rather ovate shape. Similar sized ***P. pholadiformis*** have a rougher sculpture with fewer ribs; this applies also to related, rare ***P. cultellus*** from India and Sri Lanka. As such this Japanese *Petricolaria* is **undescribed**.

SI6: ***Lajonkairia*** has been generically separated by CLEMAM. It has a divaricate sculpture, a lunule is present, and the habitat is non-boring.

It seems that H. Adams, 1870 and 1871 described the same species twice from the Red Sea, as *Lucinopsis elegans* and *Mysia tumida*. Oliver (1995) removed ***elegans*** from his former lucinid synonymy and placed it in *Mysia*. However, the strongly divaricate sculpture of *elegans* does not fit well into *Mysia*, which has otherwise a commarginal sculpture of somewhat irregular growth ridges with or without weak radials. Thus, Adams' OD and Lamy (1923) is followed in considering *elegans* a *Lajonkairia*.

Lynge (1909)'s *elegans* record from the Gulf of Thailand seems instead referable to ***digitale***. This is a smaller and more inflated species.

The Mediterranean type species, OD Philippi's *Venerupis decussata* is the same as the earlier ***Lajonkairia lajonkairii*** (Payraudeau 1826).

Tellina cancellata Gmelin, 1791 is solely based on Adanson's *Le Pirel*, which is an uncommon *Lajonkairia*, originally described from sandy bottoms, Goré Isl., Dakar, Senegal and later reported again from the Dakar area by Nicklès. The species illustrated as *L. substriata* by Ardovini et al. (2004) from Mauritania fits instead the type of *Le Pirel* (FIP42) well.

Nowadays, ***L. substriata*** is well accepted as second Med species. However, whether *substriata* is indeed a valid species or only a junior synonym of *cancellata* is open. Also open is the distribution of *substriata*. It was described from Great Britain also reported from Scotland by older British authors, but this species is completely lacking in modern British literature (Tebble, HAY90). Further material is necessary to clarify. For the time being 3 MED/WAF species are differentiated in shape, inflation and biogeography.

Gmelin's ***Tellina gibbosa*** is based on Gualteri pl. 77 fig. Q. Deshayes (1853) clearly and Lamy (1923) possibly considered it as monstrosity of *substriata*. However, Gualteri's figure may well have meant *lajonkairii*. Gmelin did not give a locality. Unless Gualteri's type can be found, *gibbosa* is best considered a nom. dub.

SI7: ***Mysia***: 2 E. Atlantic ***Mysia*** are recognized. ***M. marchali*** has been described quite recently by Cosel, 1995.

Should the S. Australian ***Lucinopsis pellucida*** Tate, 1891 indeed belong here, then a new name is necessary. Heilprin, 1890 described a *Mysia pellucida* from Bermuda which belongs to *Diplodonta*. However, more likely is that a further **undescribed** Australian petricolid genus is present. Unfortunately, Tate's *pellucida* was not collected and no material was available.

SI8: ***Cooperella***: Rehder, 1943 described ***C. atlantica*** from Florida, Lake Worth as minute 6.5 mm species. *C. atlantica* has subsequently been reported from Florida, West Indies, Bahamas, Jamaica, Puerto Rico, and Colombia. However, all specimens from these locations are small, less than 7 mm, only once up to 8 mm (Colombia). These came from subtidal sandy bottoms and are trigonal-ovate in shape, quite close to the Panamic type species ***subdiaphana***.

However, Rios (1985 and 1994 sp. 1415) illustrated a marked distinct species from Brazil, as recognized by Cosel (1986) and Diaz & Puyana (1994). Similar sized specimens are higher and rather rectangular in shape, with prominent umbones. The umbones are not central, but marked posterior to midline. The pallial sinus is very deep and surpasses 2/3 of shell length, whereas in *atlantica* it extends almost to midline. Such specimens attain twice the size of *atlantica*. *Cooperella atlantica* "Rehder" Rios, 1994 non Rehder, 1943 is here renamed ***Cooperella riosi***. Rios gave Brazil, Espirito Santo to Rio Grande do Sul as type locality and a size of 16 mm. Specimens have been analyzed from Sao Paulo, Ubatuba and from N. Brazil, Piaui. In addition, *C. riosi* is known from Colombia (DIA94 sp. 204) and might well be expected in Venezuela and Suriname. The known habitats are 0-10 m, in sandy and sandy muddy bottoms. The name honours Eliézer Rios' outstanding work on the Brazilian bivalve fauna and his many contributions to a better understanding of this rich area.

6.56 GLAUCONOMIDAE

SG1: ***Glauconome*** is a barely known group of unique IND species. Important and still the best on glauconomids is Reeve (1844). All species depicted there, except *corrugata*, are considered valid. In addition, Deshayes (1853), Prime (1861, 1862 and 1865), Crosse & Debeaux (1865) and, finally, Sowerby III (1894) described additional species. Iredale, 1936 erected a new genus *Glauconometta* exclusively for his *plankta*. Abbott and Dance (1986 p. 349) illustrated two *Glauconome* as "*Sinovacula*". No modern review and no phylogenetic data are available.

The modern literature is very difficult and virtually all specimens illustrated have been erroneously identified.

Overall, 20 species have been named, 11 species are here recognized. Virtually all types have been studied, mainly in BMNH.

The westernmost species occurs in Pakistan and Indian water, ***G. cerea*** (type in HIG01 B1274). This is a whitish, large species reaching 47 mm, locally commonly found. *G. cerea* is neither known from Australia, nor from China. ***Tapes oncodes*** from the Mekran Coast has been synonymized by Melvill (1928) himself.

The next species is more equilateral and seems to stay smaller, but is similar in color. This is Prime's ***G. cumingi*** from Malacca. In addition to the lot in AMNH 31551 (coll. Jay, JOH59) also in the BMNH (M.C., Museum Cuming) an excellently preserved lot with 3 specimens from Malacca is available which conforms well to Prime's OD. This lot was mentioned in Prime, 1862's OD and the BMNH specimens consequently represent syntypes. Furthermore, Johnson (1959) selected the MCZ specimen of ***G. sumatrensis*** as lectotype and mentioned "paratypes" in BMNH. Indeed, 2 paralectotypes of *G. sumatrensis* Prime, 1862 from Sumatra (Cuming collection, labeled as cotypes) are present. Although *G. sumatrensis* is somewhat narrower than *cumingii*, it shares the comparatively short shape, the dehiscent yellowish periostracum, the fragile texture, the almost glossy white interior and the deep pallial sinus. There is no doubt that Prime described the same species twice, once from Malaysia and once from nearby Sumatra. Against page priority here the larger and more characteristic ***G. cumingii*** is selected to stand and *G. sumatrensis* is synonymized.

As before Allan (1962), also Lamprell & Healy (1998 sp. 550) illustrated "*cerea*" from tropical Australia. However, this Australian species is not close to the Indian *cerea*; instead it fits ***G. psammotella*** Deshayes, 1853 in shape, color, and pallial sinus precisely. The largest BMNH syntype is 45.2 mm; Lamprell & Healy gave 45 mm as size and stated Qld to NWA. *G. psammotella* was described from unknown locality. It is here placed in tropical Australia, as **type locality** N. Qld is clarified. As well recognized by Deshayes *G. psammotella* is not conspecific with any of Reeve's species and appears currently confined to Australian waters only.

Lamprell & Healy (1998 sp. 548) further illustrated a huge *Glauconome* from tropical Australia, an almost 80 mm species as "*virens*". However, Linnaeus's true ***G. virens*** (type in REV44f9; HANL55) is significantly distinct. It is a somewhat pyriform shaped, smaller species barely more than 50 mm, with a dehiscent, greenish periostracum. True *G. virens* does not occur in Australia, but in Indonesia, and has also been personally collected in Malaysia. The huge Australian species conforms instead to what is generally known as the largest *Glauconome*, namely ***G. rugosa***. Furthermore, Prime described another large species ***G. oblonga*** from Singapore, 68 mm. Specimens from Singapore have been studied. I fail to recognize them distinct from *rugosa*. *G. rugosa* reaches 80 mm, has a posterior attenuation and a strong, often wrinkled dark brownish-green periostracum. *G. rugosa* is known from Thailand, Singapore, Philippines, New Guinea and tropical Australia. Hanley's *rugosa* was first depicted on pl. 10 fig. 24 (n. & f.). This plate was published in 1843, thus, before Reeve's Icon. Other than stated by Sherborn, *G. rugosa* must therefore be attributed to Hanley, 1843 and not to Reeve, 1844.

Lamprell & Healy (1998) instead termed their sp. 549 "*rugosa*". However, this species is identical to what Prime, 1861 described and (1862) depicted as ***G. jayana***, precisely from Australia (lectotype in JOH69). However, *jayana* was originally not compared by Prime with *rugosa*, nor does the OD differ significantly from Hanley's earlier species. Thus, the question raised by Lamprell & Healy, whether these two are indeed distinct is still justified. Large collections and/or modern methods would be helpful to verify. For the time being *G. jayana* is separately listed, awaiting further research.

Finally, Lamprell & Healy (1998 sp. 547) illustrated Iredale's ***Glauconometta plankta***. This is a small species, not known to exceed 26 mm. Having compared Australian, Philippine and Malaysian specimens, then *plankta* is perceived conspecific with Reeve's ***G. radiata*** originally described from the Philippines. More or less strong purplish colors are typically found. However, almost all white specimens occur. As synonymized by Lamprell & Healy (1998) there is no justification for a separate subgenus *Glauconometta*.

G. curta appears as valid species, currently only known from the Philippines. It is also comparatively small, less than 28 mm, but ovate, and comparatively high with a rather smooth, yellowish-green periostracum inside purplish with a remarkably short pallial sinus. *G. curta* has been depicted (n. & f.) by Hanley, 1844 p. 10, pl. 14 fig. 41. Whereas Hanley's pl. 14 was published late 1844, Reeve published his *G. curta* in April, 1844 (Icon. sp. 7); thus, here Reeve stands. Other than stated by Sherborn, all of Reeve's *Glauconome* were first published in the Icon. in April. The formal descriptions in P.Z.S.L. appeared later in July.

The type material of Reeve's ***G. straminea*** and ***G. corrugata***, both from rivers running into Manila Bay, and from Deshayes ***G. rostralis***, from adjacent Borneo, is present in BMNH. All three species measure between 34 and 35 mm and share an elongate, rostrate shape with more or less marked commarginal ridges. *Rostralis* and *straminea* are whitish inside, *corrugata* is internally purplish. A syntype of the latter is depicted (HIG01, B1273). The original habitat of *straminea* and *corrugata* seems to be destroyed now, but *corrugata* has also been reported from China and Okinawa (HIG99). However, comparing the type series I failed to establish clear differences and these 3 species are considered conspecific. The earliest, ***G. straminea*** is here selected to represent.

In the South and East China Sea, extending into mainland Japan, a small species quite commonly occurs. This is usually illustrated as *G. chinensis* by Japanese authors (Kira, 1972 pl. 59 fig. 16; Okutani, 2000 pl. 498 fig. 1) or as *G. primeana* by Chinese authors (e.g. ZHO pl. 171 H). This small common species fits Reeve's ***G. angulata***. It is known from Malaysia, E. Thailand, Philippines, China, Yell, Okinawa, and Japan, Honshu. ***G. primeana***, originally described from N. China, is a junior synonym. The largest specimen seen is 25.4 mm (Okinawa), Crosse & Debeaux, 1865 gave 26 mm, Japanese authors state 20 mm. The periostracum is brownish to greenish-brown and quite dehiscent, underneath the shell is white. Inside it is whitish to pale purplish and a blunt keel is running form the umbones to the posteroventral margin.

G. chinensis itself grows much larger, at least to 43 mm. *G. chinensis* has been described from China and occurs there to Taiwan, but is not known from Japan. Identical specimens occur in Thailand waters and have also been studied from Myanmar. *Chinensis* is a posteriorly attenuate species (type HIG01 B1272) similar to *virens*. It is elongate, comparatively narrow, with a greenish-yellowish periostracum. The type of ***G. sculpta*** Sowerby III, 1894 described from the Bay of Bengal is depicted in Annandale & Stewart (1909 pl. 2 fig. 5). In color, shape and size *sculpta* matches *chinensis* well and is considered the same.

Thus, actually 11 glauconomids between Pakistan and Japan are here recognized.

6.57 HEMIDONACIDAE

QP1: **HEMIDONACIDAE** have been variously placed; very early in *Cardium*, then in *Donax*. Iredale & McMichael (1962) recognized this particular group first and placed it a separate family, but still near CARDIIDAE. This view has been shared in the review by Ponder et al. (1981), whereas Bernard, Cai & Morton (1993) still followed Keen in Moore (1969) in a placement close to donacids.

However, most recent phylogenetic analyses remove this family from cardiids and donacids and place it closer to VENERIDAE and MACTRIDAE (e.g. Taylor et al., 2006). Hemidonacids are here tentatively placed as their superfamily in between VENERIDAE and MACTRIDAE, waiting for its final place.

Other than the well accepted Iredale & McMichael, 1962, according to the **NOMC** experts, HEMIDONACIDAE has to be used as of Scarlato & Starobogatov, 1971.

QP2: ***Hemidonax***: Ponder et al. (1981) reviewed this small group of mostly Australian species. Lamprell & Whitehead (1992) depicted the 5 Australian species. Their views are largely followed.

However, the earliest name for ***H. donaciformis*** is Bruguière, 1789 (Enc. Meth. 214). Schröter, 1786' *Cardium* was proposed in a non-binominal, thus, invalid publication. *Donaciformis* is currently the only species not known from Australia. It seems that Bruguière's type locality India, Tranquebar was in error. *H. donaciformis* is recorded from various Indonesian locations, commonly found in the Philippines and reported by Bernard, Cai & Morton from Guangsi, Beibu Gulf. Apart from *pictus*, this is the largest *Hemidonax* extending to at least 36.3 mm in Bali.

Reeve's NWA ***H. australiensis*** is, in addition to biogeography, sufficiently distinct in smaller size, more elongate shape and restricted radial sculpture to qualify today as full species.

Iredale & McMichael (1962)'s record of ***H. chapmani*** from NSW has to be confirmed.

6.58 CYRENOIDIDAE

PI1: **CYRENOIDIDAE** is a barely known group of bivalves. Earlier, these were placed close to lucinids. Starobogatov (1992) considered them distinct and placed them in their superfamily, closely related to galeommatids and lasaeids. Glover & Taylor (2006) considered this family as anatomically and phylogenetically unrelated to lucinids, but as very recently stated, near cyrenids and glauconomids. CYRENOIDIDAE are here tentatively placed in their superfamily close to glauconomids and ungulinids, waiting for its final place.

PI2: ***Cyrenoida***: It appears that in Caribbean swamps and marshes 2 distinct species may be found, ***americana*** and ***floridana***.

From Panamaic mangrove swamps also 2 species have been described, the smaller ***C. insula*** from Panama Bay, Pearl Isl. and the larger ***C. panamensis*** from the mainland.

From WAF 5 species were described by various authors, generally not compared to earlier named species. As demonstrated by Pilsbry & Bequaert (1927) at least two distinct species occur. From the various OD's and the specimens studied, there remains no doubt, that Deshayes redescribed the larger, shape-variable ***Cyrenoida dupontia*** from Senegal unnecessarily again as ***Cyrenella senegalensis*** from the same location. Lamy (1921) further reported *dupontia* from Gabon, Mayumba River. However, from there Martens described his also solid, comparatively large and also internally bluish ***Cyrenoida rhodopyga***. It appears that only one larger, more solid species occurs at least from Senegal to Congo River. Specimens analysed from in between, Ivory Coast, are perceived conspecific. The type species *C. dupontia* is well depicted in Magasin de Zool. V, pl. 64 figs. 1-3 and its anatomy on pl. 70.

As described by D'Ailly, 1896 there is a second WAF species, smaller, more ovate and inflated and less solid, typically with projecting larger teeth. ***C. rosea*** has been described from Cameroon, Ekumbi. A couple of specimens have been personally collected in Ghana, Volta River mouth, on mud in a small mangrove area. Whereas fresh, well preserved specimens have indeed these strongly projecting, comparatively large teeth as described by D'Ailly, in somewhat worn material from the same small area these teeth are much shorter. It is therefore most likely that Pilsbry & Bequaert, 1927' ***C. brevidentata*** is in fact synonymous to *rosea*, which may have a whitish or rose coloring.

If these findings are confirmed, then also in WAF 2 species are found, quite widely distributed.

Thus, currently 6 global cyrenoidids are recognized.

Deshayes, 1855' **IND** *Cyrenella* with a distinct hinge configuration are instead placed in *Joannisiella* in UNGULINIDAE, as elaborated by Lamy (1921). However, shape and habitats may be close and phylogenetic relations of *Cyrenoida* and *Joannisiella* are as yet unresolved.

6.59 MACTRIDAE

RA1: Overall, mactrids are among the better known bivalves. Two dilligent revisions are available, i.e. Weinkauff's and Lamy's mactrid revisions. Important are further Gray (1837), Reeve (1854), Tomlin (1924) with a compilation of Reeve's and Deshayes' names, as well as Keen in Moore (1969), Coan et al. (2000) and Beu (1966-2006).

Many mactrids received various names due to color differences (e.g. *corallina* – *stultorum* – *fasciata*; *grandis* – *mera*; *cygnus* – *purpurea*; *abbreviata* – *meretriciformis* or *lilacea – jickelii*), many others received various names due to variable forms (e.g. *Mulinia edulis* or *Mactra quadrangularis*).

Whereas in most families too much genera are available, in mactrids there is too little. Especially in the Atlantic (Caribbean and West Africa) some groups do not match any of the available extant genera. Some could be accommodated by fossil taxa; some further species have been set in "brackets" and attributed to the closest resembling genus. Definitely, in mactrids some new genera are necessary, i.e. for ***M. inceri*** and ***M. iheringi*** or for ***M. inconstans*** and ***M. vitrea***.

H. & A. Adams (1858) placed ***Tanysiphon*** within GLAUCONOMIDAE. Scarlato & Starobogatov erected a new family for *Tanysiphon* within venerids. Following Owen (1959) *Tanysiphon* is placed close to *Lutraria* in TANYSIPHONINAE Scarlato & Starobogatov, 1971.

Beu (1966) gave the reasons to consider RESANIINAE Marwick, 1931 distinct from ZENATIINAE Dall, 1895. Today, Beu assesses ***Zenatia*** as close to ***Lutraria***, but ***Resania*** still as significantly distinct (pers. com. 1/09). Consequently, he considers ZENATIINAE synonymous to LUTRARIINAE, but RESANIINAE as valid subfamily. This view is shared and here applied.

Otherwise, "faute de mieux" largely the grouping in Keen in Moore is applied. However, whether for example ***Harvella***, ***Mactrinula*** or ***Tumbeziconcha*** have any relations with *Mactra* is wide open. Phylogenetic data is virtually absent and the generic relations within mactrids are largely unknown.

All subgenera within *Mactra* s.s. show special features. However, their relations should be genetically analyzed to procure a more solid base for separation or synonymization.

Some of Philippi's large species, e.g. *Lutraria spectabilis* and *solida* (1851), *Mactra cecillii* (1849) *and corbicula* (1851) are still enigmatic. The types may possibly be in Chile.

RA2: Having compared specimens from the Red Sea, Sri Lanka, W. Thailand, Australia and Japan no convincing argument was found to keep ***M. ornata*** separate from ***M. achatina***. Thus, I follow Lynge (1909) and Lamprell & Whitehead (1992); the oldest name is *achatina*. ***M. adspersa*** was synonymized early on by Reeve (1854).

RA3: In South China waters, three closely related small mactrids may be found:

M. aphrodina is typically a rather small elongate-trigonal cream species, umbones white, interiorly white-purplish. The type is depicted in Higo et al., 2001 B859, type locality China Seas. Specimens very close were found in Hainan, S. China.

A related species is ***M. pulchella*** Philippi, 1846. This is a glossy species described from China and depicted in Philippi, Abbildungen 2, Mactra 2, sp. 3 and a larger specimen in Weinkauff (1888 sp. 43). Likely, Swennen et al. (2001 sp. 104) is the same. *Pulchella* is similar *to aphrodina*, but higher, more equal, and purplish around the umbones. Specimens have been collected in E. Malaysia, E. Thailand and are also known from Vietnam. Some Vietnamese specimens are in color similar to the Japanese *crossei*. However, ***crossei*** has a narrower pallial sinus, is smaller and the umbones are closer to the anterior end.

M. luzonica has been described from the Philippines. Specimens compared to the BMNH types are also known from Thailand (Robba et al., 2002 pl. 12 fig. 1) and have been found in SE. Thailand and in Malaysia, Kuantan. *Luzonica* is stronger inflated, more regularly ridged and inside deep purple with a small white band along the margin. Lamprell & Whitehead's Australian "*luzonica*" record, sp. 257, is distinct.

M. pusilla from SE. Australia is a related species, resembling *pulchella* and as stated by Lamy (1917) quite distinct from *Nannomactra jacksonensis*. It is therefore treated as true *Mactra*.

RA4: ***Mactra cordiformis*** Reeve is a characteristic, large species, mottled with rust red towards the umbones. It was described from unknown locality, but was subsequently identified from N. Australia and personally collected in the Darwin area (Lamprell & Whitehead, 1992 sp. 252 as "*turgida*"). In error, Smith, 1914 synonymized *cordiformis* with *M. turgida*. Reeve (1854) and Weinkauff (1884) well recognized these two species as distinct. Indeed, ***M. turgida*** is only known from India and Sri Lanka, as depicted by Chemnitz 6 21 210-2 or Abbott & Dance (1986 pl. 334). The umbones are more acute and typically purple, whereas in *cordiformis* they are broader and typically rust colored. Adult *cordiformis* are more inflated, trigonal elongate, acute and posteriorly compressed, whereas *turgida* is trigonal rounded and less inflated. The surface sculpture in *M cordiformis* is almost smooth, whereas *M. turgida* has commarginal ribs. Neither *M. turgida* nor *M. cordiformis* fit into *Coelomactra*, both are true mactrids.

RA5: Gmelin, 1791 based his *cuneata* and later Spengler, 1802 referenced his *purpurea* on Chemnitz 6 22 215. Therefore, these two have been synonymized by most authors (e.g. Reeve; Weinkauff; Lamy; but not Tomlin, 1924). However, Spengler's *purpurea* (type Lynge, 1909 pl. 4 figs. 17-19) is distinct and not the adult form of true ***M. cuneata*** (Reeve, 1854 sp. 109; Weinkauff, 1884 sp.10; Lamprell & Whitehead, 1992 sp. 250, Preston, 1904 as *M. delicatula*). Chemnitz' species is unique in shape "keilförmig"; it is "durchsichtig" and flat, depressed, whereas Spengler's ***M. purpurea*** is rounded-trigonal, inflated, larger and usually more solid. Both may be purplish inside, whereas *purpurea* is quite common, *cuneata* is uncommon to rare. Surprisingly, Spengler's ZMUC *M. gallina*-syntypes proved instead the same as Da Costa's *gallina* (= *Spisula solida*).

M. lurida Philippi is the same as *M. purpurea* of Spengler, as stated by Lamy (1917). *M. corbiculoides* Reeve, 1854 was synonymized by Lynge (1909). Tomlin (1924) further synonymized *M. radiolata* Reeve, 1854 and *M. intuspicta* Deshayes, 1855 with *lurida*. Reeve's ***radiolata*** is internally and externally purplish radially streaked, inside often tinged with brown, Tomlin's synonymy is shared. Unfortunately, Abbott and Dance (1986 p. 333) illustrated the *radiolata* color variety of *purpurea* as "*cuneata*", causing many misinterpretations in modern literature. *M. purpurea* is a highly variable species in color, and to a minor extent also in shape. Spengler's and Philippi's specimen are rounded, inflated, internally purplish. Reeve's syntypes of ***hepatica*** are very close in shape, but somewhat brownish colored. Nonetheless, *hepatica* is also perceived conspecific. Reeve's syntypes of ***attenuata*** are also purplish, but unusually attenuate; but the low pallial sinus excludes the Japanese *crossei* and the larger *grandis*. They are also perceived to fall into the *purpurea* variability.

M. purpurea is generally strongly inflated, trigonal-rounded, sometimes with a remarkable posterior extension, and sometimes slightly angular posteriorly. The pallial sinus is round and very small. The periostracum is dehiscent and fresh specimens are glossy underneath. In addition to colored, usually also all white forms are found in the same lots. Most authors differentiate this white species as ***M. cygnus*** Gmelin (i.e. *cygnea* Chemnitz). However, Spengler stated clearly, while comparing his new *purpurea* with *cygnea* of Chemnitz: "This peculiar and new species need not to be described in detail, since it is completely similar to the preceding one in all respects, and is remarkable only by the color" (HYL00). Having studied many lots of these white forms (usually found in mixed lots together with the purplish ones), there is more or less solid "*cygnus*" and equally more or less solid "*purpurea*", lunule and escutcheon are the same, pallial sinuses are the same. Especially in mactrids, color only is insufficient to separate two species. In addition, Reeve's *incongrua* white, with faint radial streaks intermediates well. I therefore follow Spengler and consider his *purpurea* a mere color variety. The earliest valid name for this species is ***M. cygnus*** Gmelin, 1791. It is one of the most commonly found IND mactrids.

M. cygnus is well known from the Philippines to Okinawa (e.g. Okutani, 2000 p. 479 sp. 3 *cuneata*), Thailand (Vongpanich, 2000 *cygnus* and *cuneata*), S. India (Hylleberg et al., 2002 *radiolata* and *cygnus*), Sri Lanka (Kirtisinghe, 1978 as *cuneata*), Kenya (coll. auth.), Spry's Tanzanian *lurida* and also Lamy's Natal *intuspicta* seem to be the same.

RA6: Most authors followed Tomlin (1924) and considered ***M. semisulcata*** of Reeve the same as Philippi's earlier ***M. olorina***. Reeve's original type locality Australia, was even questioned (e.g. Smith, 1914). However, as stated by Oliver (1992) true *M. olorina* is confined to the Red Sea with a recent immigration into the Eastern part of the Mediterranean. The shell illustrated by Lamprell & Whitehead (1992 sp. 247 "*olorina*") is not close to Red Sea specimens, but is, instead, understood as true ***M. semisulcata*** of Reeve. Specimens studied from WA, Port Hedland are white inside and out, and more inflated than *olorina*. The lateral teeth are more elongate and the pallial sinus slightly larger, more ascending than in true *olorina*. However, *Mactra semisulcata* Reeve, 1854 is preoccupied by a fossil of Lamarck, 1807. Mayer, 1867 renamed it *deshayesi* (LAM17). ***M. deshayesi*** is considered an uncommon, inflated, large *Mactra*, currently known from NW. Australia. The Qld presence mentioned by Lamprell & Whitehead (1992) could not be verified as yet.

Mactra alta is also white, moderately inflated and also known from NWA, but more solid and less rostrate.

The white ***Mactra westralis*** lives also in NWA, but this is a rather fragile and compressed species.

RA7: The snowy white, trigonal ***Mactra eburnea*** Philippi, 1849 from EChi, Ryukyu Isl. with striated lunule and escutcheon with a deciduous yellowish periostracum and a rounded pallial sinus has been briefly mentioned by Lamy (1917). Philippi originally described a small specimen approximately 26 mm. A specimen from China, 33.2 mm is perceived to match the OD well. ***Mactra dysoni*** Reeve, 1854 also from China was described from a much larger specimen. Reeve's holotype measures 58.4 mm. It is not excluded that these two represent the same uncommon species. However, more material is needed for a firm conclusion.

RA8: Around Africa, from Canary Isl., S. Africa to the Red Sea 4 related, but distinct true *Mactra* live. Whereas modern authors only accept 2 species, older authors, e.g. Reeve, Dunker, Weinkauff, Lamy, also Nicklès differentiated more species. Here 4 species are recognized.

The comparatively small, trigonal, glossy true ***glabrata*** of Linnaeus occurs in the northern part of W. Africa, i.e. Canary Isl., CapV, Western Sahara, and certainly Senegal. This is *Le Lisor* of Adanson, 1757 (FIP42). This species has often brownish radial rays and grows to 59 mm. It is illustrated in Nicklès (1950 sp. 395) or Dance (1977 p. 285).

In central WAF, at least from Ghana, Keta through Gabon, Port Gentil to Angola, Cabinda the also glossy, but larger, more inflated, rounder ***largillierti*** occurs (PHIL3 Mactra 3 sp. 1; Nicklès, 1950 sp. 396). This species grows up to 80 mm. It was early recognized and depicted by Chemnitz 6 23 227. *Largillierti* occurs neither in Senegal, nor in SAF.

In SAF lives the largest species, up to 100 mm. It is pale brown, rounded-trigonal, less glossy. It was erroneously named *glabrata* by Barnard (1964), Boshoff (1965), Steyn & Lussi (1998 sp. 907). Barnard reported it from SAF, Natal and Zululand, Boshoff from Mozambique, Inhaca. Unfortunately, Kilburn (1974) did not accept *largillierti*, nor did he discuss *laevis*, or *ochracea* or *zellwegeri* and even confused Lamarck's *lilacea* with Linnaeus' *glabrata*. This large, quite common SAF/Mozambique species was, apart from many misidentifications, named at least 5 times. Turton's *decora* and *elongata* from Port Alfred were synonymized by Barnard (1964). Dunker's earlier OD of ***Mactra laevis*** from Mossel Bay is quite accurate and juveniles are indeed similar to *stultorum*. However, all three above names are preoccupied. On the other hand, Martens, 1880 described ***Mactra ochracea*** from Inhambane, Mozambique. In Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin for 1879, p. 744, Martens originally named this species *Mactra dissimilis* Desh. var. nov. *ochracea*. The type, MfN (ZMB7842) has been studied and proved identical to SAF material. The old labels bear first *largillierti*, which was correctly crossed through and then *Mactra ochracea* and *dissimilis var*. However, *M. dissimilis* is a quite distinct, smaller, more solid and bluish colored, stronger ribbed E. Australia species. The type of *ochracea* is 70 mm in length and 49 mm in height and has been collected by Peters in Inhambane, Mozambique. Finally, Jousseaume, 1894 described ***Mactra zellwegeri***, a large species as well, 73 mm x 50 mm from Zanzibar. It fits *ochracea* in sculpture, color, size and shape well and is considered conspecific. The locality could as yet not be confirmed. *M. ochracea* certainly ranges from SAF, W. Cape at least to Mozambique, but possibly further North to Tanzania.

Finally, the fourth species, Lamarck's ***lilacea*** is the smallest. *Lilacea* is more elongate, less inflated and often purplish inside. It is an Indian Ocean species, ranging from

Natal waters into the Red Sea and to the Andaman Sea. The type is depicted in Lamy (1917 pl. 6). *Mactra pulchra* "Gray" Reeve, 1854 is the same. Adult *lilacea* are in size and shape closer to true WAF *glabrata* than to *largillierti* or to *ochracea*.

RA9: ***Mactra grandis*** is a quite variable huge mactrid. Juveniles are often very dark, silky smooth, adults light brown, even grayish, with commarginal growth lines. The form ranges from trigonal-ovate to trigonal, often posteriorly expanded. As the size reaches almost 90 mm and characteristic radial striae are generally visible, Chemnitz' name "maxima de mactris radiatis" was well chosen. The muscle scars are broad and rounded. Generally the umbones are purplish or dark reddish and the lunule white. Having seen many specimens from Western Australia to China, I follow Smith (1885) and Lamy (1917) and consider ***M. mera*** synonymous. *M. antiquata* Reeve, 1854 **non** Spengler, 1802 is this species.

RA10: ***Mactra mitis*** was originally described from WAF, but never supported from there. It is a rounded ovate, comparatively thin, but inflated species, with a shallow pallial sinus. None of the WAF mactrids, especially not *largillierti*, as assumed by Weinkauff is close. Instead NW. Australian specimens, e.g. Port Hedland fit the BMNH-syntypes well.

This species is absent from Australian literature; therefore the exact distribution and habitat are actually not known.

It may have been confounded with *M. alta*. However, *mitis* is more inflated, less solid and the beaks are distant, whereas in *alta* these are quite close.

RA11: The true identity and distribution of the comparatively large, 54 mm, ovate, rather glossy ***Mactra semistriata*** described from unknown locality is unresolved. The BMNH holotype does not match the Red Sea *M. olorina* as assumed by authors, nor does it fit in shape the SAF *ochracea* as purported by Sowerby III (1892 p. 55). Nonetheless, Indian Ocean mactrids show indeed closest affinities.

RA12: ***Mactromeris***: The two syntypes of ***Mactra loebbeckeana*** Weinkauff, 1884 are still present in the Düsseldorf Loebbecke Museum. Both types are depicted in Weinkauff (1884 pl. 21). This is a huge species growing larger than 115 mm; it was described without locality and has remained enigmatic ever since. However, the smooth laterals exclude *Spisula*, whereas hinge, shape and color exclude the known large true *Mactra*.

The only mactrid genus perfectly fitting is ***Mactromeris***. From shape and hinge *M. catilliformis* and *hemphillii*, well illustrated by Coan et al. (2000) are excluded. Thus, *M. loebbeckeana* is considered a further synonym of *polynyma*, probably from the Asian part of its range. However, *M. polynyma* itself displays a high variability, and it is not excluded that more than only one species is present. The *polynyma* complex definitely needs more work.

RA13: ***Mactrotoma*** has been well characterized by Coan et al. (2000). The type species is the large Caribbean ***fragilis*** surpassing 100 mm; related species are found in all tropical oceans.

In the Indo-Pacific a quite similar, but smaller species occurs. ***M. ovalina*** Lamarck, 1818 has been described from the Indian Ocean and is depicted in Lamy (1917 pl. 6 sp. 1). The type of Spengler's *depressa* is depicted in Lynge (1909). Lamy is followed, these two are perceived conspecific and the earlier named ***depressa*** is applied. Lynge stated the original type locality of *depressa*, namely Guinea (i.e. Ghana) as "undoubtedly wrong". The **type locality** of *M. depressa* is herein corrected to W. Thailand, where specimens have been collected and which is in the middle of the known distribution range. *Depressa* is a typical *Mactrotoma*, widely distributed from Durban and Aden to Japan. However, as larger IND specimens, more than 40 mm, are quite close to the Caribbean form, it is likely that Gmelin's (i.e. Chemnitz') *fragilis* from Nicobars meant in fact this species and that Dall's *Mactrotoma* is instead based on the Caribbean *M.* "*fragilis*" Dall, 1894 non Gmelin, 1791. However, unless Chemnitz's type material would prove this, the conventional view is followed.

The true identity of the 32 mm ***Mactra kraussi*** Turton, 1932 from SAF, Port Alfred is currently open. From hinge, pallial sinus, and sculpture of growth lines, it appears close to *depressa* and may turn out to represent the same. The two syntypic valves should be restudied. It was neither found treated by Barnard (1964), nor by Kilburn (1971), or by Steyn & Lussi (1998).

The WAF equivalent is ***M. compressa*** Spengler, 1802. It has been described from Ghana and was also personally collected there. *Compressa* is rounded-ovate or, in Spengler's words "egg-shaped". This species was described again as ***M.*** (***Mactrotoma***) ***diolensis*** by Bouchet & Nicklès, 1976 from Casamance and was considered the only *Mactrotoma* on the WAF coast. *Compressa* is uncommon, only known from a few specimens, but extends along the whole WAF coast.

Mactroderma is not close to *Mactra*, but is closer to ***Mactrotoma***. Nevertheless, the Panamic type species ***velata*** is perceived as distinct from the global *Mactrotoma*-group and *Mactroderma* is subgenerically separated. Together with *M. isthmica* this small group shares a confluent pallial sinus, solid shells with a strong periostracum. The highly shape-variable Australian ***E. antecedens*** fits *Mactroderma* better than *Mactrotoma* and is also placed here. In elongate shape, dentition and pallial sinus it is closest to *velata*.

Another group with close affinities to *Mactrotoma* is the Australian ***Electomactra***. The type species is Hedley's SE. Australian *parkesiana*. However, ***Mactra explanata*** Reeve is a misunderstood species. The 3 BMNH syntypes reveal that *explanata* is instead the earlier name for the type species, the uncommon ***M.*** (***Mactrinula***) ***parkesiana***, bearing an erroneous type locality. Lamprell & Whitehead (1992 sp. 251) does not conform in shape, hinge and pallial sinus to *explanata*, but their sp. 261 does. The **type locality** of *Mactrotoma* (*Electomactra*) *explanata* is herein corrected to NSW, Port Jackson.

M. angulifera occurs also in N. Australia, shares many traits with *explanata* and is also placed in *Electomactra*.

"M. explanata" of Lamprell & Whitehead (1992 sp. 251) from NW. Australia is known from some larger, white specimens from Port Hedland. However, these are perceived too close to similar sized *eximia* from E. Australia to be specifically separated.

RA14: ***Leptospisula*** Dall is a valid genus (see under *Standella*). The type species, OD, the unique WAF ***striatella*** appears unrelated to *Spisula*. It is neither solid, nor closed, or trigonal and the small laterals are not striate. It is one of the largest mactrids known and is related to the *Mactrotoma* group. Adults are in shape similar to *Mactroderma*, but more inflated and widely gaping. However, the valid earlier name is ***Leptospisula nivea*** (Gmelin, 1791) based on Adanson's Le Fatan.

RA16: ***Simomactra***: Kilburn (1971) demonstrated that the SAF ***M. capensis*** is distinct from *ovalina* (i.e. *M. depressa*). Texture, shape, periostracum, the elongate rounded pallial sinus, the scarce gaping and the dentition of *capensis* matches instead ***Simomactra*** quite well.

S. chionia has equally a similar dentition as the type species *Simomactra dolabriformis* with the external ligament portion weakly separated.

Thus, these two species are tentatively placed in the otherwise E. Pacific *Simomactra*. However, it is not excluded that phylogenetic data offer possibilities for an **undescribed** genus.

RA17: ***Mactrellona***: Here placed are the large, characteristic American species ***alata***, ***subalata***, ***clisia*** and ***exoleta***. However, there are some unresolved issues.

Based on Enc. Meth. 251 fig. 2a-b, Schumacher, 1817 created ***Mactra laevigata*** and Bory, 1827 ***Mactra concentrica***. Lamy (1917) obviously did not find the type of Bory's species and was not definite in his conclusions. On the other hand, Schumacher's type of *Mactra laevigata* seems present in ZMUC and should be restudied. It is not excluded that both are earlier names for the Panamic *subalata*. Unresolved is further Gmelin's ***Venus bajana***, which according to older authors, is the earlier name for the Caribbean *alata*. All 3 species were not traced as yet.

From Nicaragua to Brazil two related rare, whitish, fragile species occur. One is ***M. inceri*** Petuch, 1998 described from Nicaragua, also known from Venezuela (MACS pl. 27 fig. 12) and Santos, Brazil (trawled 20-50 m, coll. auth.). The other is ***M. iheringi*** Dall, 1897 (holotype in DAL02) from Suriname and Brazil. Dall's *iheringi* appears to grow larger, having the umbones central instead of anterior and being more elongate less high. As such, Diaz & Puyana's sp. 206 small "*iheringi*" from Colombia appears instead to represent *inceri*.

Altena (1971) placed *iheringi* in *Mactrellona*, Rios (1994) in *Mactrotoma*; Cauquoin placed his synonymous *kempfi* in *Mulinia*; Petuch (1998) placed both as *Mactra* s.s., and Rosenberg (2006, MALAC) placed *inceri* in *Mactra* and *iheringi* in *Mactrellona*. All four genera do not fit; neither *stultorum*, nor *fragilis*, or *alata*, or *edulis* are close. These two uncommon species are tentatively retained here, but deserve **generic distinction**.

RA18: ***Barymactra***: ***Mactra rostrata*** has been placed in various genera. It is a unique, rare WAF species. Hinge, dentition, pallial sinus and texture rule out a placement within *Mactra*. However, ***Barymactra*** as characterized by Keen in Moore (1969) fits well; it was originally erected for European fossils. *B. rostrata* is large, has a very concentrated, short hinge with close set teeth, the pallial sinus is peculiarly descending and, significantly, the ventral pallial line is doubled by a row of dense punctuate scars. *Barymactra* is placed in the vicinity of *Mactrinula*, as texture and surface sculpture share some features.

RA19: ***Mactrinula***: This small group has first been recognized by Gray (1837), and was named by him later, in 1853.

The type species is ***M. plicataria***, a well known Indian Ocean species. It occurs at least off India, Mumbai (MEL07) to Java. Lamy gives Oman as additional locality. As the number of ribs in *plicataria* varies from about 20 to 30, it is not excluded that ***M. tryphera*** Melvill from Arabia represents only a juvenile specimen, occurring deeper at the end of the range. However, only the single BMNH-holotype could be studied and further Arabian material is needed for a firm conclusion.

Linnaeus's ***Mactra striatula*** is depicted in Hanley (1855 pl. 2, sp. 3). Reeve's type of ***Mactra dolabrata*** is depicted in HIG01 B861. Following Weinkauff *M. dolabrata* is understood as the juvenile form. Lamy (1917 type, pl. 6 fig. 3) demonstrated that ***M. subplicata*** Lamarck, 1818 is the same, as well as ***M. laevis*** "Chemnitz" Reeve, 1854. Dodge (1952) confirmed this assessment. In most modern books this uncommon species is illustrated as *dolabrata*, in older books often as *subplicata*. However, Hylleberg & Kilburn (2002) recently recorded it as *striatula* from S. India. *Mactrinula striatula* seems to reach the maximum depths, below 100 m, in East China Sea and Japan and occurring shallower in the West.

Scott (1994) depicted ***M. reevesii***, from Hong Kong based on BMNH type material; this is the third true *Mactrinula*.

Vongpanich (2000) well characterized all three species from Thailand waters.

RA21: Although ***Tumbeziconcha thracioides*** is rounder than ***goniocyma*** it has a ridge as well, admittedly weaker than *goniocyma*. Neither fit in *Mactrinula*. Compared to the IND *Mactrinula* both species are smaller, more fragile, the umbones more central and the surface sculpture irregular commarginal.

Cosel, 1995 redescribed ***Mactra senegalensis*** Reeve non Philippi as *Raeta senegalica*. This WAF *senegalica* is almost identical to *goniocyma* and therefore placed in *Tumbeziconcha*.

In Abbildungen III, Philippi compared his *pulla* with true *senegalensis*. His comments elucidate, that most probably, his *pulla* is a juvenile *sauliana* and true *senegalensis* a juvenile *glabrata*. The species depicted in Weinkauff sp. 44 as *Mactra pulla* is present in the Löbbecke Museum, Düsseldorf. This small specimen, 23 mm from Gabon has been studied. It represents a juvenile, vividly colored *sauliana* Gray.

In addition, Reeve, 1854 described from the Philippines ***Mactra plicatilis*** which belongs also in *Tumbeziconcha*. Finally, Smith described ***Mactrinula janeiroensis*** which matches here best. This CAR/ARG species is poorly understood. Rios (1994) illustrated *janeiroensis* but placed it erroneously in *Micromactra* and synonymized the distinct *Mactrotoma surinamensis*, which also occurs in Brazilian waters. Petuch, 1998 described *Micromactra miskito* and recognized the differences to *janeiroensis*. However, he overlooked Altena's earlier *surinamensis*. The strong undulating wavy sculpture and the finely lined microstructure of *janeiroensis* are characteristics of *Tumbeziconcha*.

All five species are small, glassy, very fragile and quite uncommon. Neither exact habitat nor anatomy is known. As stated in the introduction, whether *Tumbeziconcha* is correctly placed in MACTRINAE is unresolved.

RA22: The number of true ***Mulinia*** is hard to assess. Every researcher has another system. Philippi (1893) was able to differentiate 10 Chilean mulinids and more than 20 names are available.

Concluding from the type species of *Mactra*, it can not be completely excluded that only one highly variable species is present from Peru to Argentina. Some well known forms are illustrated. However, only an extended genetic analysis can solve this issue.

Reeve's ***Mactra epidermia*** is without doubt a Magellanic *Mulinia*. The BMNH-holotype represents a comparatively thin form, with a broad, rounded pallial sinus. The type locality Portugal, Faro is erroneous. *Epidermia* most closely resembles forms later described as *epidermia* by Philippi and as *fuegiensis* by Smith.

Mactra gabbi Tryon, 1870 (syntypes ANSP 51392) has been studied. It is close to typical *edulis* from Chile; the type locality California, as stated by Keen (1971) is erroneous.

M. rodatzi described from East Africa has neither been identified properly, nor found there since. The type was not found and is not in MfN (6/07). However, this species is precisely illustrated in Dunker's Novitates, sp. 21 and without doubt a true, large *Mulinia*. Neither texture, nor hinge, or pallial sinus fit *M. aequisulcata*; it is also significantly distinct from *M. ochracea* and *lilacea*, the other large mactrids known from East Africa. On the other hand, *Mulinia* is only known from the Americas and indeed *rodatzi* closely resembles large *Mulinia edulis* from Chile. These are known to surpass *rodatzi* (75 mm) in size. *M. rodatzi* is considered a further synonym of *Mulinia edulis*, the type locality being erroneous.

RA23: ***Spisula***: Comparing large series of European ***S. subtruncata*** with the Australian ***S. trigonella***, a subgeneric distinction is not supported. Especially smaller Mediterranean specimens are virtually indistinguishable from Australian specimens. Following Beu (2004 and 2006) ***Notospisula*** is a synonym of *Spisula*.

However, *S. austini* may merit subgeneric distinction.

The type of ***M. corbuloides*** Reeve was analyzed by Smith (1914). This study revealed a spisulid dentition. *M. corbuloides* was also considered the same as *trigonella* by Tomlin (1924). Thus, *corbuloides* is not, as stated by Dall and applied by US authors synonymous to *Mulinia lateralis*. ***S. trigonella*** is known from all Australian states and as a highly variable species (also Smith, 1914 as *parva*). It has at least 7 names. I am not convinced that ***S. colganae*** newly described from NT is distinct. The type of *trigonella* Lamarck (Lamy, 1917 pl. 7, fig. 3) described from Shark Bay appears almost identical.

A syntypic left and a right valve of ***Cardium triste*** Linnaeus, 1758 ink marked 74 are present in the Linnean Society Collection, box 83. The hinge configuration is typical spisulid. I fail to perceive *triste* other than a juvenile *solida*. *Triste* is not close in shape to *elliptica*, or in shape and texture to *subtruncata*.

According to Lamy (1917), who analyzed Locard's collection, Locard considered *elliptica* synonymous to *solidula* and renamed true *elliptica* erroneously as ***gracilis***. Some European authors still consider *gracilis* valid. However, *elliptica* is variable and "very light, elongate" *elliptica* specimens are found in the Alboran Sea, but are also known from the North Sea.

Neither ***M. marplatensis***, nor ***M. isabelleana*** are mactrids, as classified by Rios. Their compressed, closed, trigonal shape, the rather strong periostracum, the lacking gloss and a dentition with slightly striate laterals makes them spisulids.

M. petiti is perceived to belong here as well. It was described by Orbigny from Rio and is well known to live also further south, in Argentina. Dall described and depicted (DAL02 pl. 31 fig. 5) ***richmondi*** from Nicaragua. This species was synonymized by Altena with *petiti*, a conclusion obviously not shared by Rios. Diaz & Puyana (1994 sp. 207) illustrated *richmondi* from Colombia. Despite Altena's claim, I strongly doubt synonymy of *richmondi*. Biogeographically there is a gap to *petiti*, at least from Northern to Central Brazil. *M. petiti* grows significantly larger than the known *richmondi*. The adult shape is in anterior and posterior slopes and umbones distinct; the pallial sinus is marked larger. Following, Dall and Rios, ***richmondi*** is understood as valid species. It is an uncommon small species, up to approximately 20 mm and is currently known from Nicaragua to Suriname.

Smith (1914) synonymized ***Mactra symmetrica*** "Deshayes" Reeve, 1854 with *petiti*. This view was shared by Rios (1994). The BMNH syntype is indeed close, but has a broader pallial sinus and shows differences in shape to all *petiti* studied. In addition, a size of 39.2 mm was not nearly seen in any *petiti* as yet. *Symmetrica* is in pallial sinus and shape closer to *richmondi*, but has twice its size. Although Reeve described *symmetrica* without locality, Lamy pointed that Deshayes originally designated New Caledonia as locality. Indeed, the BMNH wood board bears this location. If *richmondi* would be found twice as currently known in size, these two should be compared again. As further the New Caledonian mactrid fauna is not particularly well known either, *symmetrica* is currently treated as unresolved.

M. petiti, ***M. isabelleana*** and the fossil *M. patagonica* are on Orbigny's pl. 77 thus, n. & f., **1841**.

As stated by Powell (1979) a trigonal form (i.e. ***discors***) and an ovate from (i.e. ***murchisoni***) occur in New Zealand. However, the periostracum in typical *discors* may be dark or straw as in *murchisoni*, both forms have a posterior keel and both forms have transversely striated laterals. Comparing large series of *discors*, shapes almost identical to *murchisoni* occur. As stated by Hutton and Lamy it is hard to keep these two apart. Nonetheless, Powell gives distinct habitats and a different maximum size. Modern methods have to clarify whether indeed two distinct species are involved. Dentition, solid adult form, small rounded muscle scar, hinge with strong spur and rough, obliquely striated laterals exclude *Mactra*, but make both true spisulids. ***Spisulona*** Marwick, 1948 fits subgenerically precisely. Large *discors*, more than 80 mm, are very close to Keen in Moore (1969 N603 4a-b). The rounded, often fragile juvenile forms and the often abraded laterals make it sometimes difficult to recognize their spisulid affinities.

RA24: The species usually placed in ***Longimactra*** or ***Pseudoxyperas*** *e.g. Longimactra elongata*, *Pseudoxyperas egena* and *aspersa* have striate laterals. The type species *Oxyperas*, OD Lamarck's preoccupied ***Mactra triangularis*** has striated laterals as well. Shape and sized are comparable. As main difference between *Oxyperas* and *Pseudoxyperas* (syn. *Longimactra*), just the strength of commarginal ribbing remains. As argued by Beu (2006) this is barely enough for subgeneric distinction. Thus, *Pseudoxyperas* is here synonymized with *Oxyperas*. As such ***Oxyperas*** encompasses currently 8 mostly uncommon, comparatively large, elongated species with striate laterals and a variable strength of commarginal ribbing.

RA26: Neither *M. nitida*, *M. subnitida*, *M. angolensis* nor *M. acutissima* fit *Mactra*. Smith (1872) classified *nitida* in *Schizodesma* (i.e. *Scissodesma*), where it has also been placed by Gray (1837). However, true SAF ***Scissodesma*** is unique in shape, texture and ligament.

On the other hand, Eames, 1957 defined the West African ***Crepispisula*** which fits well. These robust shells are similar in outline to *Scissodesma* and share the same radial structure on the fresh periostracum. The sculpture is slightly commarginal; they have the same ligament slit as *Scissodesma*, but smaller. Lunule and escutcheon are sulcate, stronger so than in *Scissodesma*. The dentition is very close and both share pustulose laterals. *Crepispisula* is not closely related to *Spisula* s.s. but to *Scissodesma*, and is here considered as subgenus of the latter.

As no growth series could be analyzed, it is not known, how juvenile ***angolensis*** look like and whether they are indeed distinct from *acutissima*.

RA27: ***Lutraria***: Lucas (1985) is followed, who demonstrated that ***L. magna*** Da Costa is a synonym of *L. lutraria* and not a *Psammophila*. As such, he confirmed the earlier conclusions of Lamy (1917 p. 373) and the opinion of Turton (1819). His findings have been neglected by virtually all modern European authors. As *solenoides* of Lamarck is the same as Gmelin's *oblonga*, ***L. oblonga*** represents *Psammophila* typically.

Philippi, 1851 validly named a European species ***Lutraria solida***. He referred to his Moll. Sicil. I (1836) *L. elliptica*. Obviously, Philippi came to the conclusion that his *elliptica* is distinct from Lamarck's. However, already in Moll. Sicil. II (1844) he created two *elliptica* varieties, namely *latior* and *angustior*. For his 1851 *solida* he used exactly the same measurements as for his 1844 *latior*. It therefore appears that *Lutraria solida* Philippi, 1851 is an unnecessary nom. nov. for *L. elliptica var. latior* Philippi, 1844 and a further synonym of Linnaeus' *lutraria*. ***L. angustior*** is a valid European species.

The **SAF *Lutraria*** have received many names. All species are somewhat similar to European forms, but none is identical. 2 species appear confined to SAF proper. In addition, one species occurs on the eastern border, extending tropical. ***Lutraria capensis*** Reeve, 1854 is the broad, slightly humped, heavy species as adult, in texture superficially similar to the European *angustior*. As Turton, 1932 clearly misinterpreted *capensis*, it seems, that his *albanyana* is instead a humped *capensis*.

The second SAF species is usually illustrated as *lutraria*. However, with its characteristic crested and pointed form, the larger resilium, the more compressed and elongated pallial sinus, the rougher, darker periostracum it is distinct from *lutraria*. The European type species is also depicted in Poppe & Goto (1993 pl. 17 fig. 3a-b). The SAF species appears unnamed. It is well illustrated and characterized as *L. lutraria* "Linnaeus" Steyn & Lussi, 1998 non Linnaeus, 1758 sp. 904a and here renamed ***Lutraria* (*L.*) *steynlussii***. The distributional range has been indicated as S. Namibia, Oranjemund to S. Africa, East London. Steyn & Lussi gave a maximum size of 85 mm. However, the largest specimen studied from Knysna measured 115 mm, and it may be that *steynlussii* grows even larger. Both, *L. capensis* and *steynlussii* are *Lutraria* s.s.

The third species is a *Psammophila* named *L. oblonga* by Barnard (1964 partim, Natal non Knysna records), and has been described as ***L. inhacaensis*** Boshoff, 1965. Specimens from Inhaca are identical to specimens found in Kenya. Spry's *rhynchaena*, sp. 174 from Dar es Salaam is, as stated by Kilburn (1973), the same. *L. inhacaensis* is a valid species confined to SE. Africa. It is strongly gaping, often curbed with a comparatively angular end and with a dark brown, tough periostracum. The pallial sinus is broad and completely fused with the pallial line. In fresh specimens a yellowish hue is usually found internally.

Beu (2006) demonstrated that the Red Sea and Arabian species illustrated as "*australis*" by Oliver (1995 sp. 1099) is "not conspecific with the lectotype and paralectotypes of *L. australis* Reeve", but is the same as Jousseaume's ***L. turneri***. Specimens have been dived off the Oman coast, Khor Fakkan and Dibba in murky water at 13-17 m. Oliver (1992 fig. 6c, MNHN) seems to be the same, whereas (fig. 6a and b, NMW) might indeed be true *australis*, which, however, does not occur in the Red Sea. *L. turneri* is elongate, straight, anteriorly pointed and has a very rough periostracum. As the paralectotype of *turneri* is labelled "Zanzibar" it is not excluded, that this species also occurs there. However, Spry only depicted *inhacaensis* and I also, collected exclusively *inhacaensis* in Kenya. Thus, an East African presence of *turneri* needs confirmation.

Lutraria curta is considered a valid *Psammophila* confined to South China Sea, Thailand, Pattaya (coll. auth.), Hainan (Zhongyan, 2004 pl. 150 F; coll. auth.) and likely Philippines (= type loc.). The large, broad quadrangular pallial sinus is similar to *turneri* from the W. Indian Ocean. However, the shells are consistently broader and shorter, angulate and quite thick. The pallial sinus is confluent with the pallial line.

Beu (2006) demonstrated that ***australis*** is the same as ***philippinarum*** and that *australis* has precedence. Both types have a very similar, elongated form and such forms are well known from the Philippine and tropical Australia. Furthermore, Lamprell and Beu are followed in considering *arcuata* a synonymous shape form. Beu (2006) also synonymized herein *Lutraria bruuni* from Kermadec Isl. However, this special form, narrowing at both ends, was not encountered as yet in any *australis* studied and ***bruuni*** is kept distinct for the time being. Biogeographically *rhynchaena* is closer and these two should be compared.

The temperate ***Lutraria rhynchaena*** has consistently been recognized by S. Australian authors (Cotton, 1961; Allan, 1962; Lamprell et al., 1992; Jansen, 1995) against the tropical *australis*. It has a clear type locality and a restricted biogeography. *Rhynchaena* appears generally rougher in sculpture (ridges) and periostracum, more pointed at both ends and with a deep, more trigonal, pointed pallial impression. It is here also recognized as valid S. Australian species distinct from the tropical *australis*. Beu's view is not shared.

Gray, 1837 described ***Lutraria elongata*** from Prince of Wales Island, very probably today's Penang, Malaysia. Hedley (1909) adopted this name for a Queensland shell, presumably based on the Prince of Wales Island in Torres Strait. Iredale, 1929 renamed Gray's *elongata* non Münster, 1835 (= foss.) as ***impedita*** and created a new genus ***Lutromactra***. Finlay, 1930, not aware of Iredale's earlier action, renamed this species unnecessarily again as *L. porrecta*. However, according to Allan (1962) and Lamprell & Whitehead (1992) there is only one ridged species along the tropical Australian coast, namely ***L. impar***. *Impar* has earlier been designated type species of ***Goniomactra*** by Mayer, making Iredale's *Lutromactra* and *impedita* synonyms. *L. impar* is quite widely distributed, known from Mergui Archipelago (MAT87), Thailand (VON00), Malaysia (OD), Phil (coll. auth.) and recently identified by Kilburn from Vietnam (HYL03). As such, Gray's preoccupied *L. elongata* occurs indeed in both Prince of Wales Islands.

On the other hand, as stated by Gray (1837) and confirmed by Lamy ***L.*** (***Lutrophora***) ***complanata*** (i.e. Chemnitz 238-9, *Mactra planata*) is a significantly distinct species, smaller, ovate-oblong with umbones almost central, confounded by Beu (2006) with *impar*. This rare species is well depicted in Swennen & al. (2001 sp. 112). It is not known from Australia, but from Pakistan to Vietnam. ***L. costata*** Tryon, 1870 erroneously described from Senegal is the same (ANSP 51290, 2 syntypes studied). Tryon (1870) just compared *costata* with the distinct *L. impar*, but did not consider *complanata*.

The huge IND ***Lutraria spectabilis*** Philippi, 1851 is unresolved. The type has not been traced, it might be in Chile.

RA28: As noted by Lamy (1917), the WAF *Mactra striatella* Lamarck (= type species *Leptospisula*, OD Dall 1895), was not under the species mentioned by Gray, 1853 for his ***Standella***. Thus, the SD type designation of Stoliczka, 1871 is without base; but it conforms to *Standella* H. & A. Adams, 1856 non Gray, 1853. The Adams brothers included here mainly today's *Mactrotoma* and *Leptospisula*.

According to Lamy just *Spisula fragilis* and *Spisula aegyptiaca* were mentioned by Gray 1853. Of these, *Spisula fragilis* Gray, 1837 or precisely "*Mactra fragilis* Gray, non Chemnitz = *M. pellucida* (Ch.), Gmelin, 1788; not *Standella*, H. & A. Adams, 1856" was designated by Dall, 1898 p. 886 as type species of *Standella*, SD.

S. aegyptiaca was later separated by Iredale as type species of *Meropesta*. Thus, *Spisula fragilis* Gray, 1837 (= *Mactra pellucida* Gmelin, 1791) SD Dall, 1898 is the correct course for the type species of ***Standella***. Keen in Moore (1969) depicted erroneously the WAF *striatella* and confused subsequent authors.

Having seen many *Standella* throughout the Indo-Pacific, I fail to accept more than one highly variable species. It has irregular growth lines only and in adults a radial ridge. ***S. hubbardi***, the large inflated Australian form, has been correctly synonymized by Lamprell & Whitehead (1992). ***S. annandalei*** of Preston is a fragile, juvenile form from India, here synonymized. Gould's ***debilis***, as indicated by Lamy (1917), is understood as further synonym; juvenile specimens are indeed rather fragile and close to *Mya arenaria* in shape as originally compared by Gould, 1850. *Meropesta capillacea* is generically distinct.

Thus, *Standella* is considered monospecific, reaching about 80 mm and ranging from Arabia to China. It is not known from Japan. Okutani (2000) depicted *Meropesta nicobarica* instead of *S." pellucida"* from there.

RA29: ***Heterocardia***: ***H. gibbosula*** Deshayes, 1855 (not preoccupied by *Mactra gibbosula* Reeve, 1854) is a variable species. It has been described from the Philippines and is also well known from SChi, Malaysia and Thailand. The OD and picture of ***H. elliptica*** Zhuang, 1983 from SChi, Guangdong, Nanao Island shows a quite typical specimen, admittedly larger than usual, but otherwise no obvious differences were given. It is here synonymized and considered a large end of range form.

RA30: ***Meropesta*** appears to consist of 3 species:

M. nicobarica is a variable widely distributed species and was even named twice by Chemnitz due to differences in sculpture and shape (Lynge, 1909; Lamy, 1917). It grows more than 70 mm. Shape, fragility and strength of ribbing in *nicobarica* is variable, but not the base sculpture, with 3 distinct structural areas. Okutani (2000 pl. 482 sp. 20) represents instead *nicobarica*.

M. sinojaponica has been described by Zhuang, 1983 from Shandong (ZHU83; Zhongyan, 2004 pl. 150 G). Zhuang synonymized *Standella capillacea* Habe, 1984 non Reeve, 1854 from Japan and China.

True ***M. capillacea*** (type: Higo et al., 2001 B876; also Zhongyan, 2004 pl. 150 sp. B), originally described from India occurs widely but seems eastwards restricted to China, Fujian. It is a huge species, growing exceptionally to 100 mm in India.

Dall, 1898 very briefly described ***Standella*** (***Eastonia***) ***stimpsoni*** while discussing ***nicobarica*** as "a species with finer sculpture, from the China Seas, has the hinge similar, but depauperate". Although not illustrated, and barely recognizable Boss et al. (1968) considered it as valid name. Both *M. capillacea* and *M. sinojaponica* occur in Chinese waters and both have a finer sculpture than *nicobarica*. As the characteristic brownish periostracum of *sinojaponica* was not mentioned, it is more likley that Dall's *stimpsoni* is the same as Reeve's *capillacea*.

RA31: ***Darina rustica*** sp. nov.

Introduction: In addition to the well known *D. solenoides*, another *Darina* species lives in Puerto Santa Cruz, S. Argentina. It was collected by Alejandro Fabian Suarez and Tito Narosky and provisionally named *D. rustica*. After analysis of many specimens of *D. solenoides*, *D. rustica* is considered encompassing the restricted variability of *solenoides*. It is here described as new:

Diagnosis: An inflated, rather solid, coarse and slightly distorted *Darina* with a rhomboidal shape and an enlarged, narrow pallial sinus.

Description: Shell inflated, rhomboid with a straight ventral margin, posterior obliquely truncate, anteriorly rounded; rather solid and somewhat distorted, both ends gaping, umbones low, slightly back of midline, resilifer in a deep, broad, vertically extended buttress. Typical *Darina* hinge, concentrated, left valve with a divided cardinal and two small laterals, right valve with two receiving small cardinals and two laterals on each side, one only rudimentary. Deep, elongate narrow pallial sinus extending to midline. Periostracum brownish yellow, slightly wrinkled posteriorly. Measurements (holotype): length 32.6 mm; height 12.8 mm; thickness 9.7 mm. The variability in all species studied is low. The maximum size known is length 42 mm (paratype 3). The specimens were live taken, but the soft parts were not preserved.

Derivatio nominis: The MS name of A. F. Suarez and T. Narosky is applied. It characterizes this coarse, rough new species well.

Type locality: Puerto Santa Cruz (50.0°S, 68.5°W) Santa Cruz Province, Patagonia, Argentina; at extreme low tide attached to algae; also in shallow water, attached to algae. A couple of specimens were live collected in October, 2002 by T. Narosky and A. F. Suarez.

Type material:

The holotype is deposited in the NHM, London, type collection

Paratypes 1 (30.1 mm, RA115) and 2 (32.2 mm, RA115 1) in collection M. Huber

Paratypes 3 (42 mm) and 4 (33 mm) in collection A. F. Suarez

Paratypes 5 (35 mm) and 6 (34 mm) in collection T. Narosky

Distribution: The new species is currently only known from the type locality and its surroundings.

Discussion and comparison: Compared to *D. solenoides* the new species is
a) Less high and strongly inflated; equal sized *solenoides* are slightly higher, and the shell is flatly compressed with a thickness generally less than 6 mm.
b) More solid and somewhat distorted; whereas *solenoides* is fragile, translucent and more regular
c) Rhomboid, posterior obliquely truncate with a straight ventral margin; whereas *solenoides* is ovate elongate
d) Smaller; the largest *rustica* measures 42 mm, whereas *solenoides* attains 49.5 mm (seen) and Rosenberg (2006, MALAC) even indicated 51 mm.
e) The pallial sinus is narrower, more elongate-pointed and reaches midline; whereas in *solenoides*, the sinus is broader, rounded and confined to the posterior third
f) The buttress is broader in *rustica*.

Lamy (1917) mentioned and depicted ***Darina tenuis*** (Philippi 1845). Philippi, 1845 described this species from the Magellan Strait, Gregory Bay. However, this form with marked umbones, slightly convex posterior, slightly concave anterior and very fragile and thin texture fits *solenoides* well. This form is often seen in younger specimens. Consequently, it has been synonymized (e.g. Bernard, 1983; Forcelli, 2000).

Darina declivis Carpenter, 1856 erroneously described from Vancouver Isl. was synonymized with *solenoides* by Coan et al. (2000).

Lutraria kingi P. Fischer, 1867 is an unnecessary nom. nov. for *D. solenoides* and an objective synonym.

No other extant *Darina* are known.

RA32: ***Mactra vitrea*** Gray, 1837 has been well depicted from Maluku (Reeve, 1854 sp. 44) or from Maluku and India (Weinkauff, 1882 sp. 94). It was placed in *Mactra* (Weinkauff), *Mactrinula* (Conrad; H. & A. Adams; Lamy), or in *Harvella* (Dall). However, the fragility, the inverse direction of the umbones and the dentition exclude these three genera, but point into PTEROPSELLINAE.

In the 20th century it was recognized that this species was mislocated and occurs instead uncommonly in WAF (e.g. Nicklès, 1950 sp. 400 as *Labiosa*; Ardovini et al., 2004 as *Mactra*).

Dillwyn used *Mactra vitrea*, 1817 earlier than Gray for a distinct species (i.e. *Clementia papyracea*). However, even earlier, Spengler, 1802 described a *Mactra vitrea* from Nicobars, not recognized from there since. Mörch (1871) declared it a *Raeta* and the OD points clearly into the West African species. The type is present in ZMUC, but could not be studied as yet. This application of Spengler's name for this WAF species is therefore tentative.

In addition, a closely related species was recently described by Cosel, 1995 as ***Mactra*** (***?Mactrinula***) ***inconstans***, which is close in biogeography, texture and hinge. None of the existing genera and subgenera fits, but as concluded by Nicklès, *vitrea* is closest to *Labiosa* (= *Anatina*). Here a **new genus** is indicated.

RA33: ***Raeta***: ***Raeta pellicula*** occurs uncommonly from Aden through Australia to Japan. As stated by Oliver (1992) the posterior margin appears highly variable, from acute, over rounded to subtruncate. This obviously changes the form of the pallial sinus. Thus, it seems justifiable to synonymize the extended *indica* of Dall (DAL25 pl. 20 fig. 2) as done by Lamprell & Whitehead (1992) and Higo et al. (1999). As such, *pellicula* represents ***Raetina*** typically.

On the other hand, ***Raetella tenuis*** Dall, 1898 from Hong Kong is understood as indistinguishable from the earlier *pulchella*. Thus, ***Raetella*** Dall, 1898 antedates ***Raetellops*** Habe, 1952.

It is possible that ***Neaera tenuis*** Hinds, 1844 and ***Neaera lyrata*** Hinds, 1844 antedate *Raeta pulchella* and *Raeta pellicula* which are both known to live in the Philippines. However, the types were neither found at BMNH in 11/08, nor in 3/09. Thus, Hinds' names are treated as nom. dub.

6.60 CARDILIIDAE

RD1: Altogether 6 extant cardilids have been described, here 4 species are recognized. Very few specimens are available in collections. As far as is known, detailed anatomy, reproduction, and feeding are still unknown. No phylogenetic data were seen. Thus, the conventional position within mactrids is unconfirmed.

Deshayes (1844), P. Fischer (1861) and Lamy (1918) treated the extant species.

Usually, the **type designation** of *Cardilia* is indicated as *Isocardia semisulcata* SD Herrmannsen, 1846 (e.g. Keen in Moore, 1969). However, Deshayes, 1844 in his *Cardilia* review stated "J' ai établi ce genre, en 1835, dans le tome VI de la deuxième édition des *Animaux sans vertèbres* de Lamarck. Une petite coquille très singulière, rapportée par Lamarck à son genre Isocarde, est devenue pour moi le type de ce nouveau genre, dans lequel…". As such, SD Deshayes, 1844 precedes Herrmannsen, 1846.

Cardilia atlantica described by Nicklès, 1955 from WAF, Ghana, has also been reported off Liberia and Nigeria. All other species known are IND/JAP.

C. gemmulata Gould, 1861 was described from the China Sea, as juvenile 2 mm specimen. As it has been mentioned by Lamy (1917) and Johnson (1964), it is not a nom. obl. as concluded by Higo et al. (1999). However, the type is lost, and *gemmulata* is best considered nom. dub.

P. Fischer (1861) compared the types of Lamarck, Deshayes and the specimens from the Cuming collection and recognized as before Deshayes (1844) 3 distinct IND species.

The type species ***C. semisulcata*** was originally described from S. Australia, St. Peters Isl. However, Cotton (1961 p. 20) unmistakably stated that this family is not present there. Lamprell & Healy (1998) gave the distribution of *C. semisulcata* from North Qld to North WA. All Australian specimens seen stem from the tropical part. Thus, Lamarck's type locality is erroneous, and *semisulcata* tropical. Deshayes (1844) recorded *semisulcata* also from Malacca, 20 mm, and Lamy (1918) from the Philippines and from Japan. This is the largest cardiliid, the single MNHN holotypic valve measures almost 22 mm. The largest specimen seen from W. Australia is 18.2 mm. Lamarck's type (in Lamy, 1917) appears indistinguishable from Japanese specimens, e.g. Habe (1951 fig. 19) or Habe (1971 pl. 60 fig. 13). This has also been accepted by Keen in Moore (1969). The maximum size for Japanese specimens is 20 mm, and as such equals the tropical Australian ones. Smith (1906) further reported *Cardilia semisulcata* off Port Blair, Andaman Isl., 183 m; Melvill & Standen (1907) reported a few *Cardilia semisulcata* from the Persian Gulf from 285 m and Oliver (1995) illustrated *semisulcata* from offshore Oman. The accuracy of these records was not verified.

Cardilia inermis Deshayes, 1844 pl. 100 is a smaller, more squarish species. It has been described from Sumatra. Hidalgo, 1903 did not accept the identity of Sowerby's (Reeve's Icon. fig. 2) with Deshayes' species and renamed Sowerby's *inermis* as ***C. reeveana***. However, afterwards Lynge (1909) accepted Sowerby's interpretation, and reported *inermis* also from SChi, E. Thailand. Before, Fischer (1861) had also accepted a Philippine distribution of *inermis*. It appears that Hidalgo's *reeveana* is an unnecessary nom. nov.

The third species ***C. martini*** from Malacca Strait and the Philippines grows medium in size, is the narrowest and has much stronger ribs, which are squamulate.

6.61 MESODESMATIDAE

RC1: Mesodesmatids build a small family, which is, due to the papers of Reeve (1854), Lamy (1912-14), Davis (1965-67), Rooij-Schuiling (1972) and Beu (1971-82), quite well known. Most genera are monospecific or composed of a few species only. As in mactrids, Reeve's Iconography was published earlier, in 1854, whereas the referenced descriptions of Deshayes were published in 1855.

The type species of *Mesodesma*, was according to Keen in Moore (1969), as well as Beu (1971), designated by Anton. However, Anton (1838 p. 3) only listed three species and gave the number of these specimens in his personal collection without selecting anything: "*MESODESMA* Desh. 105. 1. *jauresii Joannes*. 106. 2. *donacia* Desh. = *Mactra donacia*. Lam. 107. 2. *striata Desh. = Crassatella striata Lam. = Mactra striata Gm. Ch. 6. 222. 223.* (*3 Arten.*)". Later, Gray, 1847 and Herrmannsen, 1847 designated SD *Mya novaezelandiae* as type species of *Mesodesma*. However, this Chemnitzian name was not among the 7 *Mesodesma* species listed by Deshayes, 1832, who used instead *chemnitzii*. Lamy, 1912, p. 246 appears to be the first having validly designated a type species. Thus, the **type species** *Mesodesma*, SD Lamy, 1912 is *Mactra donacia* Lamarck, 1818.

Rooij-Schuiling, 1972 erected *Mesodesma* (***Regterenia***), a new subgenus for a SAF mesodesmatid. However, this species is neither in dentition, form, pallial sinus, nor in size close to *Mesodesma*. *Regterenia africana* is a small, solid, trigonal species without pallial sinus and here understood as valid genus, placed tentatively between *Donacilla* and *Davila*.

Japanese authors place *Monterosatus amamiensis* in mesodesmatids. However, ***Monterosatus*** is now considered a synonym of the montacutid *Planktomya* and placed there.

Mesodesma retusa Reeve, 1854 wedge shaped, without pallial sinus and a rough commarginal sculpture with fine radials appears also related to *Planktomya*.

RC2: The type species of ***Ceronia*** (i.e. *deauratum*) and ***Mesodesma*** (i.e. *donacium*) are close. Many authors synonymized. The species involved have solid, truncate shells, a small rounded pallial sinus and as in *Spisula* strongly serrate laterals. However, a quite distinct biogeography, the much larger size and the remarkable gaping at both ends of *donacium* recommend, at this state of knowledge, to upheld distinction. Genetic methods should clarify the strength of a subgenus *Ceronia*, separating the 2 NW. Atlantic *arctatum* and *deauratum*, from the PER type species.

On the other hand, ***Mesodesma mactroides*** is significantly distinct in texture, shape, dentition and pallial sinus. Whereas most American authors classify it as *Mesodesma*, Lamy (1914) well recognized the differences and placed it as *Taria*. However, *Taria* is a distinct NZ-grouping of large, solid species, and is neither in biogeography, nor dentition, pallial sinus or texture closely related. As none of the existing IND genera/subgenera, nor any of the fossil genera characterized by Keen in Moore (1969) (e.g. *Ceroniola*, *Mactropsis*, and *Myadesma*) fit, a new genus is described herein:

Amarilladesma gen. nov.

Description: A mesodesmatid genus with medium sized, light and fragile shells, ovate in form with prominent umbones; extended, elongate rounded pallial sinus passing midline; hinge with a small external and a large internal portion in a rounded resilium; cardinals as in *Mesodesma*, laterals almost smooth, only weakly striate; shell strongly gaping at both ends; whitish with a dehiscent yellowish periostracum; two large separated siphons.

Type species: *Mesodesma mactroides* Reeve, 1854

Derivatio nominis: After the Spanish name Almeja amarilla; the gender is understood as neuter.

Distribution: *Amarilladesma* is recent monospecific; the only species known lives in ARG (S. Brazil to Argentina)

Remarks: The main differences to *Mesodesma* are found in form, texture, pallial sinus and lateral dentition. A comparison of the hinges is found in Lamy (1914) p. 5 (*donacium*) and p. 29 (*mactroides*), however, the laterals in *Amarilladesma* are also striate, though much weaker than in *Mesodesma*

In addition, Marins & Levy (1999) demonstrated a high genetic distance between *A. mactroides* (Brazil) and *M. donacium* (Chile). Zurich University genetic experts considered these figures as a solid base for a longstanding separate evolutionary development. These findings further support a distinct genus.

RC3: ***Paphies***: As stated by Lamy (1914), Iredale (1915), Finlay (1928), and Powell (1979), but not accepted by Beu et al. (1982), ***Taria*** is well recognizable and here considered at least subgenerically distinct from *Paphies*. ***Paphies*** (***P.***) is recent monospecific with a very solid, ovate species, umbones central, non-gaping and with a very small pallial sinus. The 3 *Taria* are all donaciform, less solid, with a larger, rounded pallial sinus, all are at least slightly gaping. They also grow larger than *australis*.

As stated by Powell (1979) the largest *P.* (*T.*) ***ventricosa*** can be rocked lengthwise on a flat surface, whereas the two other lie almost flat. *Ventricosa* also has a much larger, more elongate pallial sinus, passing the resilium line and is stronger gaping. The largest *ventricosa* seen is 121.8 mm (Wellington).

The two others are close to each other. The mainly N. Isl. *P.* (*T*) ***subtriangulata*** has generally two weak ridges posteriorly, the pallial sinus is slightly larger and the shells often more solid than ***donacina***.

RC4: ***Atactodea striata*** is the only IND mesodesmatid very widely distributed and very commonly found. It is highly variable in shape, thickness of the valves, and number and strength of the ribs which led to a multitude of unnecessary names. Gmelin started and separated the smooth *glabrata* from the ribbed *striata*. For this species often ***glabrata*** Gmelin, 1791 is applied. However, this name is preoccupied by a Linnean mactrid. Characteristic for *striata* is the white color, a strong hinge with two broad, massive laterals in each valve and generally a trigonal form. The pallial sinus is very small and trigonal-rounded. ***Donax candida*** Gmelin, 1791 based on Schröter pl. 8 fig. 5 is the same, as recognized by Mörch (1853). The BMNH syntypes of Reeve's ***mitis*** revealed a typical small trigonal *glabrata* form, solid, whitish, with few ribs. The label reads Australia. Lamprell & Healy (1998 fig. 750) appears to represent a further *striata*.

A similar species, but elongate-ovate is the SAU ***A. cuneata***, full adults show heavy laterals, as does also Lamarck's type (LAM14 pl. 1 fig. 2).

Close in shape to *cuneata* is the W. Indian Ocean ***M. bahreinense***, which has a narrower hinge plate with a finer lateral dentition compared to *striata* and is only found smooth with growth lines. In addition, here the pallial line is more distant from the ventral margin. However, Melvill & Standen, 1907 did not compare their new species with Jousseaume's earlier ***Mesodesma subobtusa*** from Aden, which is undoubtedly the same. Jousseaume stated 25 mm as maximum size, the largest collected in Gulf of Oman, Leema are 24.8 mm. *Striata* grows much larger. *A. subobtusa* is also known from Madagascar (coll. auth.) and may have a wider distribution in the W. Indian Ocean.

Further known are two Australian species ***heterodon*** and ***erycinea***, well captured by Australian authors.

A unique species is ***A. layardi*** described from Sri Lanka. It is very close in shape and dentition to *striata*. However, it has a purplish color, irregular commarginal ridges and the pallial sinus is slightly deeper. As far as is known, no further specimens were ever collected.

The BMNH syntypes of ***Mesodesma transversa*** Reeve, 1854 originally described without locality, but now labeled Philippines, represent typical *Donacilla*. I was unable to detect any differences to white *cornea* well known from the Mediterranean.

RC5: ***Donacilla***: Lamy, 1912 considered Lamarck's ***Amphidesma cornea***, doubtfully from Mauritius, as distinct from Poli's species and renamed it ***Mesodesma pseudocornea***. Lamy approached it to *Donacilla*. However, the 26 mm type could not be located at MNHN 6/09 and no further records are known. As such *cornea* is one of the very few missing Lamarckian types in Paris. Unless this type can be studied, *pseudcornea* is treated as nom. dub.

RC6: Following Kuroda & Habe in Koyama et al. (1981) ***Davila*** is monospecific. ***D. plana*** is quite variable in color, all white to purple-red umbonally, and in form trigonal-ovate to strongly inequilateral. The entire pallial line is characteristic. Kuroda and Habe reported it from Honshu, Wakayama Pref., whereas other Japanese authors limit it to Amami Isl. or to Kyushu. The Honshu presence of *plana* needs verification.

RC7: ***Anapella***: Most authors differentiate 2 species in SA, a larger trigonal and a smaller ovate form. Crosse & Fischer, 1864 even differentiated these two subgenerically and considered the larger trigonal *pinguis* a *Mulinia* and the smaller ovate *amygdala* a *Mactra* s. s. Based on Lamarck's type material, Lamy (1914) tentatively identified the trigonal inflated form as Hanley's ***triquetrum*** and the small ovate form as Lamarck's ***cycladeum***. In contrary, Lamprell & Whitehead (1992 sp. 287 and 288) identified the high trigonal form as Lamarck's *cycladeum* and the smaller ovate form as ***Anapella amygdala*** (CRO65), but their figure 288 "*amygdala*" approaches much closer Lamarck's type (i.e. Lamy, 1914 pl. 1 fig. 8) than their figure 289 "*cycladea*".

This, and the material studied from S. Australia clearly indicate that just one *Anapella* is present, highly variable in shape and inflation. ***A. cycladea*** is as juvenile often more ovate and rather compressed and as fully adult more inflated and trigonal. In most specimens no embayment of a pallial sinus can be seen, in a few the sinus is very weakly marked.

Anapella retroconvexa has precisely been described by Zhuang, 1978 from South China. This species is also well characterized and illustrated in Zhongyan (2004 pl. 150 K). Although similarities in shape and dentition are present the rather deep, pointed pallial sinus removes *retroconvexa* from *Anapella*. Modern methods should clarify its relations. In case of a distinct phylogeny, a **new mesodesmatid genus** is indicated, based on morphology, biogeography and likely anatomy.

It this is confirmed, then *Anapella* is also monospecific.

RC8: ***Coecella***: Rooij-Schuiling's 3 subspecies were elevated to species rank by Sakura and Habe (1973). This latter view is shared. The specimen here illustrated as ***C. formosae*** was collected in Honshu, Mie, Ago Bay. This indicates a wider distribution than originally described. The three ***C. chinensis*** specimens were also collected in Honshu, in Aichi and Wakayama Pref. In general, *formosae* is smaller, ovate, more inflated and has a smaller pallial sinus.

Mesodesma aequilatera Römer, 1862 was described from unknown locality. Later, Martens (1887) identified and illustrated it by from the Andaman Sea, Mergui Archipelago. However, hinge, deep, narrow pallial sinus, shape and periostracum clearly demonstrate that this is not a *Mesodesma* but a *Coecella*, identical to ***C. horsfieldii*** specimens found and here illustrated from Satun, W. Thailand.

In addition, from Arabia Morris & Morris, 1993 described ***C. geratensis*** with an internal shelf, a central umbo, a rounded ventral margin and a light periostracum. Specimens collected in N. Oman have been compared to *chinensis* from Japan. *C. geratensis* is perceived as valid species. It may well be that Rooij-Schuiling's Red Sea and Arabian *chinensis*-records refer instead to *geratensis*. At present *C. chinensis* is not known from the Indian Ocean.

RC9: **Gen. nov.**: Reeve, 1854 described an enigmatic species from NW. Australia as ***Mesodesma lanceolata***. Australian authors did not mention this species, whereas Lamy (1914 p. 17) considered it a juvenile of *M. donacium* with an erroneous type locality. However, recently two valves 17.7 and 23.8 mm, beach-collected in Indonesia, Sulawesi, Makassar have been studied. Extreme elongated shape and glossy surface indicate that these appear to represent Reeve's lost species. This find also indicates, that Reeve's original locality may have been correct.

The very broad and deep pallial sinus and the unique hinge configuration remove it from any described genus within MESODESMATIDAE. Furthermore, I am even not convinced that *lanceolata* is a mesodesmatid. At present, the scarce material, missing anatomy and the very limited knowledge recommend patience and further collecting.

6.62 DREISSENIDAE

SL1: This is another difficult bivalve family. 3 extant genera constitute DREISSENIDAE: ***Dreissena*** van Beneden, 1835, ***Mytilopsis*** Conrad, 1857, and ***Congeria*** Partsch, 1835 (MOR98).

The distinction between *Dreissena* and *Mytilopsis* was recognized early on in his dissertatio by Dunker (1855 p. 11-12). However, Dunker did not name these two groups. Dunker recognized 3 recent *Dreissena* and 11 recent *Mytilopsis*, whereas here nearly 10 *Dreissena* and 8 *Mytilopsi*s are recognized. *Congeria* is recent monospecific.

SL2: In ***Dreissena***, the freshwater habitat with separated populations in various river- and lake-systems adds complexity. Thus, many authors differentiate *polymorpha*- (e.g. Schütt, 1993) or *rostriformis*- (e.g. Kijashko, 2006) populations. Locard (1893) was able to differentiate 30 *Dreissena* mostly found within Europe. Rosenberg et al. (1994) is important as they depicted many type species; their views are here largely followed. Schütt (1993) did not use any subgenera in *Dreissena* but expressed the differences at the specific level. Modern authors usually apply *Dreissena*, *Pontodreissena* and *Carinodreissena* as subgenera. These subgenera represent the three main forms found in *Dreissena*, well characterized by Molloy (2004). Therriault et al. (2004) demonstrated that molecularly these subgenera are close and consequently weak, but all three are quite distinct form *Mytilopsis* and *Congeria*. Rizhinashvili et al. (2005) came to similar results.

Pontodreissena combines the broader rounded-elongate forms without keel, mainly known from Caspian and N. Black Sea, and recently invaded in the USA. Usually two species are considered distinct. The larger, freshwater ***bugensis*** from Black Sea, Bug and United States is recognized by most authors. The other species, smaller, brackish water from the Caspian Sea is sometimes called *grimmi* with *rostriformis* as fossil form and sometimes ***rostriformis***. However, a separation of *grimmi* from *rostriformis* would require solving the issues of the earlier named *eichwaldi* and *brardi*. *Grimmi* has therefore been synonymized by Rosen et al. with *rostriformis*. Stepien et al. (2003) concluded on 16S rDNA, that the two *Pontodreissena* are either subspecies or recently diverged species. Therriault et al. (2004) demonstrated *bugensis* as identical in more stable nuclear and divergent in the faster adapting mitochondrial DNA from *rostriformis*. Here, 2 closely related *Pontodreissena*, *bugensis* and *rostriformis*, are recognized, which, inferring from the mitochondrial situation, are in an early phase of speciation.

Carinodreissena was recently introduced for the newly described ***D. stankovici*** from Lake Ohrid. *Carinodreissena* is characterized by a sharp keel and a straight anterodorsal line with a somewhat hooked pointed apex. The surface sculpture is often comparatively strongly ridged. However, this is a very old and well known species from the Balkan Lakes. *Stankovici* was not compared to ***D. blanci*** Westerlund, 1890 described from nearby Mesolongion, Greece and found in Macedonia as well, nor with ***D. hellenica*** and ***D. thiesae*** Locard, 1893 (Mesolongion, Greece) or with ***Dreissena blanci var. presbensis*** Kobelt, 1915 from the adjacent Prespa Lake, which are all understood as earlier names for *stankovici*. Furthermore, Dunker, 1853 described ***Tichogonia carinata***, positioned later, Dunker (1855), in *Dreissenia* [sic] and compared to *D. chemnitzii* (= *polymorpha*) and *D. cumingiana* Dunker, 1855. *D. carinata* has been precisely described from unknown locality, presumably acquired in Italy. All above mentioned earlier names are here understood describing the same species from the same region. Between material from Albania, Mesolongion, Greece, and Trichonida Lake, Greece no significant differences were found. Locard (1893) depicted most named forms; Kobelt (1915 pl. 566) gave a good overview on the variability of this Balkan species. *Carinodreissena* is considered monospecific with ***carinata*** as oldest and well fitting name.

Within ***Dreissena* s.s** five groups appear recognizable:

First and best known is the highly variable, large ***polymorpha***, nowadays widely distributed in Western, Central and Eastern Europe. This is typical black/brownish-yellowish zebra patterned, a rather glossy species and may grow more than 40 mm. Locard (1893) well demonstrates the high variability in shape in creating more than 10 synonyms. His types are based on specimens from the Bourguignat collection, now housed in the MHNG, Geneva. Thanks to the generosity of Y. Finet, MHNG 4 somewhat crucial species could be studied.

D*. *bedoti was described from England, Bath, Somerset canal (lot 2220, 2221) and ***D*. *magnifica*** from Danubie (lot 2284). However, Bourguignat had identified *magnifica* also from England, Bath, Somerset canal as well (lot 2285); exactly from this location *bedoti* was described. A further *magnifica* lot is present from England, Lancashire (lot 2283). Comparing with "normal" *polymorpha*, amply present in the general MHNG collection, I could not find substantial reasons to keep these comparatively large forms apart.

D*. *paradoxa is present from a single, left valve, labelled Paris (lot 2309). It is uniquely curbed in front, but otherwise shares all features of a typical *polymorpha*. In gastropods such specimens are usually called "freaks" or malformations.

Two further species appear related to *polymorpha*. However, ***D*. *caspia*** and ***D*. *elata*** are probably extinct today. The salinity in the Aral Sea was at the time of the OD of *pallasi* (= *caspia*) less than 10 and is today more than 100%o!

A second group appears present in Asia. Schütt (1993) demonstrated that the Euphrates ***Dreissensia bourguignati*** Locard, 1883 is a fossil not found living and that ***D*. *chantrei*** Locard, 1883 is a synonymous fossil. The closely related extant species from Euphrates and Tigris was identified by him as Locard's ***D*. *siouffi***. As also accepted by Kobelt (1915) these Asian forms are recognizable, quite elongate, and compressed, without keel. The last of Locard's species studied in MHNG, ***D*. *elongata***, 14.4 mm from Euphrates (lot 2238) proved distinct from *polymorpha* in elongate, rather compressed, somewhat irregular shape and weaker coloring. However, it matches the comparatively small, extant forms known from Euphrates, identified as *siouffi* by Schütt and is considered synonymous. Another specimen from the same locality "*bourguignati*" measured 20.5 mm (lot 2228), which currently indicates the maximal *siouffi* size.

Finally, from Turkey 3 distinct groups are known: a very broad form named ***caputlacus*** Schütt, 1993 from Lake Gölbasi, E. Turkey a small, grey blue form, named ***anatolica*** by Locard, 1893 from Lake Beyşehir, SW. Turkey and the group of small, rather broad forms from Anatolian lakes grouped under ***gallandi*** by Andrusov and recognized so also by Schütt.

Whereas Schütt considered *polymorpha* and *caputlacus* as species and the others as morphs, all five *Dreissena* s. s. groups appear recognizable. However, the relations among them are unknown.

Thus, approximately 10 *Dreissena* species or species-complexes are perceived recognizable.

The famous ***D*. *cumingiana*** Dunker, 1855 from "Mississippi" was synonymized by Marelli (1983) with *leucophaeata*. However, this species was, at about 38 mm, much larger than any *leucophaeata* known. Furthermore, Dunker, 1855 clearly placed it in *Dreissena*; the OD unmistakebly excludes *Mytilopsis*. The type material was not returned from a BMNH-loan. The label, which was found in the drawer of the borrower, the late C. P. Nuttall, but without any specimens reads: "a single specimen was mentioned measuring 17 lines in length. The largest of the 3 most closely fits this measurement although the evidence on the original labels does not agree with the published type locality, "Missisippi"." Obviously, the huge size was confirmed, the locality not. Most likely *cumingiana* was a *polymorpha*. Due to missing type material, however, it is best treated as nom. dub. ***Mytilus tenebrosus*** Reeve, 1858 is an unnecessary nom. nov. for *cumingiana*.

SL3: ***Mytilopsis***: Stoliczka, 1870 p. 367 first designated *leucophaeata* as type species SD. On p. xxi, Stoliczka, 1871 further designated *subglobosa* as type species SD of ***Congeria***.

It appears that in WAF at least 3 ***Mytilopsis*** are found. Nicklès (1950) considered 4-5 species distinct and illustrated ***africana***; PIL27 listed 7 species, illustrated ***ornata*** and synonymized *bananaensis*. In addition to *ornata*, Oliver et al. (1998) illustrated the larger *africana* and synonymized Preston's *gibberosa*. Morelet, 1885 depicted *ornata* and ***lacustris***. This latter species is difficult to concile with others. It is small, narrow, and internally whitish. Whereas *lacustris* belongs to Marelli's group A, *ornata* is closer to group B.

D'Ailly's *Dreissensia holmi* from Cameroon is without doubt a *Mytilopsis*. It has been described as distinct from *africana*, which seems correct. However, it was not compared to Morelet's earlier *ornata*, and *holmi* appears close to the latter and is probably a synonym.

From the restricted material analyzed it is likely that in WAF 3 species are present *africana*, *ornata* and *lacustris* and that all WAF species are distinct from the Caribbean *sallei* and *leucophaeata*.

If indeed more than one species occurs in WAF, as here understood, then of course the question of the origin of *Mytilopsis* should be reconsidered. "From Africa" would then become a much more likely view than "from America".

The maximum size indicated by Marelli & Gray (1983) for ***M*. *leucophaeata*** is 21.48 mm, based on more than 1000 specimens analyzed. In literature the largest size found was up to 25 mm. All specimens personally collected measured less than 20 mm.

M*. *allyneana is crucial as it has been described from Fiji. It has been differently treated. Morton (1981) and Marelli & Gray (1983) considered it a synonym of the Caribbean *sallei*. However, in 1985 Marelli & Gray reanalyzed *allyneana* and considered it synonymous to the Panamic *adamsi*. The type of *allyneana* is depicted in Morton fig. 12 B. *M. sallei* has been redescribed in MAR83. The question of identity of *allyneana* is important as the populations in Asia (India, Singapore, Gulf of Thailand, Japan, Fiji) are then either *sallei* or *adamsi*.

Here, Marelli & Gray (1985)'s arguments are shared, making *adamsi* a COS species and *sallei* a mainly Caribbean form. Specimens found in the Gulf of Thailand and Japan grow larger than 35 mm and are identical to Panamic specimens; but they are larger, less trigonal, ventrally straighter and less hooked than the Caribbean ***sallei***. Apart from this lacking hook, *adamsi* has a comparatively small septum, whereas in *sallei* this is quite large; *sallei* is often whitish inside, whereas *adamsi* is generally bluish. Obviously, Swennen et al. (2001) came to the same conclusion. This view was recently confirmed by Marelli (pers. com. 12/07).

On the other hand, Chemnitz 11 205 2027, from his own collection, depicted ***Mytilus perviridis*** from Tutucoryn (i.e. S. India, Tuticorin) just before *Mytilus wolga* (sp. 2028, = *D. polymorpha*). This has been an enigma ever since. Holten, 1802 first "latinized" this species. Küster (1840, n. & f.) first recognized the non-mytilid character and placed it in *Tichogonia*. Clessin (1887) only quoted Küster's action and depicted Chemnitz' figure, but obviously did not know the species. Winckworth (1943) briefly commented on this species, but placed it in *Chloromya* (= *Perna*), whereas Chemnitz treated *Mytilus smaragdinus* (= *Perna viridis*, 8 83 745) before and explicitely stated *perviridis* as significantly distinct.

Shape, size, surface sculpture, and the unique tooth mentioned in *perviridis*, but not in *wolgae* would not exclude *Mytilopsis*. Chemnitz had ample material from India and the Andaman Sea. The localities of specimens from his own collection are in general reliable and there is no reason to doubt above locality. Obviously, it has been found quite commonly in India, as Chemnitz mentioned some variability. This find before 1795, if verified, would throw a new light on Marelli & Gray's distributional assumptions and would be the first *Mytilopsis* reported globally and the first for India. However, Chemnitz' material presumably in Russia and extant Indian material should be genetically analyzed to clarify this issue. Currently, *Mytilopsis perviridis* (Holten 1802) is treated as possible earlier name for *adamsi*.

Marelli (pers. com. 12/07) considered ***Congeria hoeblichi*** from Venezuela as most likely synonymous to *sallei*. The depicted 19 mm paratype from SMF in SIM06 sp. 1030 has a destroyed hinge which obviously excludes a firm conclusion. However, from size, shape, muscle impression, biogeography and habitat Marelli's assumption is very likely. Fresh material from the Caroni River could easily settle this issue.

6.63 MYIDAE

SO1: Except Eastern Pacific (Coan, 1999; Coan et al. 2000) this family is not well known. Considering the current state of knowledge the usage of 3 subfamilies appears premature.

Following Coan et al. (2000) four distinct ***Mya*** species occur, easiest differentiated by biogeography and pallial sinus.

Mya neoovata and *Mya neouddevallensis* Høpner Petersen, 1999 are both unnecessary nom. nov. At least the former would have been justified, as Jensen's name is preoccupied, but *Mya pseudoarenaria* Schlesch, 1931 from nearby Iceland is the same (Coan et al., 2000). I fail to differentiate Høpner Petersen, 1999 third "new" species ***M. eideri*** from the widely distributed, highly variable *truncata*. Obviously, Jensen (1900) came to the same conclusion.

According to Tomlin (1938), both ***Mya antarctica*** and ***Thracia antarctica*** Melvill & Standen are juvenile *Laternula elliptica*.

SO2: **Cryptomya**: Xu, 1987 described ***Tugonia huanghaiensis*** from the Yellow Sea. However, this is instead a *Cryptomya* (*Venatomya*). *Tugonia* s.s. have a complete radial sculpture, whereas in *huanghaiensis* one portion is commarginal, the other half radial, the rostration commarginal. Consequently, this Chinese species has to be compared to the other *Venatomya* described. There is indeed an inflated species, with a centrally placed umbo, with divided surface sculpture, comparable size and a large chondrophore. It has been described as ***Mya semistriata*** by Hanley, 1842 and depicted in his Catalogue, p. 20, pl. 10 fig. 16 (also depicted by Sowerby II, 1875, Reeve's Icon. Mya, pl. 2 fig. 6). *Semistriata* was described from unknown locality, considered valid by Lamy (1927), but recently synonymized with *princeps* by Swennen et al. (2001). However, the single BMNH holotype, 25 mm of *semistriata* has the shape and the tripartite sculpture, commarginal, then radial medially, and finally commarginal on the rostrum as found in *huanghaiensis* and is considered the valid earlier name. *Princeps* grows larger and is distinct in broader, less rostrate shape and in details of sculpture.

Xu, 1987 also described ***Tugonia sinensis*** from China, Fujian Pref. This is instead also a *Cryptomya* (*Venatomya*). Xu did not compare with any other species, especially not with the type species ***elliptica***, which is well known from these waters. I fail to perceive any significant differences to *elliptica*, which is somewhat variable in shape and widely distributed from the Red Sea to Australia and Japan. Gould's *truncata* from Taiwan was earlier synonymized by A. Adams (1868), confirmed by Lynge (1909) and accepted by Lamy (1927).

Fresh ***C. thryptica*** have a sculpture of rough growth lines and very fine radials. Also shape and dentition recommend a placement in the subgenus *Venatomya*.

C. busoensis is a *Cryptomya* s.s. similar to *californica*, but decidedly smaller and more elongate in shape, radial striae are generally absent. Furthermore, there are no biogeographic records to connect these two species. Together with Japanese authors Coan et al. (2000)'s synonymy is not shared. On the other hand, a further Samarang species ***Mya mindorensis*** was described by Adams & Reeve, 1850 from Mindoro, Philippines. The figured syntype is depicted in HIG01 B1282. This was a mysterious species ever since and nothing close is known from the Philippines. The BMNH type lot has been studied. From large size and morphology there remains very little doubt that *mindorensis* represent instead misplaced E. Pacific *Cryptomya californica*. The Japanese *busoensis* is not known to anywhere near this size.

SO3: ***Sphenia tumida*** was described by Lewis, 1968 from Florida, Pleistocene. It has been reported living by modern US authors, but was not personally collected or seen.

Ungulina alfredensis with a spoon shaped hinge from SAF seems instead to represent a *Sphenia*, reaching up to 25 mm. An earlier *Sphenia* described from there is Smith's 4 mm ***natalensis***. Also the minute *Sphenia rietensis* Turton, 1932 with a more ovate shape, but with a radiating slit appears to be the same. In larger specimens the radiating striae emerging from the umbones are barely or no longer visible. The shape in *natalensis* is highly variable.

6.64 CORBULIDAE

SP1: CORBULIDAE is among the better known families, due to many works.

Following Coan (2002) it appears premature to consider *Varicorbula* as full genus, as proposed by other American authors. The same applies to *Anisocorbula*, *Minicorbula* or *Solidicorbula* generically separated by Japanese authors (e.g. Habe, 1949 and 1964; Kira, 1972; Koyama et al., 1981; Higo et al., 1999; Okutani, 2000).

Anderson & Roopnarine (2003) presented a genetic analysis discovering three quite distinct clades; first *Corbula*, a second *Caryo-/Hexacorbula* and a third group with *Julia-/Tenui-/Panami-/Varicorbula*. This may lead to a more robust grouping. Unfortunately, only a few American corbulids and a few American genera were included and no comparison to *Erodona* or *Potamocorbula* was undertaken. Furthermore, I am not fully convinced that *Tenuicorbula* and *Hexacorbula* are indeed restricted to American waters. The IND *C. arcaefornmis* and *C. sinensis* should be considered in a further study as well. In addition, the subgenera are currently quite distinctly interpreted on a global scale by various authors. Much further work is necessary, but definitely a bivalve genus with nearly 70 species is comparatively too large.

Beesley et al. (1999) recognised 8 corbulid subgenera: ***Corbula***, ***Varicorbula***, ***Notocorbula***, ***Anisocorbula***, *Serracorbula*, *Panamicorbula*, *Physoida* and *Potamocorbula*. Of these, *Serracorbula* is synonymous to the earlier ***Caryocorbula***, following here Coan (2002). On the other hand, the Japanese ***Minicorbula*** and ***Solidicorbula*** are considered useful groupings, the first for a few minute, commarginally ridged and finely radially striated, deeper water *Anisocorbula*-like species, and the second for the two large, solid, almost equivalve *erythrodon* and *hydropica*. Furthermore, ***Juliacorbula***, ***Tenuicorbula*** and ***Hexacorbula*** are considered valid groupings, following here Vokes (1945), Coan (2002) and especially Anderson & Roopnarine (2003). ***Panamicorbula*** and ***Potamocorbula*** are instead placed in POTAMOCORBULINAE. Thus, 11 corbulid subgenera are here recognised for global corbulids.

In ***Physoida*** other authors (e.g. VOK45, CLEMAM) is trusted, none was ever seen. However, recently Repetto et al. (2005 sp. 1482) depicted a *physoides* specimen from Algeria as *Basterotia*, unfortunately, without hinge details. The shape does not match *Basterotia* particularly well, *Anisodonta* should also be compared. Definitely, the true identity of ***physoides*** is as yet not settled.

In order not to create another couple of groups at this point of time, especially *Anisocorbula* and *Caryocorbula* are widely interpreted. The group of *venusta/luteola/zelandica* for example, could well be split off from *Anisocorbula*. On the other hand, *amethystina* and *biradiata* are not very typical *Caryocorbula*. Nonetheless, some peculiar species could not be accommodated properly. These are placed s.l. and may require further genera/subgenera: ***C. barrattiana*** and ***colimensis***, and ***C. niasensis***. Additionally, the Caribbean ***C. patagonica*** does not belong to *Varicorbula*; it is sometimes placed as *Corbula*, but does not match there either.

On the other hand, the non-marine *Potamocorbula* have a distinct habitat and almost equivalve, generally smooth, rather thin shells. Together with *Erodona*, they share the same broad divided chondrophore in the almost equivalve left half. The umbones are often corroded. These species are separated generically, following Habe (1977) and Higo et al. (1999) and placed in POTAMOCORBULINAE Habe, 1977.

Instead as family, **ERODONINAE** Winckworth, 1932 is here considered at most a subfamily and placed within CORBULIDAE very close to *Potamocorbula* and *Lentidium*. The differences to CORBULIDAE are, as well demonstrated by Edwards & Pain (1978), too small to justify a family. Edwards and Pain only found 1 out of 10 characters differing. In addition, there is only a single extant erodonid known. Compared to important monospecific families e.g. ARCTICIDAE the paleontological past is short and geographically restricted. Edwards & Pain demonstrated that *Mya plana* and thus, *Potamomya* is not closely related to *Erodona* or to corbulids, making Keen in Moore's assumptions in geography and time obsolete. Finally, *Erodona* shares the same habitat and many morphological features with potamocorbulids.

It should be genetically analyzed, whether the relations of *Erodona* to POTAMOCORBULINAE and LENTIDIINAE are not much closer than usually assumed, questioning 2 subfamilies. Lamy (1941) considered the oldest *Erodona* as special group within corbulids and placed therein *Potamocorbula* and *Panamicorbula*. Thus, it may well be that besides CORBULINAE only the oldest ERODONINAE is justified.

CORBULINAE comprise marine species only, whereas the other groups contain estuarine to freshwater species. Whereas Beesley et al. (1998) recognised 50 corbulids, Boss (1982) considered less than 100 valid species. Here, more than 80 corbulids are distinguished on a global scale.

Corbula similis Hinds, 1843 was described from the Philippines, Manila Bay. However, in 1845 Hinds did not depict it, neither did Reeve. A type was not located in BMNH. It remains a nom. dub.

Corbula polita Hinds, 1843 was described from the Philippines, Luzon. However, Hinds did not depict it in 1845. Reeve, 1844 did, but the type was not located in BMNH as yet. Its subgeneric and specific identity could not be unambiguously resolved and *polita* is considered a nom. dub.

Some further corbulids without type material and mostly without locality are here listed as dubious as well.

SP2: ***Corbula***: The WAF type species ***Corbula sulcata*** is closely related to the Caribbean ***dietziana*** and the Panamic ***speciosa***. Juvenile *sulcata* show similar irregular shapes in different growth stages as do juvenile *speciosa* and adult *dietziana*. Also the lunular area, the pallial line, the reddish color and the acute cardinal are remarkably close. The shingle-like microsculpture on the left valve in adults is the same; juvenile *sulcata* are strong commarginally ribbed as are juvenile *speciosa* and *dietziana*. Anderson & Roopnarine (2003 p. 1090) came to the same conclusion and considered these as *Corbula* s.s. Thus, only 3 true extant *Corbula* are recognized. All other extant species belong to distinct groups. From the OD it appears that Reeve's ***carnosa***, described from unknown locality was a true *Corbula* as well, most likely the earlier name for *dietziana*. However, the type was not found at BMNH and this would be necessary for a firm validation of *carnosa* as Caribbean *Corbula* s.s.

Iredale, 1930 introduced ***Notocorbula*** for *C. vicaria*, accepting neither *Corbula* as corbulid genus, nor *tunicata* from Australia. Comparing *tunicata* from Vietnam with specimens from Australia, there is little doubt, as concluded by Lamprell & Healy (1998), that these represent the same species. *Notocorbula* has basically been introduced as nom. nov. for *Corbula* Bruguière, 1797, consequently all NSW corbulids were placed there (IRE62). However, the type species *sulcata* and *tunicata* are distinct, especially in dentition in the left valve. Thus, *Notocorbula* is considered a useful subgenus, encompassing two extant species. The type of ***tunicata*** is depicted in Lamprell & Healy (1998 sp. 556). From off Brighton Beach, Victoria specimens are known, which are virtually indistinguishable from Qld ones. From SA, off Glenelg specimens are known which, as stated by Iredale for *stolata*, are less swollen. However, specimens from nearby SA, Pt. Stanvac are strongly inflated. In some SA specimens the "snout" is strong, in others weakly expressed. The sculpture in some is quite fine with many, in others quite rough with very few ribs. Thus, Iredale's *stolata* is perceived based on an extreme *tunicata* form; as already indicated by Lamy (1941 p. 24). ***C. stolata*** Iredale, 1930 is here synonymized with *tunicata*, not offering morphologically stable characteristics for distinction. Genetic analyses are not known to underlay the contrary. Hedley (1918) also recorded only one NSW-species, *tunicata*. Lamprell & Healy (1998 sp. 558) illustrated a weakly ribbed, low, Cotton (1961 fig. 331) a strongly ribbed, high and Jansen (1995) a "snouted" elongate *stolata* (= *tunicata*).

The only other species fitting into *Notocorbula* is ***fortisulcata*** (type in Lamprell & Healy, 1998 sp. 559).

Another small IND group is ***Solidicorbula***. Compared to *Notocorbula*, ***C. hydropica*** grows larger, is more inflated and often more inequilateral. The two valves are much more equal. The posterior muscle scar is strongly marked, as in *erythrodon*. The largest specimens are known from Vietnam (more than 29 mm) and it appears that ***Solidicorbula*** *tunicata* of Chinese authors (ZHU831; ZHO) are instead *hydropica*. *C. hydropica* is indeed quite close to the Japanese ***C. erythrodon*** and is also best placed in *Solidicorbula*. It seems that *hydropica* is quite widely distributed, but usually wrongly identified, either as *tunicata*, or as *erythrodon*. The latter is only known from Japanese and Chinese waters.

SP3: ***Anisocorbula***: ***C. macgillivrayi*** itself is a highly variable species. In some a predominant commarginal sculpture is found, in some fine, minutely granular radiating lines are well visible. In some adult specimens the same marginal ribs are found as in *Serracorbula*, in others of same size not. In some a clear marginal dentition is seen, in others the margins are completely smooth and a weak marginal border is found inside. In many the right cardinal is knobby and quite small in others larger and acute.

C. scaphoides (type HIG01 B1293) is quite close to *C. macgillivrayi*. However, the Australian type species grows larger, is heavier and is often quite strongly colored inside. Deeper water *macgillivrayi* are usually all white and lighter than subtidal specimens, but these are still more pointed and less truncate than *scaphoides*. *Macgillivrayi* appears restricted to Australia and S. New Guinea, whereas *scaphoides* is widely distributed, also known from Japan and New Caledonia. The shape in *scaphoides* is more variable. ***C. tosana*** is considered a higher *scaphoides* form, following here most Japanese authors. The hinge configuration is identical.

C. crassa Reeve, 1843 (= *C. ovalina* Lamarck, 1818) and ***C. sinensis*** (nom. nov. *cuneata* Reeve and Hinds non Say) are at first glance quite similar, especially so as juveniles. The types are depicted in HIG01 B1290 and B1291. However, *sinensis* has in the thick shelled adult stage coarse commarginal waves without any radials and is strongly rostrate, no lunule present. It is somewhat glossier, usually with yellowish umbones, internally whitish with orange. *Sinensis* fits the criteria for ***Hexacorbula*** (VOK45) well and is close to the Panamic *esmeralda*, also in dentition. *Sinensis*, as stated by Bernard, Cai and Morton (1993) appears restricted in distribution, and is mainly known from the Philippines and the China Sea. The SAF, Arab (MEL07) or JAP presence could not be verified. Lamy had only material from the Philippines, and Barnard (1964) none from SAF.

The well known ***crassa*** itself is more solid, often heavily inflated, strongly colored inside especially along the edges, and has a finer sculpture with weak radials. *C. crassa* shares many traits, including the grooved margins with adult *macgillivrayi* and fits better in *Anisocorbula*, where also placed by Chinese authors. However, Lamarck, 1818 described ***C. ovalina*** from Australia and ***C. impressa*** from unknown locality. Both have been validly proposed and are not preoccupied. Hanley (1843 p. 46) considered these two distinct, *ovalina* as valid and *impressa* synonymous to *gibba*. However, Lamy (1941 p. 121) studied the type material and considered *ovalina* as valid as well, but *impressa* as variety and both as juvenile *crassa* from Australia. Unfortunately, Lamy's conclusions were neglected by subsequent Australian authors. Both type lots are present in MNHN, *C. impressa*, 12.6 mm from the Bruguière collection and 2 syntypes, up to 13.2 mm of *C. ovalina* from Australia. All three specimens are considered conspecific and marked distinct from *gibba*. Comparing with larger samples of all recently known *Corbula* from Australia, I could not detect any errors in Lamy's conclusions and his view is here confirmed, *C. crassa* is a junior synonym. Lamy selected the localized ***ovalina*** to stand.

Lamy (1941) reported three related species from the Red Sea - ***C. taitensis***, ***C. acutangula*** and ***C. modesta*** - whereas Oliver (1992) as well as Decker & Orlin (2000) only mentioned one species. Higo et al. (1999) reported *taitensis* and *modesta* from Japan, whereas other Japanese authors only illustrate *modesta*. Having studied many specimens throughout the IND, I am convinced that only one small, variable species is present, extending from the Red Sea, SAF, Eastern Cape, Australia, Philippines, Japan to Polynesia. Thus, Lamprell & Healy (1998) synonymy of *modesta* with *taheitensis* (= *taitensis*) is shared. Furthermore, ***C. rugifera*** has been described from Natal, but also identified from Japan (LAM41), Karachi (MEL07), and Singapore-Thailand (LYN09). Specimens from Natal (Steyn & Lussi, 1998 sp. 996) have been studied and proved indistinguishable. Furthermore, ***C. valdiviae*** from Dar es Salaam has been synonymized by Barnard (1964) with *rugifera*; indeed its OD fits *taitensis* well. Finally, the two BMNH syntypes of ***Corbula variegata*** Adams & Reeve, 1850 have been analyzed and proved also conspecific. The oldest name *C. taitensis* Lamarck, 1818 is valid (*tahitensis*, *taheitensis* are unjustified emendations). This is a comparatively solid, small, trapezoidal species sculptured with rough commarginal ribs. The color may be cream, yellowish, reddish, but with characteristic whitish radial streaks. In some the ribs on the posterior part are oblique (= *rugifera*), in some well expressed (= *modesta*, HIG01 B 1294), in some clearly intermediate. Other than assumed by Smith (1903), the obliquely wrinkled posterior is of no specific value. By most authors *taitensis* is placed in *Anisocorbula* and it fits indeed best here, sharing many traits, as also the minutely granular radials well visible in some.

C. pallida Reeve, 1843 originally described from Singapore is a small highly variable species regarding thickness and color. Typical specimens are thin, whitish outside and reddish around the umbones, regularly finely ribbed, but quite thick, or all white, rose and yellowish or rougher ribbed forms are found together with typical specimens. It grows much smaller than *erythrodon*, is less inflated and has finer commarginal growth lines. It is closer to *taitensis*, but more regularly ribbed, smaller and lacking the radial white lines. Locally it occurs quite commonly, coarse sand 10-15 m.

The Argentinan ***C. lyoni*** is, as stated by Lamy (1941), very close to the type species *macgillivrayi* in shape and surface sculpture, and has internally a weakly dentate submargin as well. Farinati (1978) synonymized it with the earlier ***C. pulchella*** Philippi, 1893 and her view is followed.

The Panamic ***C. ira*** *is* very close to *ovalina*, though much smaller and also placed in *Anisocorbula*.

A special group consists of some small Pacific species: The E. Pacific ***luteola*** is quite close to the Japanese ***venusta***. The latter has been consistently placed by Japanese authors in *Anisocorbula*. The related, more fragile and smaller, rose patched or rose colored ***marmorata*** from PAN is placed here as well.

C. zelandica and *C. verconis* are in shape, size, and dentition close and are also placed near *venusta*. Lamy (1941) also recognized a close relation of *verconis* and *luteola* and placed both close to *scaphoides*, another *Anisocorbula*. Powell (1979) came to the same conclusion for *zelandica*, placing it in *Anisocorbula*. Angas (1867) reported *zelandica* also from Sydney, but since Hedley (1918), these two species were strictly separated by subsequent NZ and Australian workers. However, morphology as surface sculpture, shape, dentition, pallial line, further average size, and also habitat are the same. Unless genetic methods render strong arguments, ***verconis*** is considered a junior synonym of *zelandica* and resynonymized. The largest specimens are 12.5 mm (SA) and 13.8 mm (NZ, N. Isl., Whangarei). S.-SE. Australian as well as New Zealand specimens may be reddish tinged especially so internal umbonally. Otherwise, the predominant color is a yellowish-white.

Furthermore, from Australia, Central to North Qld various lots show similar but much less solid, more inflated and white specimens. These specimens from the former Lamprell collection have also been identified as *verconis* by K. Lamprell himself. The maximum size is 14.7 mm (Central Qld). However, more likely, this is an **undescribed** tropical Australian species related to this group.

SP4: ***Caryocorbula***: Coan (2002) synonymized ***Serracorbula*** with *Caryocorbula* and this course is followed. Coan demonstrated that the marginal ribs are of neither subgeneric, nor specific value. Furthermore, these ribs are found in old *Anisocorbula* as well.

From the OD and the type-illustration (Lamprell & Healy, 1998 sp. 560) ***C. venusta*** Angas (= *smithiana*) is not a *Notocorbula*, but instead a *Caryocorbula*. Furthermore, Cotton (1961) and Allan (1962) stated *smithiana* as closely related to *flindersi*. Lamprell & Healy synonymized *flindersi* and *coxi*, but placed *smithiana* in a distinct subgenus. However, typical "*coxi*" from Victoria has smooth margins and a recess as well. No marked differences could be detected to separate these supposed "species". Following Hedley (1918) *smithiana* is considered the same as *coxi*, making ***smithiana*** the earliest name for this widely distributed Australian species. Specimens closely resembling the type material are also known from tropical Australia. *C. smithiana* is somewhat variable in shape, but generally strongly inflated in both valves, which are quite equal. The white shell is often rusty colored. The largest specimen is 19.4 mm, S. Qld from the former Lamprell collection.

Whereas Keen placed the solid ***C. biradiata*** in the quite distinct *Juliacorbula*, Coan (2002) removed it from there and placed it in *Corbula* s.l. From dentition, shape, sculpture and solidity it is perceived as closest to *amethystina*. However, ***amethystina*** itself is not a very typical *Caryocorbula*.

Whereas Coan (2002) considered the Caribbean ***chittyana*** (type CLE50 pl. 48 fig. 4-5) as probable synonym of ***swiftiana*** Adams, 1852 most Caribbean authors consider Adams' species as distinct. This latter view is here shared. *C. chittyana* appears as smaller, shorter, more inflated species, trigonal instead of elongate in shape. The surface sculpture is somewhat finer than in *swiftiana* with quite strong radials. *C. lavalleana* Orbigny in Sagra, 1853 is considered the same. The size of *chittyana* is usually 6-8 mm, whereas *swiftiana* is often found larger than 10 mm. *C. chittyana* is well known from the US Coast (N.C., Florida, Texas), *C. swiftiana* is mainly known from WInd-E. Panama-Brazil. I doubt that Adams's *kjoeriana*, described from the West Indies is anything other than a pointed *swiftiana*. Indeed, Humfrey (1975) illustrated a quite acute *caribaea* (= *swiftiana*) from Jamaica. Coan (2002) also considered *kjoeriana* synonymous to *swiftiana* and *contracta* a distinct, valid species.

Corbula contracta appears to be the only *Corbula* living also North of Cape Hatteras, well known from the New York area (JAC61). It seems restricted to the NE. US coast, not found in the WInd. Nothing closely similar is known from Brazil. Nonetheless, most Brazilian (e.g. BRASIL) and Uruguayan authors (e.g. SCAR) consistently depict or mention *contracta* from Rio to Uruguay. This species is instead ***C. uruguayensis*** Marshall, 1928 which has erroneously been synonymized with *swiftiana*. It was described from Uruguay and is here reinstated. *C. contracta* is often eroded, whereas *uruguayensis* has rather glossy valves. *Uruguayensis* is more regular trigonal and less inflated than *swiftiana*. Radials are lacking. The smaller valve has an unusual, overhanging *Mya*-like chondrophore as originally described and well depicted by Marshall, 1928. *Uruguayensis* is known from Rio, through Uruguay (coll. auth.) to at least Argentina, Buenos Aires area (coll. auth.) True *swiftiana* is known to Sao Paulo and Brazilian specimens have been studied. Whether *swiftiana* occurs in Uruguay as stated by Scarabino, (2003), or whether this record is based on the misinterpretation of *uruguayensis* could not be ascertained.

C*. *tryoni seems to be another valid, but uncommon, smaller and deeper living species, occurring in Brazil and Uruguay. It has weak radials on the umbonal part.

C*. *barrattiana Adams was synonymized by most authors with *swiftiana*, but Dall (1986) and Abbott (1974) kept it distinct. A large lot from off Dry Tortugas, Florida, 5-8.5 mm contained many whitish corbulids, often tinged with red or orange, having a remarkable thin shell, the ventral margin rounded. The sculpture shows generally few irregular commarginal ribs. The strong radials found in *chittyana* and less so also in *swiftiana* are absent. They fit OD and holotype of *barrattiana* (CLE50 p. 259, pl. 47 figs. 7-8) quite well and are tentatively placed there. Unfortunately, no minute specimens, less than 5 mm, were available. Abbott classified it as *Caryocorbula*. However, it does not fit into this group of more inflated, stronger sculptured and more solid species. Also juvenile *dietziana* (AND77 p. 250) are quite distinct. In texture it appears closest to the Panamic *C*. *colimensis*. It is here understood as valid species and together with ***colimensis*** placed as **s.l**.

SP5: The Caribbean ***Varicorbula*** are disputed. Mikkelsen & Bieler (2001) considered *disparilis* (syn. *limatula*), *krebsiana* and *philippii* as valid, and *operculata* as nom. dub. Coan (2002) considered only *operculata* as valid with *krebsiana*, *disparilis* and *philippii* as synonyms. Rosenberg (2006, MALAC) listed 4 Caribbean *Varicorbula* including *operculata*.

From the material at hand 3 Caribbean *Varicorbula* are here recognized.

C*. *philippii well depicted by Smith, 1885 is considered valid. The radial ridges in the left valve, are as stated by Mikkelsen & Bieler quite strong, the left valve is very small and strongly embedded in full adults. The largest specimens, about 12 mm are known from Brazil, usually listed as *operculata*.

Another valid species is ***Corbula limatula*** Conrad, 1846 (type in Mikkelsen & Bieler, fig. 3-5). ***C*. *disparilis*** Orbigny in Sagra, 1853 is a junior synonym. The radial ridges are vanishing, or only visible at the border, as stated by Mikkelsen & Bieler, but often commarginal ridges are found on the left valve. The left valve is comparatively larger and the right valve comparatively flatter, less curbed. Often reddish streaks or even all red specimens are seen. However, I fail to recognize *krebsiana* as distinct. The posterior pointed shape is found in large lots off Florida (coll. auth.; ANDER03 fig. 1 sp. 14-18 as *operculata*) or Texas (Andrew, 1977 p. 250) as well, the color and sculpture may be identical. *C*. *limatula* is perceived as the most common of the 3 Caribbean *Varicorbula*, quite variable in shape and color. The largest specimens came from batfish stomachs 11.4 mm off Florida, Dry Tortugas, typical *krebsiana* forms.

C. *philippii* has been described by Smith, 1885 against Philippi's *operculata*, differing especially in shape and the lacking keel in the right valve. ***C*. *operculata*** has been precisely described by Philippi, 1848 from the Gruner collection, collected by Gruner himself in muddy bottom from 30 m, St. Thomas, 11.2 mm. This is perceived as a distinct, rare species. The single specimen at hand is from N. Brazil, dredged 25 m, 11.1 mm. It has the "doppelte Kante" from the strongly enrolled umbo, a rough ribbing and is indeed close to the referred Reeve fig. 2 but more pointed or "beinahe geschäbelt" as stated by Philippi. A few weak radial lines are found on the left valve from the umbones to the margin. Compared to *philippii* this 3rd Caribbean *Varicorbula* is pointed not truncate. The left valve is comparatively larger and the keel on the right valve is distinctive. In the ample material studied from Florida and the Gulf of Mexico nothing similar was found. Thus, *C*. *operculata* might be restricted from the Central West Indies to N. Brazil, whereas *philippii* is widely distributed and well known from Florida to Central Brazil. However, only one specimen was available, and above conclusions need confirmation.

The rather ovate shape, the deeply sunken, small left valve, the dentition and the minute size classify the widely distributed IND ***C*. *monilis*** rather as *Varicorbula* than as *Notocorbula* (i.e. Lamprell & Healy, 1998). In hinge, sculpture of the left valve and shape *monilis* is similar to some *limatula* forms. Lamy, 1941 placed it close to members of this group as well. The related Australian ***C*. *stephensoni*** is also placed here; *Notocorbula* is a distinct group.

SP6: In **WAF 3 *Anisocorbula*** are found. Closest to the type species in elongate shape and irregular ribbing is, as originally described, ***C*. *cadenati***. This is also the largest species and also found in Senegal.

The second species, the preoccupied *Corbula striata* Smith, 1872 non Lamarck, 1801 has been renamed 3 times by 3 different authors. The first was Dautzenberg, 1910 who proposed instead *C*. *roumei*. However, Lamy (1941) demonstrated that Dautzenberg's material is not the same as Smith's species. Lamy, 1941 renamed *roumei* non *striata* Smith as *laticostata*. Although *roumei* was obviously recognizably proposed with own type material and not preoccupied, Lamy's name has consistently been used to characterize this small WAF *Anisocorbula*, close to *taitensis* (e.g. Nicklès, 1950 and 1955; Marche-Marchad, 1958; Bernard, 1984; Ardovini et al., 2004; all erroneously as *laticosta*). Thus, ***C*. *laticostata*** Lamy, 1941 is here retained. This is the broad ribbed species.

Further, Lamy, 1941 renamed Smith' true, but preoccupied *striata* as *C*. *striatissima*. Dautzenberg, 1910 had earlier, though erroneously considered this species as being Smith's *lirata* and renamed it *chudeaui*. Although *chudeaui* was obviously recognizable and not preoccupied, this name has never been applied, whereas *C*. *striatissima* has been consistently used for many years for this small *Anisocorbula* (e.g. Nicklès. 1950, 1952, 1955; Marche-Marchad, 1958; Bernard, 1984). Then, Cosel, 1995 found *Corbula striata* Smith also preoccupied and proposed as third name ***C*. *virginiae***. Ardovini et al. (2004) used this latter name, not mentioning *striatissima*. Their depicted specimen, p. 292 is in fact Lamy's species. ***C*. *striatissima*** Lamy, 1941 is here applied as the valid name, taking Smith original type locality Benin. *Virginiae* is an unnecessary nom. nov. This is the smallest, finely commarginally ribbed species, with fine radials.

Another small WAF species is referable to *Caryocorbula*. Lamy, 1941 renamed *C*. *lirata* Smith, 1872 non *C*. *lyrata*

J. de C. Sowerby, 1840 (= foss.) as ***C. dautzenbergi***. Although this action is in modern eyes unnecessary (Smith, 1872 used in text and plate *lirata*), *C. dautzenbergi* has since unanimously been used (e.g. Nicklès, 1950, 1952, 1955; Marche-Marchad, 1958; Bernard, 1984; Gofas et al., 1986; Coan, 2002; Ardovini et al., 2004). Thus, Smith's *lirata* is not reinstated and based on prevailing usage ***C. dautzenbergi*** Lamy, 1941 is applied for this small WAF *Caryocorbula*.

SP7: ***Minicorbula***. In addition to *Varicorbula* another group of minute corbulids is found, usually less than 5 mm. These are only known from IND and adjacent regions. The valves are somewhat trigonal to quadrate, moderately inflated, ventrally rounded, and more equivalve than *Varicorbula*. They are predominantly commarginally ribbed and have fine radial threads on both valves. *Minicorbula* species somewhat approach *Anisocorbula*. Indeed, Habe, 1949 first described a small species from Wakayama Pref., Japan ***Anisocorbula minutissima*** and erected for this in 1977 his new *Minicorbula*. He gave a size of 5.2 mm; Higo et al. (1999) added a sublittoral range from 10-100 m. Specimens closely fitting, approximately 4.5 mm, are known from the Philippines from various locations, dredged in 50-80 m. However, Thiele & Jaeckel, 1931 described earlier another minute species as ***C. densesculpta*** from the Indian Ocean, Tanzania and Sumatra, 6 mm, 50-132 mm (dead). The syntypes MfN 69868-9 have been studied. Neither in shape, sculpture, solid texture, nor in tightly fitting valves with a larger, embracing right valve differences to Habe's *minutissima* could be detected; bathymetric range and size are quite close as well. All evidence points that a minute *Minicorbula* is widely distributed from East Africa to Japan, *densesculpta* being the earliest name.

Melvill & Standen, 1907 further described ***C. subquadrata*** from the Persian Gulf and India, 4.5 mm, 285 m. Prashad, 1932 reported it from Indonesia, 82 m. Specimens closely fitting have been dredged off N. Borneo, 72-94 m. Whereas *C. pygmaea* of H. Adams, 1873 is perceived conspecific, true ***pygmaea*** of Hanley, 1856 was a larger, distinct species. However, Hanley's *pygmaea* described from unknown location was not located at BMNH 11/08 and is considered a nom. dub. Compared to *densesculpta*, *subquadrata* appears to remain smaller, higher, shorter and more rounded in shape, more inflated and deeper living. *C. subquadrata* was reported by Lynge (1909) from the Gulf of Thailand. However, the shallow habitat and the large size point instead into *densesculpta*.

C. moretonensis from E. Australia is another typical *Minicorbula*, but grows only half this size. It was originally also described as *Anisocorbula*, but matches instead *Minicorbula* precisely.

SP8: Small, up to 2.1 mm specimens have been found in Sri Lanka, Negombo and well conform to Thiele & Jaeckel, 1931 ***C. niasensis***. Whereas Thiele & Jaeckel had only dead valves from 132 m, the Sri Lanka specimens have been found subtidally, one still closed. The Sri Lanka specimens are quite variable in shape, whitish to whitish orange, somewhat glossy, moderately inflated, commarginally ribbed. However, they do neither fit *Minicorbula*, nor any of the known subgenera and may require a **new** subgenus.

SP9: The Indian ***Potamocorbula*** are difficult. It appears that Preston (1907) in his typical manner named various extreme forms from the same locality as distinct species. Definitely, sales figures rise higher with 5 than only with one variable species. Here, only ***abbreviata*** is recognized. Even this species should be compared to Tryon's earlier ***adamsi*** from Sri Lanka. Whether ***Corbula chilkaensis*** is indeed a corbulid could not be verified. Annandale, 1916 reported a single specimen found, but the dentition was not analyzed. The type is still in ZSI.

Hanley, 1843 pl. 13 fig. 58 (n. & f.) first named ***Corbula nimbosa*** from Singapore, not preoccupied by *Potamomya nimbosa* Hinds, 1843, which is an *Erodona*. In 1856 *nimbosa* was described in detail. Hanley stated it identical to Reeve's fig. 28 from Singapore. As synonymized by Lamy (1941), there are few doubts that *nimbosa* is the same as Reeve's *labiata* and *ustulata* from Singapore and thus, the earliest name for this large, solid and rather heavy potamocorbulid.

P. fasciata is perceived as highly variable species in coloring and somewhat less in elongated shape. The preoccupied *faba* is the same, as concluded by Habe (1949). It is certainly found in the Philippines, the Gulf of Thailand and was identified from Vietnam by Kilburn (2003, HYL03). Although reported by many authors from China and Taiwan (e.g. HAB49), neither Zhongyan (2004), nor Zhuang & Cai (1983) mentioned it, but instead illustrated *rubromuscula*. Thus, a Chinese distribution of *fasciata* is currently not confirmed.

Corbula rustica Gould, 1861 was described from Hong Kong, Whampoa Isl., 15 mm. The type is lost and the likely identity with Zhuang & Cai's ***rubromuscula*** cannot be proven. Thus, it is considered a nom. dub.

The unnamed *Lentidium* sp. reported by Robba et al. (2002) from the Gulf of Thailand appears instead to represent a *Potamocorbula* as well. ***P. laevis*** should be compared.

In **WAF** the large majority of authors recognize one species only, e.g. ***assiniensis*** (i.e. ARC04) or ***trigona*** (i.e. Nicklès; Marche-Marchad). Both were described from WAF, but the older *trigona* is preoccupied. However, Reeve described two further estuarine species ***C. adusta*** from New Zealand and ***C. procera*** without locality. It has long been established that no estuarine *Potamocorbula* live in New Zealand. Comparing the BMNH syntypes of *adusta* with specimens from Sierra Leone no differences were found. Indeed, the BMNH type lot (3 syntypes, 15.5 mm) is now correctly labeled "W. Africa". Thus, *C. adusta* is here reinstated with its labeled locality as earliest name for the brownish, comparatively small WAF species. *C. procera* and *C. assiniensis* are synonyms. ***Azara afra*** appears to be the same as well.

Habitat, hinge and surface sculpture range ***Panamicorbula*** closer to *Potamocorbula* than to *Corbula*. Anderson & Roopnarine (2003) concluded *Panamicorbula* as sister taxon to *Julia-/Tenuicorbula*. Unfortunately, they did not include any species of *Lentidium*, *Erodona* or *Potamocorbula*.

Genetic analysis should be applied to clarify, whether these traditionally strongly separated genera (*Potamocorbula*, *Panamicorbula*, *Lentidium*, and *Erodona*) are indeed that distinct or whether Lamy (1941) is closer to reality.

SP10: Dall (1898) originally considered ***Anticorbula*** corbulid. Morrison, 1943 originally considered

Guianadesma lyonsiid. Vokes (1945) stated synonymy without doubt between *sinuosum* and *fluviatilis*. In addition to habitat, size and morphology, also anatomy fits. Furthermore, the Marañon River is a tributary to the Amazon and this species was later found in the Amazon Basin (LEI97). Vokes' opinion is shared.

Fluviatilis has been alternated to and fro between CORBULIDAE (LAM41; LEI97) and LYONSIIDAE (REG71; VOK80; SIM99/06) for 60 years. Some authors even synonymized it with the fossil *Ostomya* Conrad, 1874 (VOK45; Keen in Moore, 1969; BOS82; Vaught, 1989).

Modern authors removed it from this fossil synonymy and *Anticorbula* is considered the oldest generic name (e.g. SIM99 and references). Beesley et al. (1998) and Harper et al. (2006) stated it non-anomalodesmatan. This course is followed and *Anticorbula* is included in CORBULIDAE but placed separately. Certainly, genetic analysis could easily solve its true affinities.

6.65 SPHENIOPSIDAE

SQ1: This is a family of rare shells. Most authors place it close to CORBULIDAE within MYOIDEA. Marshall (2002) placed them within ANOMALADESMATA, a view Harper et al. (2006) did not share. The question of correct placement needs further analyses.

Coan (1990) as well as Marshall (2002) considered *Grippina* close to *Spheniopsis*. Most species are described from American or NZ waters, one by Cosel, 1995 from WAF. Redfern (2001) illustrated 3 species from Bahamas, of which at least two appear undescribed. ***Grippina*** sp. A should be compared to ***triquetra***.

The members are very small and the family poorly known, many more species may live in the world's oceans.

Furthermore, as *triquetra* has been described as *Montacuta* and *Mysella aupouria* is instead a *Grippina*, it may well be that some other small "galeommatids" are erroneously placed.

6.66 PHOLADIDAE

SX1: Due to the outstanding work of R. D. Turner this family is quite well known, especially so in the Americas. Sowerby II (1849, Thes. Conch.) gave excellent figures; in most cases with all accessory plates. Tchang, Tsi & Li (1960) treated the rich Chinese pholadid fauna in a highly important, but neglected paper. Turner (1954, 1969) and Coan et al. (2000) summarized the various plaxes, callum and apophysis, here not duplicated.

XYLOPHAGAINAE Purchon, **1941** is treated as subfamily based on the definitions of Turner (1955). Purchon (1987) came to the same conclusion.

SX2: **Pholas**: *Le Julan* was described by Adanson, 1757 from WAF, Senegal, found as single specimen in semihard mud from a river mouth. Adanson's precise data leave little doubt that the locality is correct. Later, it was latinized by H. & A. Adams, 1856 as ***Zirphaea julan***. The type was not found, although many of Adanson's species have been subsequently discovered (FIP42). Many authors considered it a *Zirfaea*, either valid or synonymous to *crispata*. However, Adanson's original drawing clearly show, in addition to the 2 valves, also 3 accessory plates, especially a long metaplax and a divided protoplax (ADAN pl. 19; FIP42 fig. 7). Although the smallest part, the mesoplax, is lacking, above configuration is unknown in *Zirfaea* but fits exactly *Pholas dactylus* (TUR54 pl. 23). Apophysis, habitat and anatomical features would fit as well. Even a somewhat divided sculpture, strong anteriorly, weak posteriorly comes close. Whereas *P. dactylus* is common and well known from Europe, it is only rarely found in SAF (BA64). WAF records are virtually absent. Nonetheless, all evidence points that *Zirphaea julan* is a somewhat humped ***P. dactylus*** Linnaeus, 1758 instead a *Zirfaea*.

Furthermore, Adanson's picture has early been copied into Enc. Meth. pl. 169 fig. 3-4. Bory, 1827 named this species earlier than the Adams brothers validly ***Pholas mytiloides***.

SX3: **Barnea**: Turner in Moore (1969) considered ***Umitakea*** monospecific and synonymous to *Barnea* (*Anchomasa*). In both respects, her views are not shared.

Umitakea is perceived at least subgenerically distinct, following here Japanese and Russian authors. Its remarkably broad and deep shape, the huge gape, the special habitat and marked anatomical differences to *Barnea* (*Anchomasa*) as shown by Evseev (1993) demonstrate this well. Furthermore, two species are valid, but usually confounded. One is known from China, Japan and Russia, the other is tropical, centered on Indonesia, known from the Philippines, Australia to the Bay of Bengal and the Andaman Sea. The distinct protoplax, when present, makes recognition easy. Apart from a lanceolate, narrower, parallel-sided, elongated protoplax, the type species ***B***. (***U***.) ***japonica***, is in general more elongate, less high and grows smaller. Lutaenko (2005) came to the same conclusion; Tchang et al. (1960 fig. 6) depicted the protoplax well

B. birmanica was well described and depicted by Philippi, 1949. It is a typical *Barnea* s.s, but much larger than the type species. Obviously, this species is also found in E. Thailand (Swennen et al., 2001 sp. 222 as *manilensis*) and in China (TCHA60 as *candida*). *Pholas bakeri* (e.g. REV712 sp. 47) is considered the same. *Birmanica* was described as of 100 mm in size. The largest specimens studied measured slightly less than 100 mm (Thailand).

In the Yellow Sea a distinct species ***B. davidi*** occurs, broader and even larger (TCHA60 fig. 3; Zhongyan, 2004 pl. 175). Due to the large pedal gap this is an *Anchomasa*, the largest species within this subgenus. The shell and the protoplax are broader than in *manilensis*.

Barnea erythraea was not recognized as valid by Hoagland & Turner (1981). Barnard (1964) also synonymized it with *manilensis*. Only Oliver (1992) recognized it as similar to *manilensis*, but gave no further arguments for separation. ***B. manilensis*** described by Philippi, 1847 and depicted 1849 is an *Anchomasa* with only a moderate gape, generally quite strongly spined on the anterior part with comparatively few commarginal ribs. On the posterior part the sculpture is usually fading, especially so in adult specimens. The protoplax is lanceolate, ridged, and comparatively small. The apophysis is well developed, narrow, acutely pointed. As specimens from Japan and Natal and St. Lucia Bay are very close to the Red Sea forms in all features, *erythraea* is considered the same, following here Barnard (1964)' arguments and citations. The somewhat broader ***inornata*** **form** (type HIG01 B1319s) was kept distinct by Kira (1972 pl. 63 fig. 23) and Habe (1971 pl. 63 fig. 16). However, both mentioned many intermediate forms and modern Japanese authors synonymize *inornata* with *manilensis*. From the Japanese material at hand this course is followed. Okutani (2000 pl. 511 fig. 2) depicts such an intermediate form.

On the other hand, Sowerby II, 1849 described ***P. fragilis***. Though closely related, this species has a more pointed anterior shape, a wider gap and a denser sculpture with much more ribs, compared to equal-sized *manilensis*. This species has been described from the Philippines, is known from S. and E. China and Yell (TCHA60). It has also been found in Japan, in various places in Chiba Pref. Whereas most Japanese authors (e.g. Koyama et al., 1981; Higo et al., 1999) synonymize *fragilis* with *manilensis*, Hidalgo (1905, Phil), Lamy (1925) and Tchang et al. (1960) kept it separate, Yokoyama (1920) reported it living in Western Japan and Hoagland & Turner (1981) listed it as valid species. This latter course is followed. *B.* (*Anchomasa*) *fragilis* surpasses even the high variability of *manilensis*. The protoplax is lanceolate, somewhat lamellate ridged, and comparatively small as well shown by Sowerby II, 1849, pl. 108 fig. 92. The apophysis is also well developed, but somewhat more spathulate.

SX4: ***Barnea*** (***Anchomasa***) ***ghanaensis***. This species will be described in a separate publication.

From Western Africa only one *Anchomasa* species was recorded, namely **Barnea** (**Anchomasa**) **truncata** (Say 1822). This characteristic, broadly truncated species is amphiatlantic, found in Eastern N. America from Maine, through N. Carolina, the West Indies to Brazil, Rio and in W. Africa from Senegal to Angola and further to S. Africa, Table Bay. It lives from 0-55 m, boring into clay, waterlogged wood and soft rocks. It may grow to a size of 100 mm. *Truncata* is illustrated in Nicklès (1950 sp. 454) and Turner (1954 p. 27). *B.* (*A.*) *truncata* is very characteristic with its large, broad parallel, truncate form. The variability is restricted. The WAF forms are, as stated by Turner, identical to the US forms. In Ghana some *truncata* valves have been found beached. The new species has a quite distinct, more elongate and posteriorly rounded shape and is much finer sculptured. It is more strongly beaked in the anterior third, whereas *truncata* has a low beak at the end. *Ghanaensis* stays also much smaller than *truncata*.

In addition, 2 *Anchomasa* species occur in neighbouring regions. ***Barnea*** (***Anchomasa***) ***parva*** (Pennant 1777) is the type species of the subgenus. It is known from Great Britain, W. France through Gibraltar to Algeria and into the Western Mediterranean. It lives intertidal to 10 m; boring into soft sandstone, clay and waterlogged wood. The maximum size known is 46 mm (Noirmoutier, W. France, coll. MNHN). *Parva* is illustrated in Poppe & Goto (1993 pl. 25 fig. 2) and Turner (1954 p. 23).

In S. Africa, ***Barnea*** (***Anchomasa***) ***alfredensis*** (Bartsch 1915) is found from False Bay through the type locality Port Alfred to East London. It lives sublittoral to 55 m, boring in sand- and limestone. The maximum size known is 46 mm. *B. alfredensis* is well depicted in Steyn & Lussi (1998 sp. 1000). *B.* (*A*) *alfredensis* has a characteristic, strong commarginal sculpture with only few radial ribs anteriorly. It is usually more pointed posteriorly. In addition, it has never been reported outside S. Africa. Especially, there are no *alfredensis* records from Namibia or from Angola.

The new species is closest to the type species *B.* (*A.*) *parva*, but it is in general more elongate and relatively less high. The cancellate sculpture is more regular over the whole shell, whereas *parva* has a strong structure anteriorly, fading posteriorly. The radial ribs are also stronger in the new species. The umbonal reflection is strongly concave, whereas in *parva* it is often compressed, becoming in elder specimens slightly convex. The apophysis of *ghanaensis* is slender and pointed, whereas in *parva* it is spathulate. The protoplax is anteriorly rounded, whereas in *parva* it is pointed.

From WAF, Ardovini & Cossignani, 2004 p. 292 further depicted a very peculiar, 48 mm species from El Argoub, Western Sahara as *Barnea truncata*. Recently, from the same locality two specimens could be studied, 48.5 and 50.3 mm. Definitely, this species does not match true *truncata*, but may represent a further **undescribed** WAF *Anchomasa*. However, additional, especially juvenile specimens are needed for a clear differentiation towards *ghanaensis*.

SX5: In N. Australia, Darwin some ***Martesia*** approximately 20 mm have been found. Some were indeed shallowly boring in dead coral; others were taken from waterlogged wood. The mesoplax is ovate, roughly, irregularly sculptured and strongly pointed to the posterior side, as indicated by Sowerby II, 1849 for ***multistriata*** from N. Australia. The divided surface sculpture is similar to *cuneiformis*, but anteriorly denser ridged, no posteriorly forked hypoplax is present, as would be requested for *nairi*. As the same species was found in wood, it is likely, that ***Pholas ligniperda*** Sowerby II, 1872 described from Darwin is the same. ***M. australis*** Gray, 1851 from N. Australia may also be identical to *multistriata*. However, the type was not found at BMNH 11/08. Thus, this latter synonymy can only be tentative.

Allan (1962) mentioned *ligniperda* from mangroves in Qld. This may instead refer to ***M. nairi*** reported from there by Turner & Santhakumaran (1989).

In general, the IND *Martesia* have less plaxes than the Caribbean ones. It appears that for *multistriata* and *pygmaea* a **new subgenus** is indicated.

SX6: As far as could be ascertained, ***Aspidopholas*** P. Fischer, 1887 was never treated in-depth by Turner.

Turner (1955) synonymized *Pholas ovum* “Gray” Wood, 1828 with *Martesia striata*. However, Lamy (1926) noted *Pholas ovata* “Gray” Sowerby, 1849 the same as Wood’s species and considered *ovum* distinct from *striata*.

Against Lamy’s clear view, Turner in Moore (1969) considered Lamy’s *cheveyi* synonymous to Sowerby’ *obtecta*.

Later, Hoagland and Turner (1981) recognized 3 *Aspidopholas*: *A. cheveyi*, *obtecta*, and *yoshimurai*. Here, also 3 species are recognized, but distinctly named and composed.

Aspidopholas yoshimurai is consistently recognized and illustrated by Japanese authors and does not pose problems.

Most modern authors synonymize Lamy’s ***cheveyi*** with *obtecta*. However, Lamy (1926) synomymized Sowerby’s *obtecta* with the earlier *Penitella tubigera* Valenciennes from the Solomon Isl. , based on the MNHN *tubigera* type material, and gave a distribution including Australia and Philippines. Only 1 year later, he described *cheveyi* from Vietnam in a new genus. Thus, it is highly unlikely that *cheveyi* and *obtecta* should be the same. Indeed, these two species are also subgenerically distinct. *Cheveyi* has no siphonoplax, ***tubigera*** has; *cheveyi* has anteriorly a radial sculpture, *tubigera* an oblique commarginal sculpture, but both have a greatly produced mesoplax. Lamy's view is shared and ***A. tubigera*** is understood as the second true *Aspidopholas*, *Pholas obtecta* is a synonym.

The third species is deeply boring in corals, has marked unequal valves and an almost complete anterior coverage by a white calcareous "eggshell", an excessively produced mesoplax. This species has been excellently described and depicted by Lamy, 1927 as ***cheveyi*** from Vietnam and has been recognized from S. China by Tchang et al. (1960). In addition, the BMNH syntypes of ***Pholas ovum*** were studied. The larger BMNH syntype has originally been depicted by Wood, 1828 fig. 4 (West Indies) and by Sowerby II (1849 figs. 71-72) and (1872 fig. 29a-b, no locality). *P. ovum* does not match *striata*; shape, size, very unequal valves and anterior radial sculpture do not fit. Nothing similar to *ovum* is known from the West Indies. The still present calcareous portion proved to be broken from a larger portion. From unequal shape of the valves, divided sculpture, large "eggshell" mesoplax and size, there is no doubt that *Pholas ovum* is the earlier name for *P. cheveyi*. The erroneous West Indian **type locality** is here corrected to Vietnam.

Compared to *Martesia*, *Aspidopholas* is broader, has a greatly produced mesoplax, and is a tube dweller instead of a wood borer.

SX7: ***Pholas cordata*** Gmelin, 1791 (i.e. type MT, *Schroeteria*, TRY621) was based on a species depicted by Schröter, 1786. According to Sherborn, Gmelin's name was validly proposed. The new genus and the species were described before ***Diplothyra*** *smithii* Tryon, 1862 (TRY622). Nowadays, these two are considered the same (Turner in Moore, 1969). Genus and name have been discussed by Lamy (1926 p. 199). Thus, neither is *Schroeteria* a nom. obl. as erroneously stated by Turner in Moore (1969) or Vaught (1989), nor is *Pholas cordata* Gmelin, 1791.

The requirements of ICZN Art. 23.9.1.1. for a reversal procedure are not met. Prevailing usage clearly favours *Diplothyra* and *smithii* and therefore *Schroeteria* and *Pholas cordata* could be formally invalidated by ICZN. Following Art. 23.9.3. the junior genus and the junior name are for the time being applied, awaiting an action of American authors.

Turner visited BMNH in August, 1965 and selected the types in PHOLADIDAE. She also selected in sched. a lectotype for ***Pholas grayana*** "Leach" Sowerby II, 1872, described from unknown locality and wrote on the lectotype label "is *Diplothyra curta*". Her decision is followed.

The Caribbean *Diplothyra* is locally common, the Panamic appears rare.

SX8: ***Penitella***: ***Zirphaea gabbii*** Tryon, 1863 was originally described as originating from Japan (KEG89 p. 313). Turner (1955) identified specimens from California as *gabbii*. However, Kennedy, 1989 recognized the Californian species distinct from the Japanese and described the higher and comparatively shorter Californian form with a distinct mesoplax as ***richardsoni***. Kennedy gave as distribution of *gabbii* from at least Kyushu to NE. Honshu. The type is depicted in Turner (1955 pl. 53 fig. 2) and in Kennedy (1989 fig. 1-2). In Kanagawa and Chiba Pref. commonly quite large *Penitella* were encountered, boring in hard mud or soft stones. Especially two larger specimens from Nobi, Kanagawa Pref. are virtually identical to the holotype of *gabbii* in shape and sculpture. *P. gabbii* is not accepted by Japanese authors; instead in Japanese literature these specimens are illustrated as ***kamakurensis***. However, Yokoyama (1922 fig. 10) just represents a small *gabbii* with lacking callum. From the material at hand, *P. gabbii* is as quite variable species. The callum may be completely closed or half open or lacking, the umbonal reflection partly or completely adherent to the dorsum, the shape quite regular to somewhat distorted, but the mesoplax is the same and the apophysis spathulate. Thus, I am not convinced that ***P. chishimana*** (Habe, 1965 pl. 54 f 9) is a valid species. Indeed, *chishimana* was not listed as a valid *Penitella* by Hoagland & Turner (1981) and was doubted by Kennedy (1989). Furthermore, some *Penitella penita* records of Japanese and Russian authors may instead belong to this species. At least the specimen illustrated by BOG93 from Sakhalin, extending from Sea of Japan to Commander Isl., appears closer to *gabbii* than to *penita*. *Penita* is usually more elongate, less broad than *gabbii* has an acute posteriorly pointed mesoplax, whereas in *gabbii* the mesoplax is comparatively broad, posteriorly rounded and often split anteriorly. Coan et al. (2000) restricted the Westward extension of *penita* to Alaska.

Furthermore, in many Japanese and Chinese books ***Zirfaea subconstricta*** (Yokoyama, 1920) is illustrated (e.g. Kira, 1972 pl. 63 fig. 21; Habe & Kosuge, 1992 pl. 63 fig. 14; Habe & Ito, 1965 p. 156; HIG99 p. 518; Zhongyan, 2004 pl. 175 F). Zhongyan depicted the mesoplax, and part of the small animal, which exclude the genus *Zirfaea*. Turner (1955 p. 88) stated *Zirfaea constricta* Sowerby II, 1849 (non Philipps, 1829, = GB foss.) as Japanese *Penitella* close to, eventually synonymous with *gabbii*. In Chiba and Kanagawa Pref. numbers of "*subconstricta*" have been found as well. A close comparison with *gabbii* led to the conclusion that this is the same species without callum. Neither spathulate apophysis, sculpture of the valves, nor mesoplax were distinct.

Tchang, Tsi & Li, 1960 proposed a new subgenus ***Monoplax*** within *Pholadidea* for two species with a single dorsal plate, which they termed protoplax, but which is, following Turner (1954)'s definition, instead a mesoplax. Furthermore, both species have a siphonoplax.

The huge, undivided mesoplax, as well as shape, and features of the siphonoplax approach *Monoplax* to *Penitella* instead of *Pholadidea*. As the mesoplax is large and quite extended, not seen in these dimensions in other *Penitella* and as the species are minute, *Monoplax* is considered a valid subgenus of ***Penitella***. As far as could be ascertained, neither ***Pholadidea*** (***Monoplax***) ***dolichothyra***, nor ***P.*** (***M.***) ***acutithyra*** was originally, or has been subsequently, designated as type species. Here, the first described *Penitella* (*Monoplax*) *dolichothyra* (Tchang, Tsi & Li 1960) is selected as **type species**, **SD**. These two have been variously treated in the sparse literature found. Bernard, Cai & Morton (1993) listed both twice; first, as synonyms of *Penitella kamakurensis* (p. 111), and second as valid *Pholadidea* (p. 111, 112). Higo et al. (1999) listed both as synonyms of *kamakurensis*. Zhongyan (2004 pl. 175 E) depicted *acutithyra* as "*kamakurensis*", but did not mention *dolichothyra*. However, in the many *kamakurensis* (= *gabbi*) analysed, this unique *Monoplax*-shape and extension of the dorsal plate was never encountered. Furthermore, *gabbi* reaches more than 70 mm, whereas the maximum size reported for any *Monoplax* is 11 mm. It is not completely excluded, that *acutithyra* may become a synonym of the type species, once sufficient material is available. However, for the time being, both are listed as distinct following the original arguments.

Due to limited material the high number of closely related **Californian** *Penitella* (*hopkinsi*, *richardsoni*, and *turnerae*), in addition to the studied *penita*, *fitchi* and *conradi* could not be verified. However, considering the variability encountered in the Japanese *gabbii* in shape, opening of the callum and dorsal adherence a slight doubt remains.

SX9: **Pholadidea**. Altena (1968) dredged off the Caribbean Suriname coast in 31 m *P*. (*H*.) *melanura* (REG71, p.79) identified so by Turner (REG68, p.165). As such, this rare species is found in PAN and CAR.

SX10: ***Jouannetia*** *vignoni* has been described by P. Fischer, 1862 from WAF, Gabon. It has been briefly discussed by Lamy (1926). Turner (1955) classified it, based on the excellent original figures as *J*. (*Pholadopsis*). Cosel, 1995 described a new ***J*. (*Pholadopsis*) *uncinata*** from Ivory Coast without any comparison. Neither size, nor morphology, biogeography nor rarity leaves any doubt that Cosel's species is an unnecessary synonym. Both authors assumed the habitat as soft bottoms and stated the same dimensions. ***J*. *vignoni***, as most *Jouannetia*, is a quite uncommon species. It appears to be the smallest among the 6 currently known extant *Jouannetia*.

There is no doubt that *P*. *semicostata* Dall, 1898 non Lea, 1844 is the same as *Jouannetia* (*Pholadopsis*) *quillingi* and ***Scyphomya*** Dall, 1898, thus, a junior synonym of *Pholadopsis* Conrad, 1849 (Turner in Moore, 1969, N720). However, as Lea mentioned an apophysis, true *Pholas semicostata* Lea, 1844 might instead have been a *Martesia*. Indeed, Lynge (1909) placed it under *M*. *striata*. As Lea's type is lost, her *semicostata* is best considered a nom. dub.

SX11: **XYLOPHAGAINAE** is a barely known group of mostly deeper water wood borers with likely more than 50 species.

Whereas Japanese authors, following Habe, apply subgenera, Turner (1955) synonymized all. Knudsen (1961) also did not recognize any subgenera. However, in 2002 Turner proposed 6 groups mainly based on mesoplax and siphons, without naming them. Her group 3 is close to ***Metaxylophaga***, her group 5 may be named ***Neoxylophaga*** and group 6 is ***Xylophaga*** **s.s**. Unfortunately, Turner (2002) focused on own material and neglected Santhakumaran's, Harvey's, Okutani's, Mienis' or Beesley et al.'s approximately 10 additional species. Furthermore, her many newly described species were not compared to other material available, e.g. Harvey's excellent pictures. Therefore, some Turnerian species remain somewhat shaky. Definitely, more work is needed to validate her final work and to answer the question of grouping in this large genus with currently 47 described species.

X*. *wolffi is disputed. Whereas Japanese authors consistently considered it as juvenile of *supplicata*, Turner (2002) considered it a possible synonym of *grevei*, and NZ authors (Otago) consider it a valid NZ species. Turner (2002) stated instead ***bruuni*** as close, if not synonymous to *supplicata*. It is not excluded, that *supplicata* is a variable, widely distributed species. However, for the time being Turner's opinion is followed.

Japanese authors synonymize ***japonica*** with ***indica***. However, Knudsen kept them distinct. Turner (2002) stated both as close and belonging to their group 6, but kept them distinct as well. The latter arguments are followed.

6.67 PARILIMYDAE

TC1: Whereas most authors differentiate between ***Parilimya*** and ***Nipponopanacca***, Coan (2001) synonymized the latter into the former, lacking any strong differentiating characters. As the two type species are indeed quite close, this course is followed. Whereas *P. sakuraii* and *P. haddoni* have rather smooth, granulated surfaces, in *P*. *pacifica* and in *P*. *maoria* stronger radials occur.

Panacca appears as weak genus, mainly differentiated by the cuneate shape and the sinuous anterior margin. Morton (1982) even included all species in the oldest *Parilimya*.

Recently, Krylova, 2006 described a new *Panacca* and indicated 2 additional *Parilimya* present in European waters. However, her ***P*. *montana*** was described from a single right valve only and ***P*. *africana*** was described from a single valve as well. Intraspecific variability and bathymetric range of both species are not known and it can not be excluded that these two are conspecific.

6.68 CLAVAGELLIDAE

TY1: **Clavagellids** build a small, compact, and easily distinguishable group of some more than 20 uncommon to rare species.

Phylogenetically clavagellids are close to lyonsiids and pandorids (HARP). Furthermore, genetic analyses of *Clavagella*, *Brechites* and *Verpa* show a quite uniform picture, forming a robust clade (e.g. HARP).

Here, 2 genera are recognized, either *Brechites* with both valves attached to the tubes or *Clavagella* with one valve free. In the first group *Humphreyia*, and in the second group *Stirpulina* have an untypical mode of life. Proposals to divide into various families (e.g. Gray, 1858; Morton, 2002-5) are not shared. These divisions appear exaggerated and were also not applied by Harper et al. (2006). Subgeneric and specific levels seem to offer ample possibilities for differentiation.

At present, for most species a separate subgenus is available. Most have been characterized by Morton, some by Smith (1976) or by Tryon (1862).

TY2: ***Clavagella*** *s.s*., as stated by H. & A Adams (1858), is restricted to fossils only; the closest extant form is *Dacosta*.

From the Mediterranean approximately 10 *Bryopa* have been described. Of these, usually 3 species are considered valid, namely *aperta*, *melitensis* and *balanorum* (MICAL, REP, CLEMAM). However, Philippi (1844) only listed 2 species from Italy, Tryon (1862) doubted the validity of *balanorum* and Smith (1976) also recognized 2 species only, and synonymized *balanorum* into *aperta*. From the material at hand this latter course is followed. Whereas ***aperta*** (lamellate tubes, large and usually elongated valves) and ***melitensis*** (radiately striate tubes, smaller and usually quadrate valves) have clear diagnostics, I fail to recognize *balanorum*. The habitat "among barnacles" is also found in *aperta*, whereas *balanorum* is also found "im festen Kalksteine" (PHIL44). The tube cross-section, considered important by Micali et al. (1989) is seen in broken or low tubed *aperta* as well and also depicted by Chenu pl. 1 fig. 3a for *aperta*. The valves do not offer special traits. Thus, ***balanorum*** is considered erected on imperfect *aperta* specimens, found in a peculiar habitat. According to Cretella et al. (2005) *Clavagella balanorum* is available as of Scacchi in Philippi, 1840 (Wiegmann's Archiv). Scacchi's type is lost.

Aspergillum maniculatum Philippi, 1836 described from a lamellate fossil piece of tube might be a further synonym of *aperta*, as stated by Caillaud and accepted later by Philippi (1844).

Philippi's hexagonal tube piece of ***C. angulata*** was differently interpreted. Whereas Tryon (1862) and Smith (1976) considered it synonymous to *melitensis*, CLEMAM synonymized it with *aperta*. From the OD, *melitensis* is more fitting and Tryon and Smith are followed.

Aperta and *melitensis* are widely distributed in the Med, *C. aperta* is also known from the Atlantic, SE. Portugal, Olhos de Agua.

Smith (1976) considered ***C. lata*** and ***C. elongata*** synonymous and selected against page priority the available *lata*. This course has been accepted by subsequent authors. Very probably Japanese *lata* records are instead referable to Morton's ***Bryopa aligamenta***.

C. mullerae appears sufficiently distinct from ***C. australis*** to abolish subgeneric constructs. ***C. mascarenensis*** seems at least closely related to the former. More material needs to be compared to ascertain distinctiveness. Morton, 2003 introduced for this group ***Dianadema***, based on *multangularis*. From the OD, Habe's ***japonica*** seems to belong here as well.

A typical *Stirpulina* is depicted in Smith (1962), also in Moore (1969 F32 fig. 2). However, the extant Japanese *ramosa* has distinct, anteriorly lacking "plaited ruffles". Thus, Stoliczka and Japanese authors are followed, considering *Stirpulina* extinct and applying ***Stirpuliniola*** for the only known extant species. ***Clavagella*** (***Stirpuliniola***) ***ramosa*** is excellently depicted in HABE sp. 712. As far as is known the uncommon *ramosa* is confined to Japan and the Yellow Sea. Philippine specimens with two small affixed valves, often mislabeled *ramosa*, are instead referable to *Verpa*.

TY3: ***Brechites*** Guettard, 1770 was validly proposed, as rectified by Smith (1971) and earlier accepted by Sherborn. Guettard's names have also been applied by Turner in teredinids (i.e. *Kuphus*, *Uperotus*).

Virtually all authors use ***Penicillus*** Bruguière 1789 subgenerically for the small, slender, anteriorly smooth forms (*penis*, *philippinensis* and *aquarius*). However, Guettard, 1770 used *Penicillus* earlier and validly for polychaets. ***Verpa*** Röding, 1798 is the next available name for this group. The type *Verpa*, MT is *Serpula penis*. *Aspergillum* Lamarck, 1818 has been considered a synonym of *Penicillus*, at least since Gray (1847) and stated obj. by Keen & Smith in Moore, 1969. As such it is understood that Keen & Smith implicitly selected in 1969 SD *A. javanum* as type species, making *Aspergillum* indeed an obj. synonym of *Penicillus* (= *Verpa*).

For *Verpa* species a multitude of names are available. Most modern authors differentiate two species. However, from the material at hand 3 extant species live in the Indo-Pacific.

These are differentiable by the position and size of the small valves on the tube, the number of disc crenulations, the shape of the tube, and the strength of adherent particles on the tubes. Linnaeus' Indonesian ***penis*** is depicted by Keen in Moore (1969 F32 fig. 3), as *javanum* and *annulosum* by Reeve (1860 fig. 1 and fig. 3), as *javanum* by CHENU (pl. 2 fig. 1), or by Smith (1976 fig. 21, d'Argenville; 24, *annulus*; 25, *javanum*). Chenu's middle figure of *javanum* has been selected by Hanley (1855) to fit "precisely" Linnaeus single complete specimen. The identity of *javanum* and *penis* has also been accepted by Chenu, but the better known *javanum* was still applied. *Penis* has a conical shape with the two small valves quite strongly embedded and very close to the disc, within a distance of less than 10 mm. The disc itself is bordered by very finely, densely ridged crenulations, about twice the size than found in the other two species. *Penis* is currently not known from the Philippines.

There, the widely distributed, more common ***philippinensis*** is found, well depicted in CHENU (pl. 4 fig. 7), Reeve (1860 fig. 8 and 10 as *zebuense* and *philippinense*) or by Smith (1976 fig. 26, type; figs. 27-31, synonyms). In larger *philippinensis* the two small valves are 20-30 mm beneath the disc, also embedded. The disc itself is more roughly ridged. Generally the portion just below the disc is tied. Smith (1971) recognized this "neck" region beneath the disk also in *strangulatum* which he (1976) synonymized with *philippinensis*. In shape *philippinensis* is very close to the rare Japanese *C.* (*Stirpuliniola*) *ramosa*. However, in *ramosa* the two small valves of *Verpa* are replaced by a single large one. *Philippinensis* grows largest of the 3 *Verpa*, and is usually heavily adorned by sandy, stony or shelly particles. These strong attachments, however, are usually absent in the other two species.

The third and smallest species has been named ***dichotomum*** by Chenu, 1842 pl. 2 fig. 6. It has a similar shape and the sparse attachments of *penis*. The two small silvery valves are set on the usually smooth surface; but these valves are generally about 20 mm beneath the disc in specimens of approximately 100 mm; thus, consistently more remote from the disc than in *penis*. The conical shape without any "neck" beneath the disc is similar to *penis*. The ridges on the disc are much rougher compared to *penis*, similar to *philippinensis*. Sowerby I, 1825 compared his ***Aspergillum sparsum*** with *javanum* (= *penis*). He stated a double sized slit in the disk and only half the number of radiating ridges on the disc. This fits exactly *dichotomum* compared to *penis*. Other than synonymized by Chenu, Sowerby's species is perceived the same as Chenu's *dichotomum*. Furthermore, Tryon (1862 p. 491) considered Burrow's ***Serpula aquaria*** the same. His arguments are followed. As such, ***B*. *aquarius*** is reliably known from SW. Thailand, Satun and East Malaysia, Perlis, Singapore and the Gulf of Thailand. The Red Sea locality mentioned by Chenu is considered erroneous. It was neither reported by Lamy, by Oliver (1992), by Dekker & Orlin (2000), nor personally collected there. *A. semifimbriatum* originally from the same "Red Sea" lot is considered conspecific. The species illustrated as *philippinensis* by Swennen et al. (2001) from the Gulf of Thailand is instead *aquarius*. *Dichotomum* (= *aquarius*) has been recognized by Lynge (1909) from the Gulf of Thailand and Reeve's *disjunctum* has been synonymized. Smith (1976 fig. 22, *dichotomum* and fig. 23, *disjunctum*) depicted the types, but he confounded this species with *penis*. Therefore, the exact distribution of *penis* and of *aquarius* has to be further elaborated. The reference in Hylleberg & Kilburn (2002) might indicate a presence of *aquarius* in S. India, Mannar and would restrict *penis* around Indonesia.

In all 3 *Verpa* species the disc is medially split, weakest in *penis*.

Aspergillum kobeltianum Löbbecke, 1879 has been validly proposed and described, but not depicted; it is not a nom. nud. as erroneously stated by Smith (1962). From the OD identity with *aquarius* is most likely. However, the type, possibly at the Loebbecke Museum in Düsseldorf, should be reanalyzed.

The W. Australian and the Red Sea specimens studied do not imply that ***Brechites attrahens*** and ***australis*** need a subgeneric construct. Apart from disjunct biogeography, in *australis* the tube is generally broader; the attached valves are significantly smaller and the plaited ruffles, as illustrated, distinctly sculptured. Both are true ***Brechites*** s.s. and ***Warnea*** (type SD *australis*) is without doubt a synonym.

Foegia is restricted to the type species ***novaezelandiae***, occurring from the Andaman Sea to Australia, but not in New Zealand.

B. (*Foegia*) *veitchi* has been redescribed by Morton, 2004 and ***Kendrickiana*** was proposed for this unique S. Australian species. Here, the small valves are usually hidden beneath calcareous deposits. The earlier *A. incertum* Chenu, 1842 from Swan River has been differently treated by authors. Evidence points to a composite species. Chenu's fig. 6 represents *B. australis* as stated by Gray (1858), Smith (1971) and Lamprell & Healy (1998). The disc clearly excludes *veitchi*, as well as *novaezelandiae*. However, Chenu's fig. 5 represents a distinct species and might indeed have been a deformed *veitchi*. As stated by Smith (1971), Cotton (1961 fig. 153) illustrated a *veitchi* specimen under *incerta*. Here **Chenu's fig. 6** is selected to represent ***A*. *incertum***. This is the specimen illustrated by Smith (1971 pl. 11 fig. 14). As such, *Aspergillum incertum* becomes an unambiguous synonym of *australis*. Lamprell & Healy (1998 sp. 657) is instead *veitchi*.

Aquaria imbricata Perry, 1811 is not a nom. obl., but as rectified by Petit (2003) a nom. dub.

6.69 PANDORIDAE

TG1: **PANDORIDAE**: This is a neglected family; instead of 25 (BOS82) approximately 40 pandorids are perceived recognizable.

Usually **6 subgenera** are differentiated (e.g. Keen in Moore, 1969). However, the rather superficial definitions only cover a few extremes. Going through the global pandorids, at least 7 additional subgenera would be necessary, most monospecific:

P. dissimilis (similar hinge as *Pandora*, but with a strong white lithodesma),

P. oblonga (similar hinge as *Pandora*, but with radials on the right valve),

P. rhypis (similar hinge as *Foveadens*, similar shape as *Pandorella*, but radials on both valves),

P. flexuosa (similar shape as *Pandora*, but with additional posterior crura),

P. radians (similar shape as *Frenamya*, but with a large posterior crura in the left valve),

P. perangusta (unique with a strong commarginal sculpture),

P. uncifera (similar to *Pandora*, but with a divided sculpture and an additional posterior crura).

None of above species fit extant subgenera. Not even *P. pinna* is a very typical *Pandora* s.s.

In addition, the presence of a shelly *lithodesma*, enforcing the resilum is sometimes, quite ambiguous. In some species strong lithodesma are present, in others clearly none. However, in some species, minute white traces occur, where no lithodesma should be present (e.g. *ceylanica*, *radians*).

Furthermore, *Pandorella* and *Clidiophora* are quite close. Both have a lithodesma. The base dentition with 2 main crurae in either valve plus a resilium portion is the same. *Gouldiana* and *trilineata* described and/or placed in *Clidiophora* (BOS651) appear instead as a typical *Pandorella*. The larger left valve has a quite strong radial ridge, whereas the right valve has a more or less strong radial sculpture, visible in fresh specimens. In addition, the exact hinge configuration among Californian "*Clidiophora"* species is quite distinct from the condition in the type species *claviculata*.

Boss & Merrill (1965 p. 193) recognized these issues as well, and stated "the questionable value of subgeneric traits".

Last but not least, the attribution of species to subgenera is diverse through time, authors and regions. Some authors did not apply subgenera as not fitting (e.g. Oliver, 1992 and 1995), or expressed the need for additional criteria (e.g. Coan et al., 2000). Probably, it would be best to abolish subgenera in *Pandora* completely and use instead the specific level for precise descriptions only.

For the time being, some species are attributed where they have clear affinities; the remainder is placed s.l. Much more work and genetic analyses are needed to arrive at substantial relations within this family. Definitely, in the current state of knowledge there is no justification to separate genera within *Pandora* as proposed by Japanese authors.

Carpenter's important PZSL article was in the 1864 edition, but part III had just been published in May, 1865 (DUNCAN).

TG2: ***Pandora***: The European **type species** is difficult. Instead of 1, **three species** are recognized. *Pandora* s.s. has in the right and left valve a posterior resilium and *single anterior crura*, strong and pointed in the smaller right valve, elongate, dorsal in the larger left valve. No additional white shelly plate (*lithodesma*) supports the resilium.

Linnaeus' ***Solen inaequivalvis*** as depicted by Hanley (1855) and as stated by Lamy (1934) represents the Mediterranean species.

Röding, 1798 referred his *Calopodium albidum* to Chemnitz 6 11 106; Chemnitz 106 a-c depicts a comparatively broad form. Obviously, Tebble (1976) considered this broader, heavier, thicker Atlantic ***albida*** distinct from the slender, fragile, pointed Mediterranean *inaequivalvis*. Boss & Merrill (1965) and CLEMAM synonymized, Lamy (1934) made strong varieties. From the material at hand, the Med forms are quite uniform and the Atlantic forms as well, forming two distinct groups. In SW Spain both forms occur. Lacking intermediaries, these two species are separated. In addition to above mentioned differences in shape and texture, also the posterior ventral portion is consistently broader and more curbed and the muscle scars are larger in *albida* compared to *inaequivalvis*. Both species attain about 40 mm. The **type species** *Pandora*, SD, Lamarck's *rostrata* is represented by the Atlantic form. *P. inaequivalvis* of Sowerby II (1874 fig. 2 from GB) is *albida*, but not Linnaeus' species. As such, Tebble (1976 fig. 106) excellently illustrated the type species of *Pandora*.

Linnaeus' *inaequivalvis* is a related Med species. ***P. brevifrons*** Sowerby I in Sowerby I & Lytellton Powys, 1835 was originally described from Panama, but not subsequently found. Concluding from a type photo, it appears that *P. brevifrons* is a misplaced *inaequivalvis*.

Furthermore, Lamy renamed a unique, small Mediterranean species ***P. sicula***, earlier named *flexuosa* by Payraudeau, 1826. This species is uncommon and virtually absent from European literature, not listed in CLEMAM, and erroneously synonymized with *inaequivalvis* by Boss (1965). However, in La Conchiglia 1981 p. 19 a synoptic table shows all 3 Mediterranean pandorids. In addition to *inaequivalvis* and *obtusa* (= *pinna*), also *sicula* (erroneously as *P. pinna*) is well illustrated. *P. sicula* is similar in shape to *albida*, but deeper living, smaller and currently only known from the Western Mediterranean.

The Red Sea and Arabian ***flexuosa*** with its inflated left valve, lacking lithodesma and shape is closest to *Pandora*. However, it has an additional posterior crura. The Panamic ***uncifera*** has this additional crura as well and, additionally, a divided surface sculpture.

The huge, quadrate SAF ***P. dissimilis*** was not treated by Lamy. Barnard (1964) well characterized it, but did not mention the lithodesma. It has indeed a similar dentition as *Pandora* with a resilium and a large pointed crura in the slightly flatter right and a dorsally elongated crura in the left valve. However, it has a strong lithodesma, the valves are only slightly inequivalve, and the surface sculpture is roughly, irregularly ridged. Shape and sculpture are not close to the European forms or to any other pandorid. The largest specimen is 48.3 mm, live taken in 35 m in the Hout Bay area, Western Cape; it extends to at least East London, dredged in about 100 m. It is illustrated in Steyn & Lussi (1998 sp. 1005), the lithodesma well visible.

As stated by Carpenter (1865) the uncommon WAF ***oblonga*** is indeed closest to *rostrata* (= *albida*). It has a similar shape, and a quite similar hinge configuration without lithodesma. However, the much smaller right valve is not commarginally sculptured as in typical *Pandora*. It has radial streaks as found in *Pandorella*. The original type locality "Gamberoon" remained dubious. It is here clarified as **Cameroon** which is in the middle of the presently known distributional range.

A special IND-group is usually termed ***Frenamya***. Indeed, some species *elongata* (= ***aversa***), ***ceylanica***, ***cumingii***, ***similis***, ***sinica*** and ***patula*** have no lithodesma and a shelly plate (septum) in the left valve covering both crurae. However, their shape is quite distinct and the SAF s*imilis* is even usually placed in *Pandora* s. s. *P. ceylanica* is an uncommon Red/Sea/Indian Ocean species, whereas *cumingii* is known from the Philippines, Negros and N. Borneo. The rare *P. cumingii* has a stronger dorsal curvature, a broader "snout" and grows larger. *P. aversa* may have a similar septum, but has a quite distinct shape.

Coelodon elongatus Carpenter, 1865 (= *Pandora*) is preoccupied by the small European fossil *Pandora elongata* Risso, 1826. Hedley (1906 fig. 16) illustrated a juvenile *Coelodon elongatus* (Carpenter) from tropical Australia, Mast Head Isl. In 1913, he considered his Australian species distinct from Carpenter's Borneo and China *elongatus* and renamed it ***C. aversus***. On the other hand, the tropical Australian specimens illustrated by Lamprell & Healy (1998 sp. 628) are perceived conspecific with Carpenter's BMNH syntypes. Unless in tropical Australia two closely similar *Frenamya* can be identified, Hedley's *P. aversa* is applied for the preoccupied *elongatus*. ***P.*** (***Frenamya***) ***aversa*** is a comparatively small, rather narrow-elongate species, the dorsal margin is only moderately curbed.

Chinese and Japanese authors usually synonymize ***Coelodon delicatulus*** Carpenter, 1865 with ***C. ceylanica***. However, *ceylanica* has a quite distinct shape, is not straight dorsally, and does not occur in China or Japan. Instead, the *delicatulus* type (HIG01, B1398) points towards the "*Pandorella"* group. *Delicatula* was originally described without a type locality. Sowerby II (1874) gave Japan and Lamy (1934) confirmed this. In dentition and shape *delicatulus* appears closest to *P. pseudobilirata* (= *bilirata*). Indeed, Koyama et al. (1981) synonymized *delicatula* with *pseudobilirata*. This course is tentatively followed, but it needs confirmation. *P. pseudobilirata* itself has recently been synonymized with *P. bilirata* Conrad, 1855 by Coan et al. (2000). Evseev & Yakovlev (2006 p. 109) recently illustrated *bilirata* as *P. "glacialis"* from Russian waters.

The Panamic "*Frenamya*" ***radians*** has a similar shape as *ceylanica*, but the hinge configuration is quite distinct. It is placed s.l.

The W. Atlantic pandorids are difficult. The few species belong all to the "*Pandorella/Clidiophora*" group. ***Inflata*** is the most inflated, ovate, small species; *arenosa* is similar in size, but less inflated and more elongate. *Gouldiana* is the large common one, *trilineata* is half moon shaped with strong dorsal ridges. The latter was recorded by Dall from New Jersey and is also known from Massachusetts, Marblehead. Another lot from the New York area, Suffolk Co. is considered to represent *trilineata* as well.

It appears that the Panamic *Pandora* are much more numerous, and that Keen (1971) synonymized too many species with *arcuata* (Valentich-Scott pers. com. 2010). Neither *claviculata* nor *cristata* appear to be the same as *arcuata*. However, as most pandorids these are very uncommon in collections.

Furthermore, the 13.3 mm type of ***Pandora discors*** Sowerby I in Sowerby I & Lytellton Powys, 1835 described without locality is present in BMNH. This appears to represent a juvenile E. Pacific *Pandorella* with a marked divided sculpture. It may well represent a valid species, but growth series are necessary to recognize its true identity.

Myadora rostralis Deshayes, 1850 (Traité, pl. 12 bis, fig. 13-15) is instead a *Pandora* from unknown locality. The 24.3 mm holotype is present in MNHN. Its specific identity is as yet unresolved.

Pandora nasuta Broderip & Sowerby I, 1830, ***Pandora unguiculus*** Broderip & Sowerby I, 1830, ***Pandora depressa*** Broderip & Sowerby I, 1830 are considered nom. dub. They were described from unknown locality and the types were not found (Carpenter, 1865; Boss, 1965). Lamy (1934) came to a similar conclusions, although he tried to place *nasuta* in Florida, followed by some authors.

6.70 LYONSIIDAE

TK1: Approximately 15 genera and subgenera have been created for the fewer than 30 lyonsiids. Prezant (1981) recognized only 3 genera, *Lyonsia*, *Entodesma* and *Mytilimeria*. He weighted habitat data strongly and stated subgenera as representing ecomorphs. This course is followed.

Anticorbula without lithodesma is placed in corbulids. ***Allogramma*** and ***Bentholyonsia***, also morphologically significantly distinct, are placed in LYONSIELLIDAE. Genetically, ***Allogramma formosa*** is closely related to *Lyonsiella abyssicola* (HARP; MOR03; MOR04).

Chaper, 1885 described ***Lyonsia morgani***, 6.4 mm from India, Chennai. The syntypic lots with a dozen specimens are present in MNHN. However, neither biogeography, nor morphology fits lyonsiids. Instead *morgani* appears closer to thraciids, possibly even representing a new genus. Lamy's 8 mm ***Lyonsia velaini*** from St. Paul was said to be close to *morgani*. However, the type is not isolated as yet and may still be found in the MNHN general collection. Furthermore, Preston, 1914 described ***Lyonsia samalinsulae*** also from Chennai; obviously *samalinsulae* should be compared to the earlier *morgani*. According to Ramakrishna et al. (2004) the single *samalinsulae* type is in ZSI, India. Lamy (1929) considered these 3 closely related. All 3 species are removed from LYONSIIDAE and positioned unplaced in THRACIIDAE.

TK2: ***Lyonsia***: It is not likely, that the common, shallow water Japanese ***Lyonsia ventricosa*** originally described from Hokkaido, Hakodadi Bay in shallow sandy mud, is the same as the Arctic ***L. arenosa*** as synonymized by Coan et al. (2000). Whereas *L. ventricosa* is known from EChi to Hokkaido, Coan et al. restricted the Westward extension of *arenosa* in the Okhotsk Sea. Furthermore, the Japanese species appears more fragile and distinct in its more slender, elongated shape; it also is marked smaller than *arenosa* which reaches 36 mm in Siberia. Here, Lamy (1928) and Japanese authors are followed and *ventricosa* is recognized.

Whether ***L. granulifera*** is indeed the same as *arenosa*, as assumed by Ockelmann (1958) could not be verified. It appears that only the original specimen is known.

L. kawamurai has been variously treated. The type is depicted HIG01 B1391. Whereas Higo et al. (1999) synonymized, most Japanese authors separate. As all *ventricosa* studied proved quite uniform and no intermediaries have been encountered as yet, the majority of authors are followed and ***L. kawamurai*** is treated as valid species.

L. praetenuis has been well depicted by Dunker, 1882 from Wakayama and described against Lischke's *rostrata* (= *ventricosa*). Lischke's material may quite safely be assumed to have been available to Dunker. Also Lamy (1929) considered *praetenuis* valid and distinct form *rostrata*. Indeed, *L. praetenuis* did not resemble *rostrata* but appeared at first glance much closer to *L. tanakai* Habe, 1981 described from exactly the same locality with the same size and shape, type in HIG01 B1392. Consequently, the syntypes of *praetenuis* in MfN ZMB108803 were studied. There remains no doubt that Habe (1952) misidentified *praetenuis* and in 1981 described the same species as ***L. tanakai***. The latter becomes a junior synonym and the uncommon ***Lyonsia praetenuis*** (Dunker, 1882) is herein reinstated as valid Japanese species.

From Taiwan recently ***L.*** (***Glabrolyonsia***) ***taiwanica*** has been described. Due to the almost smooth surface a new subgenus was proposed. However, in shape and surface sculpture *taiwanica* is close to large Caribbean *floridana*. The habitat also matches certain Caribbean *Lyonsia*. Thus, unless other criteria could be established, *Glabrolyonsia* is treated synonymous to *Lyonsia*.

Recently from Panama Bay a small lot was obtained, 160-180 m, dredged in mud, 12.5-13 mm. According to Keen (1971), the only lyonsiid found there is *panamensis* which was described from a single valve, 13.5 mm from 1017 m. As indeed the shape is higher than in *gouldii* (= *californica*), the umbones prosogyrate and the radiating lines more distant these specimens have been identified as ***L. panamensis***. Inferring from other family members, most likely *panamensis* occurs rather sublittoral than bathyal and the OD was based on a down slopped valve.

Dell (1972) analyzed the minute, broken type of ***Lyonsia malvinensis*** from the Falklands. Today, its BMNH type is missing. Dell stated the single valve representing a *Lyonsia*. Dall reported *Lyonsia* and *Entodesma* from the Falklands. For the time being, *Lyonsia* from the Falklands are assumed to represent Orbigny's *malvinensis* and *Entodesma* from the Falklands to represent Preston's *falklandicum* (= *solemyalis*).

Dell (1964, 1972 and 1990) synonymized ***Pholadomya mawsoni*** Hedley, 1916 and ***Lyonsiella planulata*** Thiele, 1912 with ***Lyonsia arcaeformis*** and recognized this as sole antarctic lyonsiid. Prezant did not mention this species. Lamy (1928) placed it in *Entodesma*. However, Dell (1972) depicted the type, stated it close, but distinct from *alvarezii* and placed it consistently in *Lyonsia*. Thiele, 1912 stated sand grains attached to the valve of the synonymous *planulata* (DELL90), which points indeed into a lyonsiid habitat.

Scarlato, 1981 proposed ***Lyonsia inflata*** from the Okhotsk Sea. This name was used earlier by Conrad, 1837 (= *E. pictum*). Should Scarlato's inflated species indeed prove distinct from ***L. cucumerina***, then a new name is necessary.

TK3: ***Entodesma*** have a distinct habitat and are in general more irregularly shaped, somewhat more solid and with a thicker periostracum. However, morphologically they may be close to *Lyonsia*. Especially the surface in fresh specimens may also bear periostracal radials with periostracal hairs (PRZ81 figs. 8, 10). In general *Entodesma* are extremely variable in shape, and Prezant, basing on ratios, underestimated the variability, especially in the Northern *E. navicula*.

In S. America *6 Entodesma* species have been described between Central Peru to Central Argentina. Prezant considered ***Anatina cuneata***, ***Entodesma chilensis*** and ***Lyonsia fretalis*** as valid. Furthermore, ***Lyonsia elegantula*** Soot-Ryen, 1959, ***Lyonsia delicata*** Marincovich, 1973 and ***Mytilimeria falklandica*** Preston, 1913, all not treated by Prezant, appear to represent true *Entodesma*. Irrespective of names, Prezant considered 3 species as distinct, Marincovich (1973) has been able to differentiate 2 species in Iquique; Forcelli (2000) illustrated 2 species from the Magellanic and Soot Ryen (1959) discerned 3 species between Valparaiso and Magellan Strait.

Comparing these records and the OD's involved I fail to recognize more than 3 species. First, ***E. cuneata*** described from Arica, reported from Iquique, Chiloé and Magellan Strait, this is a comparatively large species, usually strongly distorted with a brownish flaky periostracum and with weak to absent periostracal radials and hairs. *E. chilensis* is considered the same. Second ***E. falklandica***, which is usually smaller, less distorted and with stronger radials and hair. *E. elegantula* Soot-Ryen, "*E. elongatula*" of Forcelli and *E. fretalis* are considered the same. *E.* "*elongatula*" as illustrated by Forcelli seems indistinguishable from the *fretalis* depicted by Prezant, and as stated by Forcelli the differences between *elegantula* and *falklandica* appear too small for specific distinction. Third, the Peru to N. Chile ***E. delicatula*** seems very close to this group, but is reported smaller, only up to 6 mm.

In addition, Lamarck, 1818 described ***Mya solemyalis***, originally from Australia. This is an *Entodesma*, according to Deshayes (1835) and Lamy (1929) who both analyzed Lamarck's species. It is the earliest described *Entodesma* globally and definitely a valid name. However, nothing similar is known from Australia, neither in literature, nor from my own collecting. Beesley et al. (1998) reported the Family LYONSIIDAE absent from Australia. According to Lamarck, (1818 p 461), he had a single specimen. The holotype in MNHN has been studied and proved to represent an American *Entodesma*. Without a doubt ***Tetragonostea*** with the type species, MT *Mya solemyalis* is a junior synonym of *Entodesma* as concluded by Prezant (1981). Specifically, the 20 mm type, of which one valve is broken, closest resembles in size, in rectilinear shape with moderate umbones, in comparatively strong and distinctly placed radials and in fragile texture the Magellanic *falklandica* and is understood as conspecific and as the valid earlier name.

Osteodesma brasiliensis "Couthuoy" Gould, 1850 (Bra, Rio) antedates ***Lyonsia beana*** Orbigny in Sagra, 1853 (Antilles). *L. beana* was not published before 1853. I fail to recognize Macsotay & Campos' ***Agriodesma weisbordi*** other than a simple junior synonym. Redfern (2001 995b) illustrated a similar shaped specimen from the Bahamas.

The Panamic *Entodesma* as listed by Keen (1971) appear over-named, but too limited material hinders progress.

6.71 LATERNULIDAE

TI1: This is a confused family in modern literature. A good paper on laternulids is still Lamy (1934), he also depicted many types. Furthermore, Reeve (1860-63) is decisive for most species. His type material is largely present in BMNH.

Unfortunately, Morton (1976) misinterpreted many laternulids. His naming, the distribution and his conclusions are to a large extent misleading or simply false. Morton also heavily underestimated the number of extant laternulids. However, the lithodesma of *Exolaternula* is well depicted and the ANT *Laternula elliptica* has been correctly interpreted.

Also Lamprell & Healy (1998)'s part referring to the very important Australian laternulid fauna has to be consulted very cautiously; their species 622, 624 and 627 (= *Laternula*) are wrongly captured, and the distribution of 620 and 623 is not shared, many valid Australian laternulids are lacking.

Phylogenetically laternulids are close to pandorids, lyonsiids and clavagellids (HARP).

The number of valid species ranges from 6 (Coan et al., 2000), 8 (Morton, 1976), 15-20 (Lamy, 1934) to 30 species (Reeve, 1862). Own material and type investigations clearly confirm Lamy's view. Here, 19 *Laternula* are recognized, of these 3 represent *Exolaternula* species. More than half occur also or even exclusively in Australian waters.

Anatina Lamarck, 1818 has been considered synonymous to *Laternula*, at least since Gray, 1847. However, Lamarck described many *Anatina* species, but not *anatina* and some do not belong to *Laternula*. Finally, Lamy (1934) stated the type SD *Anatina subrostrata* (= *Solen anatinus* L.); this equals *Anatina* = *Laternula* by tautonomy.

Most modern authors use ***Exolaternula*** as subgenus, describing species with a trigonal, white, shelly lithodesma. This applies currently to 3 species: *limicola* Japanese authors non Reeve, 1863 = *marilina* modern authors non Reeve, 1860 (= *L. liautaudi* Mittre), *truncata* modern authors non Lamarck, 1818 (= *L. rostrata* Sowerby II) and *L. erythraea*. In addition, Zhuang & Cai, 1982 described *nanhaiensis* as *Exolaternula* from China. However, Zhongyan (2004) only illustrated *truncata* and *marilina* (= *liautaudi*) from China and omitted *nanhaiensis*. From OD and picture no convincing reasons were found to consider *L. nanhaiensis* other than synonymous to *liautaudi*. Thus, only three true exolaternulids are considered valid, none is known from Australia.

The huge majority of laternulids have no lithodesma; especially in the Australian *L. marilina* (= *gracilis*) Lamy reported none and none were seen. On the other hand, *Exolaternula* species are also granulated. They have the typical laternulid umbonal fissure, and a very similar shape as *Laternula* s.s. Neither habitat, nor known anatomy is distinct. Thus, *Exolaternula* is considered a weak subgenus, based on a single criterion of unknown importance. Unfortunately, genetic data is not available.

TI2: According to Hanley (1855) Lamarck's ***Anatina subrostrata*** is the same as Linnaeus ***Solen anatina***. The type species is silvery white, very fragile, moderately inflated and moderately gaping, surface granulated, elongate-ovate snouted, with two equal sized rounded-elongate chondrophores and without lithodesma, but with a brown resilium only. The rostrum is delimited, non granular, with a commarginal sculpture, usually covered with a periostracum. All evidence points that this is a widely distributed species, highly variable in shape with more than a dozen synonyms. From the material at hand, in addition to Lamy's synonyms (*siphonata*, *flexuosa*, *amphora*, *eximia*) and Prashad's based on the analysis of the BMNH-type material (*cumingii*, *blainvillei*, *labiata*), also *japonica* (Japan, Japanese authors) and *constricta* (N. Austr., R. Willan pers. com. 06) are considered indistinguishable. The N. Australian ***A. constricta*** has been quite commonly found around Darwin's sandy beaches, but no marked differences to *anatina* from Malaysia or Borneo could be stated. ***A. japonica*** is the type species ***Laternulina***, OD. Nowadays, it is synonymized by most Japanese authors with *L. anatina*. However, the Japanese specimens are consistently smaller and straighter than typical *anatina*, structurally they are indistinguishable and genetic data is not available. For the time being Japanese authors are followed.

Furthermore, Prashad (1932) synonymized, based on BMNH type material, ***A. bullata*** with *anatina*. This action was not followed by Lamy (1934) and others. In E. Malaysia together with large *anatina*, small forms where found, in a bay, intertidal muddy, silty sand. Little doubt remains in that *bullata* is indeed a juvenile form of *anatina*.

This gives ***Laternula anatina*** a distribution from the Red Sea to N. Australia to Japan, a maximum size in excess of 80 mm and a quite variably extended rostrum.

Japanese and Chinese authors usually also synonymize ***L. valenciennesii***. However, neither Prashad, based on BMNH-type material, nor Lamy shared this conclusion. Lamprell & Healy (1998 sp. 621) considered it valid and illustrated a specimen very close to Reeve's BMNH syntype. *L. valenciennesii* was originally described from China, but nothing known from there comes close. On the other hand, a large specimen studied from Myanmar, Andaman Sea represents this species also well. Though similar in base sculpture to *anatina*, *valenciennesii* is comparatively broader, more inflated with stronger umbones. It appears to surpass even the high variability of *anatina*. The range, instead of China, appears to be Andaman Sea to tropical Australia. Thus, most likely the original type locality was false.

Beu (2004) selected Lamarck's MNHG specimen of ***A. laterna*** as lectotype. He accepted *Anatina laterna* Reeve, 1863 (= Lamprell & Healy, 1998 sp. 620 *laterna*) as conspecific. His selection does not conform to Lamy's Paris specimen fig. 7 which is distinct (= *gracilis* Reeve). Lamarck himself did not give a precise locality. Reeve's huge *laterna* has been described from N. Australia. Indeed, NW. to N. Australia are currently the only locations where such gigantic specimens occur, the largest seen is more than 90 mm. Beu's selection makes *laterna* a tropical Australian species and the largest laternulid currently known. All of Lamprell & Healy localities could not be confirmed, nothing close to *laterna* is known from S. Australia. Despite similarities in shape, I strongly doubt the synonymy of the New Zealand fossil *Laternula synthetica* Marwick, 1948 with a marked distinct, much deeper sinus. *Synthetica* appears instead as valid NZ fossil species, unrelated to Lamarck's species. However, as indicated by Lamy (1934) Reeve's ***cistella*** from Maluku might fall into the *laterna* synonymy.

As concluded by Lamprell & Healy (1998), ***L. gracilis*** Reeve, 1860 described from Qld, Moreton Bay is perceived as valid, smaller, anteriorly and posteriorly rounded E. Australian species. In addition, ***A. marilina*** Reeve, 1860 was also originally described from Australia. Valenciennes' species is depicted in Lamy (1934). *Marilina* is indeed close in shape to *liautaudi*, but has no lithodesma. There is no reason to doubt the Australian locality of *marilina*, or that this species is not a true *Laternula*. Iredale (1930) reported it from Sydney, Allan (1962) illustrated it from there and specimens studied from Sydney Harbor and Qld are perceived conspecific. Lamprell & Healy (1998 sp. 625) indicated synonymy of *marilina* with ***gracilis***. The BMNH type lots of *gracilis* and *marilina*, both from Australia, have been compared. No argument was found not to follow Lamprell & Healy's view. *L. marilina* is here formally synonymized into the **earlier *Laternula gracilis*** (Reeve, 1860). Both illustrated upper valves are from the same Central Queensland locality, the left is in shape very close to *gracilis*, the right (pair) closely approaches the *marilina* shape.

TI3: From **S. Australia** Reeve described 4 species with precise localities. All 4 species are considered valid and occur exactly where originally described.

Laternula creccina was described from Adelaide and has been well captured by Cotton (1961), Bryce & Wells (1988 sp. 663), or Beesley et al. (1998 fig. 9.10). Lamprell & Healy (1998 sp. 622) does not match. *Creccina* is a quite large species growing up to 60 mm, oblong inequilateral with the umbones near the posterior end. The verified range is SWA, Cockburn Sound to N. Tasmania and Victoria, Port Welshpool. As stated by Iredale (1930) this species does not live in NSW or Qld.

The second species is ***tasmanica***. This is oblong-ovate as well, but the umbones are nearly central. It is erroneously illustrated as *recta* by Cotton (1961), but correctly as *tasmanica* by May (1958 pl. 5 fig. 1). This is *anserifera* of Beesley et al. (1998) but not of Spengler, 1793. The verified range of *tasmanica* is SA, Walleroo -Tasmania and Victoria, Port Welshpool.

The third species is ***recta*** described from Victoria, Port Philipp (Melbourne area) and known from St. Kilda, found there at low tide in mud. *L. recta* is reliably known from Victoria, Port Philip Bay and NSW, Dee Why Lagoon, but not from SA. This is a subpyriform, straighter more solid species, roughly ridged. It is depicted in Reeve (1863 sp. 24). Macpherson & Gabriel (1962) only illustrated *creccina* and considered, based on Cotton's erroneous perception, *recta* the same as *tasmanica*. However, Iredale (1930) considered *recta* as distinct and valid as well. In

1962, he reported it also from NSW.

The fourth species ***attenuata*** is the only one well captured by Lamprell & Healy (1998 sp. 623). It has been described from Sydney and uncommonly occurs on the E. Coast. It appears that Jansen (1995) illustrated this species from NSW and Qld erroneously as *creccina*. *L. prolongata* Reeve, 1863 from Port Curtis might be the juvenile from.

The first three South Australian species are all true *Laternula*, lacking a lithodesma. *Attenuata* was not available, but it is closest to *creccina* and is presumed to have none as well.

In WA, Exmouth Gulf a specimen was collected closely resembling the BMNH syntypes of ***A. vagina***. As far as could be ascertained, this species originally described from Moreton Bay, S. Qld, was never found or illustrated from there. The original locality appears erroneous and the species is at present only known from the opposite coast of Australia. It was not mentioned by Lamprell & Healy (1998).

Another, uncommon Australian species is ***L. argentea***. It was originally described without locality. However, specimens fitting the BMNH holotype well were found in WA, Shark Bay. *Argentea* is also absent from modern Australian literature, but is illustrated in Reeve.

TI4: ***Mya anserifera*** Spengler, 1793 (= ***Solen spengleri*** Gmelin, 1791) was originally described from Nicobar Isl. Spengler's type is well depicted in HYL011 illustr. 5. As far as is known, Spengler did not have any material from S. Australia (HYL010). Nothing similar occurs in S. Australia as erroneously copied by Morton (1976). *L. spengleri* is a huge species, almost 60 mm, closest to *rostrata*. However, it is more equally ovate, the truncate posterior portion is comparatively longer, the umbones therefore more central and a lithodesma was not reported. For the time being it is considered a rare, valid, true laternulid, found in the Andaman Sea. None of the *rostrata* specimens studied, mainly from the Philippines, came close, and all these had a clear shelly lithodesma.

The identification of *Laternula spengleri* by Kilburn in Hylleberg (2003) from Vietnam is enigmatic, it could have meant *rostrata* which occurs in these waters; their *laterna* identification is dubious as well, but could instead refer to *impura*, which is reported to occur along the Chinese coast (ZHO; ZHU82; both as *boschasina*).

TI5: From **Japan** 4 species are reported by modern authors (e.g. Higo et al., 1999; Okutani, 2000), namely *L. anatina*, *boschasina*, *truncata* and *marilina*. However, the 3 latter Japanese species need other names. Identity of *japonica* with *anatina* is possible, but genetically not confirmed.

By virtually all modern Chinese and Japanese authors *impura* was synonymized with *boschasina*; but not by Habe (1952 fig. 2) and (1971 pl. 64 fig. 21). The type of the former is depicted in HIG01 B1370. *Impura* was described from Kamakura, S. Sagami Bay, Central Honshu. On the other hand, *boschasina* was described by Reeve, 1860 sp. 13 from the Philippines, Negros. The original specimen of *boschasina* Valenciennes is depicted in Lamy (1934 pl. 1 fig. 5). Following Lamy (1934) I see no reason to synonymize these two. The shapes are significantly distinct, short, very broad and inflated in Reeve's species, but elongate, only moderately inflated in Pilsbry's species. *Boschasina* is quite fragile; *impura* is a more solid species. The chondrophore is similar; a lithodesma is in both species lacking. Whereas ***L. impura*** is well known form Japan (Ko-okina-gai), Okinawa and China (ZHU82; ZHO), ***L. boschasina*** is rare, currently only known from Negros and Masbate, Philippines. Additionally, Lamy (1934) mentioned "Asia" which may indicate a wider, but not as yet substantiated distribution.

Lamarck described ***Anatina truncata*** from the English Channel, near Vannes. His larger variety was indicated from S. Australia. According to Deshayes (1835) and Lamy (1934) Lamarck confounded two generically distinct species under *Anatina truncata*. True *A. truncata* from the English Channel is a *Cochlodesma*; only the larger variety from Australia (MNHN) is a *Laternula*. As originally stated by Lamarck and consequently selected by Hanley the European specimen is Lamarck's true *truncata* and Lamy (1934) explicitly used Sowerby's *rostrata* for Lamarck's laternulid variety. Thus, the valid name for the IND laternulid is ***Anatina rostrata*** Sowerby II, 1839 (syn. *Anatina truncata var*. Lamarck, 1818 non Lamarck, 1818). Lamarck's large MNHN laternulid variety is depicted in Lamy (1934 pl. 1 fig. 8). Although this variety was originally described from St. Peter Isl., S. Australia, this species is not known to occur anywhere in Australia and this location is considered false. Lamprell & Healy (1998 sp. 624)'s *rostrata* is not this species, but seems instead *tasmanica* with a misleading synonymy and a false distribution. ***Laternula rostrata*** is well known from the Philippines and ranges to Japan (Hiro-kuchi-sotori-gai). From the OD ***A. limicola*** Reeve, 1863 described from Japan is the same, as also concluded by Prashad (1932) and Lamy (1934). Kira's and Habe's *limicola* are instead *liautaudi*. ***Anatina elegans*** Philippi, 1844 was described as large 68 mm specimen from China in Zeitschrift für Malakozoologie. The OD, size and features clearly point into true *rostrata*. The specimen present in MNHN labeled ***Anatina olorina*** Valenciennes is perceived to represent *rostrata*, but not true *spengleri*. Reeve (1860) correctly synonymized it with *truncata* var. (= *rostrata*), confirmed by Lamy.

In addition to *rostrata*, Lamy mentioned a second *Exolaternula*. ***Anatina liautaudi*** Mittre, 1844 was validly proposed in the Magasin de Zool., according to Sherborn. It is mentioned as valid species by Lamy (1934) and Mittre's 28.8 mm type from the Philippines, Manila is well depicted in Lamy (1934 pl. 1 fig. 3) and present in MNHN. However, I fail to distinguish ***limicola*** Kira and Habe, 1977 (= type *Exolaternula*, OD) non Reeve, 1863 or ***marilina*** of modern Chinese, Japanese, and US authors non Reeve, 1863 from *liautaudi*. As such *liautaudi* represents *Exolaternula* typically. ***Laternula* (*Exolaternula*) *liautaudi*** is distributed at least from the Philippines to Japan (Usu-gini-gay) and has also been introduced in California (Coan et al., 2000).

Instead, *L. marilina* (= ***L. gracilis***) is a true *Laternula* found in S. Qld and NSW.

TI6: Japanese authors usually identify ***A. navicula*** Reeve described from unknown locality from Japan, either as valid *Exolaternula* or then as a synonym of *Exolaternula* "*marilina*" (= *liautaudi*). However, S. Whybrow analyzed the BMNH type material and identified instead in sched. Preston's ***Anatina smithi*** from Sri Lanka and Preston's

Anatina barkulensis from NE. India as identical to *navicula*. This precise view is shared. Furthermore, I am not convinced at all that ***Anatina barkudaënsis*** and ***barkulensis*** Preston, 1915 are distinct from ***granulosa*** Preston, 1914. All three were described from similar habitats on India's NE. Coast. Annandale & Kemp (1916) stated "We have found it very difficult, with all the types before us, to distribute fresh specimens among Preston's three species". All evidence points that only one variable species is involved and none of Preston's 4 names valid. This makes ***Laternula navicula*** a true *Laternula* and a valid Indian to Sri Lankan species. It is a comparatively small species, rather short, as adult rounded. The habitat is typical laternulid. The type locality is herein clarified as Sri Lanka.

TI7: ***Clistoconcha***: This new genus was created by Smith, 1910 for the uncommon SAF ***insignis***. Smith described it from 5 mm juveniles; but this species obviously grows to about 18 mm (Steyn & Lussi, 1998 sp. 1006). Smith did not propose any family, but compared the suture on the surface with the laternulid umbonal fissure. Most subsequent authors included it in LATERNULIDAE. However, *Clistoconcha* and *Laternula* are **not** close, neither in morphology, nor in habitat. Laternulids are quite uniformly subnacreous and umbonally fissured, *insignis* is markedly distinct. It has a non translucent, white, non nacreous, distorted shell, without any umbonally slit and is edentate. Furthermore, the habitat does not match. Whereas laternulids live deeply burrowed in sandy and muddy sediments, *insignis* appears to be a sublittoral nestler. Bartsch (1915) placed it in *Thracia*, but there it does not fit well either. *T.* (*Ixartia*) *distorta* is superficially similar and is known from SAF (TURT, coll. auth.). However, the markedly distinct hinges separate these two immediately.

"Faute de mieux" *Clistoconcha* is kept **misplaced** in laternulids for the time being. The true affinities of *Clistoconcha* are **unknown**, but should be clarified with modern methods. Of course, if no close relations can be established, then a **new bivalve family** is necessary, the uniform LATERNULIDAE is the wrong place for this species.

6.72 PERIPLOMATIDAE

TM1: **PERIPLOMATIDAE**: Due to many recent papers (e.g. Rosewater, 1968; Bernard, 1989; Ardila & Diaz, 1998; Coan et al., 2000; Maxwell, 2002) and Lamy's revision (1931), this family is quite well known.

Usually, periplomatids are considered close to laternulids, but, unfortunately, Harper et al. (2006) did not include periplomatids in their phylogenetic analysis.

At present approximately 35 species are considered globally recognizable. Most are uncommon.

TM2: ***Periploma***: Traditionally, Lamarck's ***P. margaritaceum*** is listed from US to Brazil. However, from the material at hand clearly 2 species are present.

The Northern *Periploma* (N.C., Fla, Texas) is elongate-square, truncate, box-like and quite distinct from the more ovate-rounded Southern *Periploma* (Guadeloupe, Columbia, Venezuela, Brazil). The differences are well visible in equal sized specimens. Whereas the US-species is usually found at approximately 15 mm, the Venezuela-species is usually found at approximately 30 mm. Furthermore, there is a distributional break in between; from the northern part of the WInd (Bahamas, Cuba, Jamaica, Puerto Rico) no *Periploma* have so far been reported.

Corbula ***margaritacea*** Lamarck, 1801 has the same reference as *trapezoides*. Considering Lamarck's OD of ***A. trapezoides***, Blainville, 1825's pl. 66 fig. 8 picture of the synonymous ***trapezoidalis*** (pallial sinus) or Schumacher's figure of ***inaequivalvis***, I see no reason not to follow Lamy (1931). As before Deshayes, Lamy considered all above to represent the ovate, larger Southern species. As such the type species of *Periploma* is represented by the larger Venezuelan form, not found in the US.

Definitely, Philippi's ***anguliferum*** represents the small US species. Lamy considered the earlier *Thracia inequalis* described from the Gulf of Mexico as synonym of *margaritaceum*. However, from C. B. Adams' type (CLE50 pl. 45 fig. 14) ***Periploma inequale*** is instead the elongated American species and considered the same as *anguliferum* and the earliest, valid name for this misunderstood American species. As stated by Lamy, *Periploma anguliferum* (= *inequale*) is closer in shape to juvenile *ovata* from Argentina, than to *margaritaceum*.

True *margaritaceum* is well known from Venezuela, Margarita Isl. and also illustrated by Diaz & Puyana (1994) from Colombia.

The species illustrated by Weisbord (1964 pl. 58) under this name is distinct as is Macsotay & Campos (2001 "*Cochlodesma leanum*"). Caribbean thraciids, e.g. *Ixartia* should be compared.

Altena (1968 and 1971), Diaz and Puyana (1994) and Ardila & Diaz (1998) treated the uncommon *Periploma* from Southern Caribbean. From their figures and the material at hand it is obvious that Orbigny's Brazil-Argentinean ***compressum*** and the Columbian/Suriname ***coquettae*** are distinct species. Macsotay & Campos (2001)'s view and their synonymy is not shared. The specimen they illustrated is *coquettae* but not as pretended *compressum*, which does not occur in Venezuela.

Furthermore, Guppy, 1882 described from the Gulf of Paria, W. Trinidad ***P. orbicularis***. This dredged *Cricoploma* has been accepted as valid by Lamy (1931), Rosewater (1968), and Bernard (1968). Unfortunately, it was not discussed by Altena (1968) or by Ardila & Diaz (1998). Shape and especially position of the umbo exclude synonymy with Altena's *coquettae*. *P. coquettae* grows also with 50 mm almost twice this size and lives at least to 150 m. On the other hand, size, shape, and sculpture of *orbiculare* fit ***coseli*** quite well. *Orbiculare* and *coseli* are both comparatively high species, with the umbo more central. *P. coseli* is comparatively common and shallow living. It is here considered a junior synonym of ***P. orbiculare***. Together with northern specimens studied, this gives *orbiculare* a range from E. Panama, through Colombia to off E. Venezuela.

Cosel, 1995 described ***P. camerunensis*** from WAF. Spengler, 1793 described earlier ***Mya lactea*** from Ghana. Unfortunately, the latter was not discussed by Cosel. From Spengler's OD, an umbonal fissure, a narrow, projecting, oblique and hollow "tooth", a similar shape as *Tugonia*, but much more fragile, mother of pearl luster and smooth and shiny valves clearly point into *Periploma* (*Cricoploma*). Very likely, Cosel redescribed Spengler's species. However, in 1871 Mörch did not find the type and in 6/09 it could neither be located in ZMUC (O. Terndal, pers. com.). As such Spengler's *lactea* type must be considered lost and a nom. dub.

Whether indeed all 6 Panamic *Cricoploma* are valid, could only partly be verified. A Panamic presence of *Periploma margaritaceum* was stated by Bernard (1989) and Skoglund (2000). However, the illustration in Bernard (1989 fig. 10) does not match *margaritaceum* or *inequale* and appears to represent a still **undescribed** Panamic *Periploma*.

Lutaenko (2003) followed Scarlato (1981) and mentioned the Atlantic *Periploma fragilis* from Amursky Bay, where it should not occur. Instead, their species seems to be the same as later named ***P. subfragilis*** by Scarlato & Kafanov, 1988. However, *P. subfragilis* appears well within the variability of *aleuticum* as indicated by Coan et al. (2000).

Smith's ***Anatina andamanica*** is present in ZSI (RAMA) and was depicted in ANA09 pl. 18 fig. 3. It was treated by Lamy as *Laternula* and also declared laternulid by Winckworth (1940). However, *andamanica* does not fit *Laternula* but is instead periplomatid. Apart from shape and chondrophore, also deeper habitat would exclude *Laternula*. Smith did not record the precise conditions of the hinge, especially the presence or absence of a lithodesma. Shape distinguishes it from the Red Sea *Offadesma* sp. and from *Pendaloma*. It is tentatively placed in *Cricoploma*.

TM3: Lamy (1931) mentioned ***Offadesma*** *angasi* from the Red Sea, Suez, collected by Jousseaume in 1921 (MNHN). Oliver & Zuschin (2000) illustrated a specimen. This seems indeed to represent an **undescribed** *Offadesma*. True *angasi* is only known from S.-SE. Austr. and NZ.

Unfortunately, Lamprell & Healy (1998 sp. 627) illustrated instead a *Laternula*. Abbott & Dance (1986 p. 374) is correct.

TM4: ***Cochlodesma***: ***Periploma*** (***Halistrepta***) ***pacifica*** (juv: MAA04 pl. 8 fig. 2; adult: Okutani et al., 2000 pl. 515 fig. 2) does not fit particularly well into the rare American *Halistrepta*. *Pacifica* appears in dentition and size closer to *Cochlodesma praetenue*. In shape and stronger commarginal ribbing in juveniles, it is comparable with *Cochlodesma tenerum* (SAL96, figs. 104-5). *Pacifica* is tentatively placed within *Cochlodesma*. Unfortunately, a genetic comparison is lacking.

The W. Atlantic sublittoral ***C. affine*** and the bathyal ***C. undulatum*** appear close to the European *tenerum*. It is not completely excluded that one or even both species are conspecific with *tenerum*. However, no convincing case was as yet seen. Both are uncommon and no material was available for comparison. For the time being the bathyal American *tenerum* reports (e.g. Dall; Abbott; Mikkelsen & Bieler) are referred to Verrill's bathyal *undulatum*. As such Rosewater (1968) is followed, however, without the distinction between *Cochlodesma* and *Galaxura*. The two type species appear too close to be separated. Furthermore, as stated by Keen in Moore (1969) *Bontaea* would be older than *Galaxura*.

Lamy (1934) noted true *Anatina truncata* Lamarck, 1818 from the British Channel synonymous to *praetenue*.

P. Fischer, 1857 described and depicted an enigmatic heavy, 30 mm ***Cochlodesma cumingiana*** from unknown locality. It does not fit in periplomatids, but appears rather myoid. However, it does not resemble any genus or specimen known. Together with V. Héros the type was traced in 6/09 at MNHN. Despite a statement "collection Jour de Conch.", neither a collection entry in the old listings, nor a specimen could be located. The type is lost and *cumingiana* is best treated as nom. dub.

6.73 THRACIIDAE

TN1: In the Northern hemisphere this large family is quite well known thanks to some excellent papers, e.g. Coan (1990), Kamenev & Nadtochy (1998), Coan et al. (2000), Marshall (2002), Kamenev (2002). Kamenev gives an overview of the generic and subgeneric characters.

The Indo-Pacific including Australian species need much more work. Most are rare and only known from a few specimens; some are doubtfully placed in thraciids (e.g. *T. arienatoma*, *T. kowiensis*). Whether *Thraciopsis* and especially ***Thracidora*** are correctly placed within thraciids is still disputed (e.g. THI34, SOO66, BEE, DREH03, HARP). For *Thracidora* no results are known.

The WAF thraciids are barely known. *T. phaseolina* appears restricted to Mauritania, replaced further South by *T. roumei* occurring to at least Congo. *T. pubescens* occurs in CapV, Senegal to Guinea-Bissau (LAM31, NIK55). The presence of *T. distorta* as listed by Ardovini et al. (2004) could not be verified, but is likely as *distorta* is known from S. Africa.

Instead of 30 species as concluded by Boss (1982) this family currently encompasses more than 90 mostly rare species.

TN2: ***Thracia***: As stated by Coan (1990) but overlooked by subsequent European authors, Poli's *papyracea* is preoccupied. It was published end of December 1791, whereas Gmelin's *papyracea* was published prior to mid May, 1791. Thus, the valid name for this species, representing the type ***Odoncineta*** is Lamarck's *T. phaseolina*.

Mya declivis Pennant, 1777 from the Hebrides has been variously treated. Following Coan (1990) it is considered the same as *Mya arenaria*. Reeve (1859) came earlier to a similar conclusion. It is not well perceivable that an uncommon *Thracia* should have furnished a favorite dish for the locals. As such, CLEMAM's synonymy of *declivis* with *phaseolina* is not shared.

Dautzenberg & Fischer, 1897 (DAU971 pl. 7 fig. 11-12) depicted the somewhat enigmatic ***T. durouchouxi*** from the Azores from 1360 m. As far as is known, this species was never found again, nor was another *Thracia* found around the Azores, nor any European *Thracia* reported living in such depths. From shape and hinge *durouchouxi* is an *Odoncineta*. Lamy (1931) placed it towards *phaseolina*, CLEMAM towards *villosiuscula*. Shape and coarse sculpture do not fit *phaseolina*. These worn valves seem instead to represent down-sloped *T. villosiuscula*. Considering the known distribution of the latter, a presence in the Azores is possible (e.g. SAL96, p.72) and CLEMAM is followed.

As stated by Coan (1990) it indeed appears that the subgenus

Thracia s.s. is monospecific. The NZ ***T. vegrandis*** does not fit well and should be reexamined, it is here placed s.l.

Most similar to *Thracia* s.s. is ***Cetothrax***. Equally, an elongate, truncate shape, and a rough irregular commarginal sculpture are found. However, apart from disjunct biogeography, the pustules in the type species ***imperfecta*** are much smaller and often abraded, the hinge configuration is more acute and the pallial sinus slightly deeper. The IND species are generally more fragile and smaller than the East Atlantic *Thracia pubescens*. The uncommon ***T. hainanensis*** from China described as *Thracia s.s.* matches *Cetothrax* quite well. ***T. salsettensis*** from Arabia and ***T. anchoralis*** from SAF, with commarginal folds, appear also best placed in *Cetothrax*. ***Thracia oblonga*** Reeve, 1859 was described from the Red Sea. However, the BMNH syntypes proved in size (35.6 mm), position of the umbones, inflation and pallial sinus closer to the Australian type species *imperfecta* than to *adenensis* from Arabia. Lamy (1931)'s synonymy of *oblonga* with *imperfecta* is shared and Reeve's type locality is considered erroneous.

If the narrow definition of ***Crassithracia*** is slightly enlarged, as indicated by Marshall (2002), then ***T. devexa*** and ***T. myopsis*** fit there as well.

Thracia jacksonensis Sowerby III, 1883 is a valid name and considered the same as earlier described from the same locality by Angas, 1868 as ***Thracia modesta***. It was in 1884 unnecessarily renamed by Sowerby III as *Thracia brazieri*. Iredale (1924) came to a similar conclusion.

Smith, 1876 described a distinct species as ***Thracia jacksoniana***. Based on a series analyzed, Iredale (1924) synonymized *jacksoniana* with the earlier ***angasiana*** described originally from exactly the same locality; Iredale stated the differences as individual only. His view is followed. Furthermore, series of the SAU *myodoroides* should be compared to verify distinctiveness from *angasiana*.

Anatina ovalis Stutchbury, 1830 was early treated as *Thracia* (e.g. Smith, 1881). As illustrated by Lamprell & Healy (1998 sp. 610, = AMS C304377) this appears indeed to be a valid, small, ovate *Thracia* from NSW conforming to Stutchbury's OD. It is somewhat similar to *modesta*, but smaller, shorter and higher. However, it is preoccupied by the European *Anatina ovalis* Brown, 1827. This name was validly proposed (n. & f., SHE). Brown's species has been synonymized by Reeve (1859) and Lamy (1931) together with Brown's later name *Thracia ovata* with *villosiuscula*. Consequently, Stutchbury's name is a junior homonym. Here, ***Thracia*** (***Eximiothracia***) ***stutchburyi*** is proposed as nom. nov. for Stutchbury's NSW species. The original type locality is Port Jackson, Sydney Harbor, NSW. A huge portion of Stutchbury's Australian collection was sold in London. The type of *ovalis* went into the Cabinet of Michael Bland, Esq. It was not traced. If missing, then Lamprell & Healy's illustrated AMS material could serve for a neotype selection.

In Japanese literature, ***Thracia concinna*** is often attributed to Gould, 1861. However, Reeve, 1859 described *concinna* 2 years earlier in the Icon., sp. 17 based on a Gould ms.; type locality is therefore Philippines, Cebu. Gould stated a close affinity to *villosiuscula* which indeed places *concinna* in *Odoncineta*.

Thracia cultrata Gould, 1861 (Sydney, Port Jackson) is currently enigmatic. If the type is found, it should be compared to *Pendaloma micans*.

Xu, 1989 described a minute, 6 mm ***Thracia*** (***Crassithracia***) ***ovata*** from the Yellow Sea, not treated by Zhongyan (2004). However, there is an earlier *Thracia ovata* Brown, 1844, European and validly proposed (SHE). Furthermore, *Crassithracia* does not appear to fit this granulated species. If it is indeed a valid species, not just a juvenile, then it should be redescribed under a new name.

TN3: ***Pelopina***: Adams, 1868 described an enigmatic genus ***Pelopia*** based on the unique holotype of ***brevifrons***. He compared the morphology with *Ixartia*, which indeed shares the ovate, solid, distorted shape, the rough commarginal ridges, the fine granulation and the comparatively low, rounded pallial sinus. However, the hinge configuration is significantly distinct, composed of two adjacent, but separated solid, vertical chondrophore-like teeth. The small calcareous piece, depicted in the OD and glued on the board in the BMNH-holotype is interpreted as the second chondrophoric tooth, which originally rested parallel to the one still in place. The only other species known close is ***Thracia rudis*** described from Malaysia. The single BMNH holotype shows these two separated, chondrophoric teeth still in parallel condition. Both species are exceedingly rare and only known from their single holotypes. If above interpretation of the *brevifrons* hinge proves correct, then it is even not completely excluded that these two turn out to be conspecific.

Concluding from the sparse data known, it may be that such specimens occur in Malaysian and Indonesian waters as nestler in rock crevices.

However, *Pelopia* H. Adams, 1868 is preoccupied by Meigen, 1800 and here renamed ***Pelopina***. Due to shell morphology *Pelopina* is conventionally placed in THRACIIDAE. However, the unique hinge configuration distances it significantly from the other thracid genera known; its correct placement is therefore open.

TN4: ***Cyathodonta*** is a predominately American genus and has been well treated by Coan (1990). However, the 2 non-American species pose problems.

The type of ***Cyathodonta granulosa*** is depicted in HIG01 B1376. This is a typical representative of the genus close to the American species. It was described from China Sea. However, the only specimen seen, closely resembling the type and with a reliable locality is from Port Hedland, NW. Australia, shallow water, 26.6 mm. Other specimens seen in old collections bear the locality ?China, but this might be in conformity to the OD. Inferring from Hanley's pl. 10 fig. 37, *granulosa* is likely represented as ***Anatina plicata*** Hanley, 1843 non Deshayes, 1832 from Australia. At present, the Chinese type locality of this "Samarang" species and the presence of true ***granulosa*** in Japan and China are doubted. So far nothing closely resembling was seen from China or Japan.

On the other hand, a 35 mm single valve from the Delessert Collection is present in MHNG labelled ***Thracia plicata*** Deshayes, Australia. This is a *Cyathodonta* as well, but more elongate, narrower in shape. This specimen appears indeed to conform to *plicata*, but according to Lamy this should be a species from Senegal. However, apart from Deshayes (1832)' somewhat dubious record no

Cyathodonta was reliably reported or depicted in WAF literature since more than 150 years. Lamy (1931) had obviously no *Cyathodonta* material from WAF either.

Definitely, the ***Cyathodonta plicata-granulosa*** complex is not resolved and needs further and reliably located material.

Japanese authors consistently illustrate as "*granulosa*" a species, which is generically distinct, more elongate, decidedly truncate, and commarginal ridged (e.g. Habe, 1971 pl. 64 fig.16; Koyama et al., 1981 pl. 8 fig. 1; Okutani, 2000 pl. 516 fig. 3). This Japanese "*Cyathodonta granulosa*" is neither a true *Cyathodonta*, nor Adams & Reeve's species, but is understood synonymous to Xu's ***Thracia*** (***Cetothrax***) ***hainanensis***.

TN5: ***Thraciopsis***: From SWA, Perth, Woodman's Point and from Exmouth Gulf, NW. Cape approximately 20 beached *Thraciopsis* valves are known, which are similar in shape to ***angustata***. However, the posterior truncate portion is much shorter, closer to the umbones and the pallial sinus is shallower, extending only about one third. The hinge structure is quite similar, the lithodesma not available. The surface sculpture seems identical to *angustata*. The maximum size is 8 mm, but *T. angustata* has not been reported west of Victoria. The WA species seems to represent an **undescribed** *Thraciopsis*. However, the unknown variability of *angustata* and the moderate quality of the material recommends patience and further collecting.

Iredale (1924 and 1962) considered ***elegantula*** Angas and ***elongata*** Stutchbury, both from NSW, as distinct species. The latter having a much deeper pallial sinus; Lamprell & Healy (1998) synonymized these two, depicting both types. For the time being Lamprell & Healy (1998) is followed, but a confirmation with additional material is necessary.

Thracidentula does not appear closely related to the quite uniform *Thraciopsis* group and is removed from there. Although the type is lost, it appears plausible, as indicated by Lamprell & Healy (1998 sp. 605/618) that Reeve's rare *anatinoides* is indeed conspecific with Garrard's *perulae*. In addition to fitting locality and shape, this gaping is quite uncommon in thraciids. The existence of this rare species in NSW was not recorded by Hedley (1918), Iredale (1924) and is not reflected in Iredale & McMichael (1962).

TN6: ***Thracidora*** is perceived as desperate conglomerate arranged by Soot-Ryen (1966). I am neither convinced that these three species are congeneric, nor that they belong into THRACIIDAE. Allen & Turner (1974) recommended no move, before the anatomy is known.

T. flindersi may be conspecific with *arenosa*. At any rate, the separating arguments of Cotton (1961) are not perceived as convincing. All three species are rare and likely **misplaced** here.

6.74 MYOCHAMIDAE

TL1: Overall, 35 myochamids are recognized, compared to Boss (1982)'s less than 15 species. The large majority is found in Australia and NZ.

Myochama is restricted to Australia and NZ. 8 names were proposed for the few extant species. The taxonomy is complicated due to Reeve's misinterpretation of Stutchbury's *anomioides*, erroneously followed by modern authors.

4 *Myochama* can be separated, following here Stutchbury (1830), Smith (1885), Lamy (1936), Crane (1983) and Marshall (2002).

The type species, MT is ***M. anomioides*** Stutchbury, 1830 (STUTCH; Keen in Moore, 1969 fig. 25 1a-b); syn. *M. keppelliana* A. Adams, 1854 (ADAMS54 pl. 15 fig. 1; REV603 fig. 2). Lamprell & Healy (1998)' sp. 631 "*strangei*" fits instead the *keppelliana* form well. However, following Smith (1885), the typically rougher radially ridged true *anomioides* of Stutchbury is the same. This species occurs mainly on the Australian East coast in deeper water. *M. anomioides* has originally been described from Sydney and has also been life taken at 61 m, off Townsville, Qld. *M. anomioides* is uncommon, with stronger, rounded rougher ribs. A shelly lithodesma is also present, though much smaller, strongly embedded into the resilium.

M. transversa A. Adams, 1850 (ADAMS501 pl. 8 fig.1; ADAMS54 pl. 15 fig. 3; REV603 fig. 1a); syn. *M. anomioides* Reeve, 1860 non Stutchbury, 1830 = *M. stutchburyi* A. Adams, 1854 (ADAMS54 pl. 15 fig. 4; REV603 figs. 4a, 4b); syn. *M. tabida*, Reeve, 1860 (REV603 fig. 3). Lamprell & Healy (1998 sp. 630 "*anomioides*") is Reeve's not Stutchbury's species. Their figure represents the finely ridged *M. stutchburyi* form. However, following Smith, *stutchburyi* is considered inseparable from *transversa*, which is typically smaller and more irregularly ridged. This irregular *transversa* form is usually found in juveniles, whereas adults have a more regular sculpture. *M. transversa* is the most common and largest species, often rosy colored, reaching approximately 30 mm. It is found on various kinds of larger bivalves, from Qld to SA. A trigonal, quite large shelly lithodesma is present, situated at the ventral part of the hinge.

M. strangei A. Adams, 1850 (ADAMS501 pl. 8 fig. 2; ADAMS54 pl. 15 fig. 2; REV603 fig. 1b). This obviously rare species has only been found illustrated in above works. It has a characteristically wrinkled and malleated surface and a brownish color. Iredale & McMichael (1962) listed it from NSW, from where it was described. Lamprell & Healy's "*strangei*" represents instead the type species *anomioides*.

M. tasmanica (Tenison-Woods 1876) (Marshall, 2002 figs. 8 B-C, E-G; Powell, 1979 fig. 115; Lamprell & Healy, 1998 sp. 632, juv.); syn. *M. woodsii* Petterd, 1884 (PETT84). Lamprell & Healy (1998 sp. 632) illustrated a juvenile *tasmanica* with the commarginal ribbing and the quite acute umbones. This species is also uncommon, small and the only myochamid also found in New Zealand. Free valves are close to *Myadora novaezelandiae*, but the latter has two deep internal ridges in both valves and a stronger commarginal sculpture.

TL2: In ***Myadora*** mainly Smith (1881) is followed. However, most of his NZ records (C. Traill) are misleading. Beu (2006) gave an excellent overview on the valid NZ species.

The remarkable variability in shape in *Myadora* species is well exemplified in HIG01 B1402-1402b for the Japanese ***Myadora fluctuosa***.

Myodora quadrata Smith, 1899 is accepted by most authors as another highly variable species in shape, originally from the NE. Indian Ocean, compressed, small, usually less than 10 mm and fragile, pearly inside, with a very broad posterior truncation. Japanese authors synonymized the Japanese *M. teramachii* (type: HIG01 B1403s), following here Knudsen (1967). Furthermore, Knudsen (1967) synonymized *M. valdiviae* Thiele & Jaeckel, 1931 and *M. weberi* Prashad, 1932. From the material at hand these synonymies are shared. However, in his review Smith (1881) described in addition *M. compressa* from unknown locality. Smith, 1899 did not compare his new *quadrata* with his earlier *compressa*. The 2 BMNH-syntypes of *compressa* are perceived indistinguishable from the more trigonal shapes found in *quadrata*. These 2 specimens are rougher ridged than the original drawing and approach the illustrated, but smaller specimen from N. Borneo. Thus, ***Myodora compressa*** Smith 1881 is understood as the earlier valid name for this well known species. The unknown **type locality** of *compressa* is here clarified as off N. Borneo. As such *M. compressa* is quite variable in shape, from very trigonal acute (*weberi*) to more quadrate elongate (*teramachii*). These forms are found in the same lots. *M. compressa* is widely distributed from EAfr to Japan, but currently not known from Australia. The depth range includes the sublittoral. Habe reported 62 m, and off Borneo many valves have been dredged in 72-94 m.

Barnard, 1964 described the small, sublittoral ***M. rectangulata*** from Zululand, ranging into East London. This is closely related to *compressa*, but appears to have an even more elongated shape and an even stronger, denser radial interrib sculpture. Furthermore, from the intermediate area, e.g. Mozambique, currently no myadorids are known.

It is likely that ***M. tenuisculpta*** Smith, 1881, described from unknown locality, is the same as Smith's ***reeveana*** from China and Japan. Smith's type of *reeveana* (HIG01 B1406) represents a rather roughly ridged form with rounded umbones, whereas denser ridged forms with acute umbones are known from Japan (Kii, Cape Shio).

The number of **Australian** *Myadora*, as proposed by Lamprell & Healy (1998) appears inflated. Instead of 16 narrowly defined, only about 10 but more variable species are here perceived distinguishable. Nonetheless, Australia remains the center of this family with the most and notably, the largest myadorids.

The type species ***brevis*** was originally described by Stutchbury, 1830 from Sydney, but one year earlier validly depicted and named by Sowerby I. It matches the specimens depicted as *M. brevis* Reeve (1844 sp. 7), May (1958 pl. 5 fig. 13), *M.* "*trigona"* Lamprell & Healy (1998 sp. 634, Gulf of Carpentaria) or *M. triggi* Cotton (1961). True ***M. trigona*** Reeve, 1844 is a distinct, much smaller species, not known from Australia. ***M. triggi*** is a synonym of *brevis*. As described by Stutchbury *brevis* is a large, characteristic subtriangular, commarginally striate species, the right valve convex with two depressed, lamellate ribs. Smith identified it as variable and reported it from NSW and Qld. It appears that *M. brevis* of Lamprell & Healy (1998 sp. 633 *brevis*) is correct identified, though of a less typical form. *M. brevis* has been reported from SWA, SA, NSW, N. Qld, and Shark Bay (coll. auth.); as such it is almost panaustralian. ***M. tessera*** Hedley, 1912 is of similar size and shape and may eventually fall in synonymy, once, larger series are available.

I fail to distinguish ***M. delicata*** Cotton, 1931 from Iredale's earlier ***M. royana***. The shape (elongation) is quite variable in *royana*. Shallow water specimens within Cotton's range from SA, Corny Point agree well with more ovate specimens from Tasmania (18 m, MAY58) or NSW (Lamprell & Healy, 1998 sp. 642). It appears that Cotton based *delicata* on an elongated *royana*.

The distinguishing marks between Hedley's ***pavimenta*** and ***pulleinei***, described from similar depths from close localities are unclear; the former appears to be the adult form.

M. ovata originally described from the Philippines seems to occur in tropical Australia as well; NWA specimens, down to Shark Bay fit the type well. However, Lamprell & Healy's Victoria record is not verified and may instead refer to the next species.

Cotton's ***M. pervalida*** seems to be the same as Iredale's earlier ***complexa***. Specimens studied from SA, Edithburgh and SWA, Rottnest Isl. are perceived intermediate between typical *complexa* and the extreme *pervalida* shape, selected by Cotton. Both, Cotton and Iredale stated that their *pervalida* respectively *complexa* were formerly recorded as *ovata*. As such, *M. complexa* is a broadly distributed SAU species, ranging from SWA to NSW, somewhat variable in shape.

Furthermore, Macpherson's ***M. latilirata*** from Victoria should be compared to ***rotundata***. At least Tasmanian *rotundata* and Victorian *latilirata* appear very close and appear to represent the same species.

Finally, the SA ***Thracia concentrica*** Verco, 1907 appears as juvenile *Myadora*. However, if it represents indeed a valid species, then a new name becomes necessary, as it is preoccupied by Récluz, 1853.

Myadora rostralis Deshayes, 1850 (Traité, pl. 12 bis, fig. 13-15) is instead a *Pandora* from unknown locality.

TL3: Maxwell (2002) gave an excellent overview on ***Myadoropsis*** and ***Hunkydora***.

Following Beu (2006) the rare Japanese ***Myadora soyoae*** (type HIG01 B1404) is tentatively placed in *Hunkydora*.

6.75 VERTICORDIIDAE

TT1: Following modern genetic results, 3 groups are here included: **VERTICORDIINAE**, **EUCIROINAE** and **POLICORDIINAE**.

EUCIROINAE is by some authors accorded family status. However, in addition to phylogeny, EUCIROINAE share major anatomical and morphological traits with VERTICORDIINAE.

Policordia was originally erected as verticordiid genus by Dall, Bartsch & Rehder, 1938 and was placed there by subsequent authors (e.g. Keen in Moore, 1969; Allen & Turner, 1974; Ivanova, 1977). In 1995, Poutiers & Bernard placed it together with *Lyonsiella*, based on edentate hinge in LYONSIELLIDAE. However, phylogenetic data demonstrate that *Policordia* is not closely related to *Lyonsiella*. Nonetheless, *Policordia* is morphologically, anatomically and in the generally deeper habitat distinct enough from EUCIROINAE and VERTICORDIINAE to justify a subfamily POLICORDIINAE.

In specific attributions, largely Poutiers & Bernard (1995) is followed.

Many species are only known from types, and most were never anatomically analyzed. In cases of doubt a question mark has been set. The listing in CLEMAM (12/06) is largely misleading and is generically and specifically in many instances not shared.

Overall, it appears that some genera (especially ***Verticordia***, but also ***Halicardia*** and ***Vertambitus***) contain morphologically and bathymetrically quite distinct species and may require additional genera or subgenera. On the other hand, ***Spinosipella*** and ***Haliris*** appear as recognizable and quite homogenous, after removal of *Vertisphaera*.

TT2: ***Verticordia***: Fischer (1860) knew 6 verticordiids only. Of these, 2 are currently considered *Trigonulina* and 3 remained fossils. Fischer clearly differentiated between the fossil type species of *Verticordia cardiiformis* and Philippi's *acuticostata*. These differences got lost in the following 135 years and some author's even synonymized *cardiiformis* with *acuticostata*. However, Poutiers & Bernard (1995) resolved this unwarranted synonymy, placed *acuticostata* in *Spinosipella*, leaving *Verticordia* for a distinct characteristic group.

Pecchiolia Savi & Meneghini, 1851 is considered fossil only.

It seems that Smith's ***V***. ***quadrata*** and ***V***. ***woodii*** approach closest the fossil type species *V. cardiiformis* of Sowerby, which is more compressed than *Spinosipella* and has a clear lunule.

However, some species, especially ***V***. ***australiensis*** do not fit well here and may require distinction. ***C***. ***monosteira*** is removed from *Verticordia*, where it does not match.

TT3: ***Spinosipella***. Iredale, 1930, confirmed by Poutiers & Bernard (1995), recognized this small group around ***ericia*** as generically distinct from the typical *Verticordia*. This course is followed.

According to TREW92 ***Verticordia japonica*** was published in March, 1862. ***V***. ***deshayesiana*** P. Fischer was published in the first quarter issue of Journal de Conchyliologie, No. 10. Winckworth (1936) was not able to give the exact publication date of the latter. However, P. Fischer (1862) in his Nouvelle note stated that No. 10 had been edited in January, 1862, two months before Adams' diagnosis. Smith (1885) synonymized these two and selected *deshayesiana*, which has been consistently applied by Japanese and Chinese authors. *V. deshayesiana* is widely distributed. Smith (1885) also reported *deshayesiana* off tropical Cape York, N. Australia in 285 m.

Comparing the excellent picture of a Taiwanese *deshayesiana* (LAN00 fig. 2) with Cotton's figure of ***ericia*** it is indeed not excluded that these two depict the same species, as indicated by Lamprell & Healy (1998). However, lacking material from S. Australia and NZ recommends caution. In addition, modern NZ authors (i.e. Otago) recognize *ericia* as valid.

S. ***costeminens*** was described from the Philippines. Compared to *deshayesiana* the ribs are fewer, much sharper and not strongly granular. It has recently also been illustrated from Taiwan (LAN00 fig. 1).

In Brazil, Santa Catarina, a further, unnamed species occurs, 23 mm, BRASIL, 12/06, as *Spinosipella* sp. In the meantime, however, this has been termed ***S***. ***agnes*** by Simone & Cunha, 2008.

TT4: ***Trigonulina***: As far as could be ascertained, *Trigonulina* was first described by Orbigny in Sagra, 1853. Coan et al. (2000) accepted *Trigonulina pacifica* as distinct from *ornata* and stated the differences. Furthermore, the enigmatic ***novemcostata***, also "Samarang", also erroneously from China Sea, is today accepted as Panamic species, antedating *pacifica* (Coan & Valentich-Scott, 2007, Light's Manual).

The Panamic *Verticordia* (*Trigonulina*) ***hancocki*** Bernard, 1969 does not fit particularly well here. It might be a juvenile and should be reanalyzed.

TT5: ***Vertambitus*** *affinis* has recently been reported by Okutani (2005) from the East China Sea. It could not be verified whether indeed the same species is involved. Concluding from the text, Okutani did not compare type material. The syntypes of *affinis* are in MfN 101628 and 77824.

The rare Japanese ***cuneatus*** (type HIG01 B1415) does not appear very close to the Australian type species ***vadosus***. At least subgeneric distinction may be diagnosed, once fresh material is available.

Lamprell & Healy (1998 sp. 667) illustrated instead of "*Haliris accessa*" the type species ***Vertambitus vadosus***.

TT6: ***Halicardia***: The species placed in *Halicardia* display an enormous variability, from strongly plicately ridged (e.g. *flexuosa*, *perplicata*, *nipponensis*, *houbricki*) to weak radially ridged (*gouldi*); from very solid (*maoria*) to thin and fragile (*gouldi*, *philippinensis*). Most species are only known from the type material. Very few species were anatomically analyzed. Most grow up to or even larger than 40 mm.

The only species originally described as *Halicardia*, ***Halicardia philippinensis*** is in many respects closer to *Policordia*. The size is also significantly smaller than in typical *Halicardia*. On the other hand, it has granules and a clear tooth in the right valve and as such somewhat approaches *gouldi*. It has been described from the Philippines, but is also well known from the East China Sea, Taiwanese waters (Pei-Yo, No. 26) and was recently also collected off Mozambique.

Pecchiolia angulata Jeffreys, 1882 does not appear to be a typical *Halicardia*.

No confirmation was found that *Verticordia* (*Laevicordia*) ***axinoides*** Seguenza, 1876 described as Italian fossil occurs recent. The Pleistocene fossil is depicted in PAV95. The other "Mediterranean *Halicardia*" *Halicardia ferruginea* Di Geronimo, 1974 has recently been placed in synonymy of *Axinus grandis* (LOEFF), together with *Mytilimeria saharica* and *fischeri* of Locard.

TT7: ***Haliris***: This is a rather compact group of small, ribbed, inflated, ovate to quadrate species, living sublittoral to bathyal.

As far as is known, true *Setaliris accessa* has never been depicted. Lamprell & Healy (1998 sp. 667) is instead *Vertambitus vadosus*. Iredale, 1930 briefly described it from NSW, 450-550 m. ***Setaliris accessa*** is the type OD of *Setaliris* as designated by Iredale, 1930 and confirmed by Iredale & McMichael (1962). True ***setosa*** is a distinct NZ species. According to Iredale (1930), the NSW *accessa* is smaller, more convex and numerously ribbed than *setosa*.

According to Cotton (1961) who analyzed NSW *accessa* material, *accessa* has more ribs, a different shape and a stronger hinge formation, compared to *H. jaffaensis*. From Iredale's and Cotton's comparison it appears that true *Setaliris accessa* might have been virtually the same as *Haliris*.

On the other hand, Keen in Moore (1969) did not depict the correct type species ***Setaliris***, but instead the NZ *setosa*. Obviously, she considered distinction from *fischeriana* (= *Haliris*) to *setosa* (not *Setaliris*) sufficient for subgeneric distinction. Thus, if ***setosa*** and the similar ***jaffaensis*** are perceived distinct from the type species of *Haliris* by subsequent authors, then a new group has to be defined for these two. *Setaliris* itself appears too close to *Haliris* to be separated.

Whereas the Med ***H. berenicensis*** (Sturany 1896) is distinct from *H. granulata*, following Van Aartsen (1992), Poutiers & Bernard (1995) and Repetto et al. (2005), ***H. trapezoidea*** has been variously treated. Following Van Aartsen (1992) and Repetto et al. (2005), *trapezoidea* is considered the third valid *Haliris* from the Med, more elongate and smaller than *granulata*.

H. lamothei described from the Azores and also reported from SAF is very close in shape to *trapezoidea*, but grows twice this size and has more radial ribs.

Vertisphaera was included in *Verticordia* by Keen in Moore (1969), whereas Poutiers & Bernard (1995) placed it in *Haliris*. However, it does not closely resemble either. Following Iredale, 1930, ***V. cambrica*** is generically separated and *Vertisphaera* placed in between *Halicardia* and *Haliris*.

TT8: ***Euciroa***: Thiele & Jaeckel (1931, Valdivia) and Knudsen (1967) are important. In general, *Euciroa* seem quite variable in shape. An impressive example of variation during its growth is given for ***E. rostrata*** by Lan (2000 fig. 4). Overall, a dozen *Euciroa* are currently known.

Except extreme rostration in juveniles, nothing really differentiates ***Acreuciroa*** from other IND *Euciroa* species. Closest in rostration is *E. galatheae*, but *E. galatheae* is considered by all modern authors a typical *Euciroa*. In *Acreuciroa*, neither structure of the hinge, nor dentition, or habitat differs significantly. Furthermore, the renamed *E. lamprelli* from W. Australia intermediates *rostrata* and *galatheae* and could easily be placed in both groups. The differences of *rostrata* are considered as of specific importance and *Acreuciroa* is synonymized, following here Knudsen (1967). Additionally, he stated the anatomy of *E. rostrata* as very close to *E. pacifica*, another typical *Euciroa*.

Euciroa galatheae is well known from New Zealand. It is mainly found around N. Island, but is also known from Tasman Sea and Chatham Isl. *E. galatheae* is depicted in Powell (1979 pl. 79 fig. 11), also in Abbott & Dance (1986 p. 375 fig. 3). The length reported by Abbott is 40 mm, by Powell 39-44.5 mm. The largest specimen studied is 45.5 mm (N. Isl., off Hawke Bay, 400 m). No reliable *galatheae* record outside New Zealand waters was found, nor was any larger size reported than 45.5 mm.

On the other hand, Lamprell & Healy (1998 sp. 672) illustrated a much larger, 63.8 mm species from NW. Australia from 856 m as *E. "galatheae"*. Beesley et al. (1998 fig. 9.16B) illustrated this same "*Euciroa galatheae*" as member of the Australian fauna. However, this NW. Australian species is clearly distinct from true NZ *galatheae* and here renamed ***Euciroa lamprelli*** nom. nov. *Euciroa galatheae* "Dell" Lamprell & Healy, 1998 non Dell 1956; type locality is off NW. Australia, 856 m. Lamprell & Healy, 1997 p. 277 compared their new ***E. queenslandica*** with *lamprelli* instead of true *galatheae*, stating the almost straight dorsal margins and the strong radial medial sculpture. Apart from *E. rostrata*, illustrated on the same page by Lamprell & Healy (1998 sp. 674), *E. lamprelli* is the largest *Euciroa* known. Lamprell & Healy gave 63.8 mm. 4 specimens have been analysed, all from NW. Australia; the largest specimen from 400 m is 63.2 mm. *E. lamprelli* intermediates *rostrata* and *galatheae*. It is less inflated than *galatheae*, but more so than *rostrata*. It is more and broader rostrate than *galatheae*, but less so than *rostrata*. In maximum size it is between these two. Internally it is pearly, finely striate on the margins as found in both congeners. The dentition is the same as in both congeners with a strong cardinal and a lateral in the right valve and two laterals in the left valve. In *lamprelli* and *rostrata* the anterior lateral is weak. The other described *Euciroa* are easily separated by shape, size or location. *E. lamprelli* is actually only known from bathyal NWA. ***Euciroa lamprelli***, as well as ***Glycymeris*** (***G.***) ***lamprelli*** and ***Lioconcha*** (***L.***) ***lamprelli*** are named after the late Kevin Leslie Lamprell. These names honour his passion, his contributions to bivalves during many years and his two important books on the rich Australian bivalve fauna.

Thiele & Jaeckel, 1931 described ***E. aethiopica*** and ***E. crassa*** from the same East African station. *E. crassa* was subsequently recognized widely distributed, extending to mainland Japan; *E. cistagemma* was synonymized with *crassa* by Knudsen (1967), accepted by Japanese authors. *E. aethiopica* was not reported from elsewhere. The main differences of these two species are shape, height-length ratios and a somewhat denser sculpture. Recently larger numbers of *Euciroa* were trawled off SE. Madagascar and from the Mozambique Channel, between about 600 and 1100 m. Within these lots remarkable differences in height-length ratios could be stated: equal, higher than long, or longer than high. Very large specimens are in shape close to *crassa*, smaller specimens identical to *aethiopica*. Similar sized specimens may even differ in thickness of the valves. Consequently, these two are considered the same. *Crassa* is by far the more common name. Thus, against page priority ***E. crassa*** is here selected and ***E. aethiopica*** is synonymized. The largest specimen studied is 43.3 mm (Mozambique Channel, about 1100 m).

E. queenslandica is somewhat similar in shape to ***millegemmata***, but grows much larger, is higher and has a rougher sculpture. It appears that *queenslandica* is also wider distributed and may extend to East China Sea, Taiwan and Okinawa. At least specimens studied from an old Japanese collection from the East China Sea, 550-600 m conform well to Lamprell & Healy's OD. Lan (2000 fig. 5 *"eburnea"*) from Taiwan may instead represent *queenslandica* as well.

TT9: As stated by Dall, Bartsch & Rehder (1938) ***Policordia*** has the same concept as understood under ***Laevicordia*** by Thiele, 1935 non Seguenza. Thiele exemplified *Laevicordia* by ***Pecchiolia insculpta*** Jeffreys, which is today accepted as synonym of *Policordia* (*P*) *gemma* (Verrill 1880). True

Laevicordia Seguenza, 1876 is here interpreted as Italian fossil only.

Soot-Ryen (1966) depict the then known policordiids. Ivanova (1977) is important for this group and treated further species.

Most policordiids are exceedingly rare and many are only known from their type material.

It is likely that ***P. media*** is a shallower, smaller species, distinct from *pilula*. Okutani (2000 pl. 518) illustrated both species. Scarlato's ***P. ochotica*** appears much closer to *media* than to *pilula*.

Richling (2000) doubted synonymy of ***uschakovi*** and ***jeffreysi***. She illustrated the anatomy of the former. Reconsidering the various records, for the time being Bouchet & Warén's and Coan et al.'s views are followed and synonymy is upheld.

6.76 POROMYIDAE

TR1: Anatomical features (e.g. structure of ctenidia) are decisive for the correct placement of species. Some species, not anatomically analyzed, are therefore tentatively placed only. Some authors use subfamilies (e.g. KRY01), others not. In poromyids much more work is necessary to achieve a stable picture of the species involved and their relations.

Krylova (1991, 1997 and 2001) is important for this family and her views are largely followed. She gave full generic rank to *Dermatomya* and *Cetomya*. Lan (2000) illustrated the 5 species found in Taiwan.

Cetomya appears to have been created by Dall in the «Albatross-report» p. 284. This then would make *Cetomya* as of 1890.

Boss (1971) gave no numbers for poromyids, but in (1968), he stated more than 30 species in USNM and estimated 100 poromyids. Although currently only approximately 70 species are more or less known, it is possible that one day Boss may be correct. More than a dozen species have been described very recently.

TR2: Species quite distinct from the ovate, ridged type species have been placed by Poutiers & Bernard in ***Poromya*** (e.g. the very close and possibly conspecific ANT *spinosula* and *adelaides* or the Japanese *hayashii*). Krylova (1997) set a question mark in these cases. It is not excluded that they belong elsewhere. On the other hand, genetic analysis demonstrated a very close relation between *P. adelaides* and the type species *granulata* (DREH03).

Krylova (2001) further demonstrated the variability of ***australis*** and synonymized Pelseneer's *pergranosa*. Dell (1995)'s «*undosa*» from NZ is very close. True ***undosa*** Hedley & Petterd, 1906 (type Lamprell & Healy, 1998 sp. 704) appears distinct and instead to extend tropically. Therefore, instead of *undosa*, Smith's *australis* appears to occur in NZ waters.

Lyonsia intracta Sturany, 1899 was classified as *Poromya* by Dekker & Orlin (2000) instead of Oliver's earlier placement in *Lyonsia*. However, the feeble dentition does not make it a typical *Poromya* either. It is not exluded that an anatomical comparison places this rare species elsewhere in poromyids.

According to Knudsen (2005) ***P. granulata*** does not occur in the Caribbean. Instead ***P. rostrata*** is widely distributed. Knudsen assumed that several species are present. Nonetheless, it is not excluded that ***P. triangularis*** Dall, 1881 from Barbados is this species. The type should be compared. Rios (1994) *granulata* record from Brazil is currently enigmatic. The smooth margins, mentioned do not fit *rostrata* (type KNU05 fig. 11,12). Diaz & Puyana (1994 sp. 307) appear to depict a distinct species from Colombia as well. Also here much more work is necessary to clarify the number and range of the involved Caribbean poromyids.

Questimya granifera appears wrongly placed in *Euciroa*. As originally intended by Cotton and as also perceived by Beesley et al. (1998 p. 423) it is replaced in poromyids. It is an uncommon thin deep water species.

TR3: Krylova (2001) synonymized *Perlaporomya* with ***Cetomya* s.s.**

The type of ***C. intermedia*** is depicted in HIG01 B1426. Although *intermedia* is usually synonymized with Pelseneer's *eximia*, these two species are considered distinct. Habe, 1952 originally doubted identity as well. *C. intermedia* is more fragile in substance, silvery transparent, whereas *eximia* is more solid, whitish and not transparent. Posteriorly *intermedia* is shorter and broader rostrated, whereas in *eximia* the rostration is smaller and more extended. *C. intermedia* usually occurs sublittoral, whereas ***C. eximia*** is lower bathyal. In the East China Sea, both species are found, the former extending East, the latter West. *C. eximia* grows much larger. Due to anatomical reasons *eximia* was placed in *Cetomya* by Poutiers (1995), confirmed by Krylova (2001).

C. intermedia is perceived to belong here as well, but it should be analysed anatomically.

The holotype of ***Poromya curta*** Sowerby III from Natal proved in size, fragile glassy texture, and granulation very close to *intermedia*. However, the clear cardinal present in the latter was lacking. As far as is known, *curta* has not been found since.

Krylova (1997) placed ***tornata***, due to its anatomy (sieve-like branchial apertures, ALL81) in *Cetomya* whereas virtually all other authors included it in *Poromya*. However, Dall (1890) placed *microdonta* and *tornata* in *Cetomya* as well. Krylova is followed.

TR4: From morphology, size and habitat *P. hyalina* fits better into ***Lissomya*** as indicated by Krylova (1997). However, the anatomical comparison is lacking.

TR5: Krylova (1997 and 2001) applied a separate family for ***Cetoconcha***, based on three instead of two paired groups of branchial apertures. However, due to the state of knowledge and the close similarities in morphology and in habitats, this course is at present not followed.

Krylova (1991) further proposed ***Cribrosoconcha***, based on the unique interfilamentar connections, as new genus within CETOCONCHIDAE, grouping here *alephtinae* (type, OD) and *elegans* both from bathyal depths in the SE. Pacific. Poutiers & Bernard (1995) synonymized without arguing. It is difficult to assess the importance of this trait and whether this is the only useful distinction within *Cetoconcha*. For the time being, a conservative approach is applied, following Poutiers & Bernard.

Kilburn (1973)'s unique record of ***Poromya gloriosa*** 35.2

mm, trawled at 36.5 m, Tugela Bank (KIL731, p.577) does not precisely fit Prashad's species (type in Lamprell & Healy, 1998 sp. 706) in shape, size and depth. It is definitely not Sowerby's *gilchristi*, which is ovate, but the surface sculpture shows similiarities with Sowerby's smaller *striata*, which appears also more rostrate than *gilchristi*. These two should be compared. However, it is not excluded that this Tugela species finally proves **undescribed**. The somewhat similiar ***boucheti*** is currently only known smaller and from the Philippines. Whether Poutiers & Bernard (1995)'s *gloriosa* from the Philippines and Bernard, Cai & Morton (1993)'s *gloriosa* from the Beibu Gulf are indeed conspecific with Prashad's species needs also confirmation.

The unique holotype of the comparatively large, 20.1 mm ***Poromya forbesi*** H. Adams, 1875 described from unknown locality is still present in BMNH. In fragile texture, dentition with a strong cardinal and granulation it is close to Okutani's ***tenuissima***. Obviously, an East China location is not excluded. However, *tenuissima* is not, as yet, known to reach Adam's species in size and more elongated shape. Unfortunately, all *tenuissima* studied were smaller than 13 mm and more ovate than the *forbesi* type.

The BMNH type series of ***Neaera hyalina*** Hinds, 1843 from China Sea is in size (23.3 mm), shape, acute umbones, fragile texture, dentition and granulated surface indistinguishable from Habe's ***japonica*** and is understood as the earlier, valid name. Originally, Habe, 1952 did not compare these two. *D. hyalina* extends also into the East China Sea. *Thetis hyalina* «Sowerby» H. & A. Adams, 1856 (nom. nud.) may have meant this species.

6.77 CUSPIDARIIDAE

TS1: Many cuspidariids are poorly known and only available from types or very small lots.

Cuspidariids may display a high variability. *Cardiomya pectinata* for example, changes its shape remarkably during its growth. Three different names have been assigned for this variable species. On the other hand, Marshall (2002) recently described many closely similar cuspidariids as distinct.

Boss (1971) estimated 100 species. At present, the number is closer to 300 species, with many species still undescribed.

In addition, due to the deep habitat and small sizes, many new discoveries have to be expected.

Protocuspidaria is variously treated; as genus by some (BEE; CLE; POU95; OKU023) as family by others (Russian authors). Regarding habitat, feeding and presumably also reproduction, they share main traits of cuspidariids. They are generally small (4-8 mm). Morphologically, they suit the variable cuspidariids. The main difference is anatomical, the distinct gill structure. Today, more than 20 protocuspidariids are known which belong in various groups.

Among the remaining cuspidariids Krylova (1993) accepted **CARDIOMYINAE** Scarlato & Starobogatov, 1993 as subfamily for *Cardiomya* and *Bathyneaera* based on anatomical features. Allen & Morgan (1981) earlier treated *Cardiomya* and *Myonera* as subgenera of *Cuspidaria*. Krylova (1994) accepted **HALONYMPHIDAE** Scarlato & Starobogatov, 1983 as family for *Halonympha* and *Octoporia*, mainly based on anatomical characteristics, whereas Allen & Morgan considered the type species *Octoporia* even a *Myonera*; other authors treated these as genera.

Based on the actual state of knowledge, a conservative approach is applied. PROTOCUSPIDARIINAE are separated and all remaining cuspidariids are placed in CUSPIDARIINAE Dall, 1886.

Vulcanomya Dall, 1886 was declared gen. dub. by Keen in Moore (1969) and although frequently mentioned, it has not been recognized since. Keen is followed.

TS2: ***Cuspidaria***: Here largely Poutiers & Bernard (1995) is followed. Furthermore, Dall (1886) defined many new genera and gave hints where to place species. This is especially important for the difficult species of Jeffreys with many types in USNM. Salas (1996) is important for the European species; Higo et al. (2001) depicted many Japanese types. On the other hand, the listing in CLEMAM (12/06) is, by and large, not shared.

At present approximately 110 species are included in *Cuspidaria*, but in most cases the intraspecific variability is unknown. *Cuspidaria* encompasses a variety of distinct forms. A few subgenera have been created: ***Allenineaera*** for *circinata*; ***Shinkaimya*** for *arcoida*; ***Nordoneaera*** for *trosaetes*; ***Subcuspidaria*** for *kerguelensis*, *concentrica* and *minima*. The value of these subgenera is hard to assess. Comparatively, however, at least 3 times as many subgenera would be justified for such a large group. Genetic data is lacking. For the time being all 110 species are listed as ***Cuspidaria***, awaiting further results.

The complex of ***Neara imbricata*** and ***Neara circinata*** needs additional study. *Neaera imbricata* Jeffreys, 1880 is a nom. nud. (JEFF82; WAR80), Jeffreys, 1881 is valid. Based on Jeffreys ms. Locard, 1898 erected *Cuspidaria imbricata*. Locard's species is considered the same as Jeffreys' ms. (POU95) by some authors, whereas *C. circinata* (Jeffreys 1876) is, by most authors, considered a distinct species. However, Jeffreys (1882 p. 942) stated his *imbricata* to be synonymous with *circinata*, a view shared by Warén (1980). *N. circinata* is well depicted in Salas (1996 fig. 125-6), the distinct *N. imbricata* in Locard (1998 pl. 9 figs. 8-11). Furthermore, Scarlato & Starobogatov, 1993 made *Neaera circinata* Jeffreys, 1876 (as *Nearea circinnata* Jeffreys, 1881) the type, OD of a new genus ***Allenineaera***, based on anatomical differences. *Allenineara* was even placed in HALONYMPHIDAE, based on 8 pores. *C. imbricata* is considered a *Cuspidaria* (POU95) or a *Rhinoclama* (KRY941). The number of species involved here, as well as their generic position is currently open. Most likely Jeffreys' *imbricata* is the same as his *circinata*, whereas Locard's *imbricata* is distinct and needs a new name.

The type of ***C. trosaetes*** from Japan Sea is depicted in HIG01 B1447. This is hard to reconcile with *glacialis* as proposed by Coan et al. (2000). Thus, Poutiers & Bernard (1995) and Japanese authors are followed and these two are kept separate. Furthermore, Okutani, 1985 created a separate subgenus ***Nordoneara*** for *trosaetes*.

The many sublittoral Caribbean ***C. jeffreysi*** reports (e.g. Abbott; GAR04; DIA94) refer to a distinct species. Following Allen & Morgan (1981) and Poutiers & Bernard (1995), *jeffreysi* is not reliably known shallower than 850 m, it is also a quite broad species with a short rostrum. A couple of these Caribbean records may be referable to ***C. luymesi*** Knudsen, 2005, which is in shape and dentition similar to *obesa*, but much shallower, occurring tropical and growing larger. The largest *luymesi* studied came from off W. Florida (18.1 mm, 93 m).

The many Mediterranean ***obesa*** records appear to belong to a distinct species as well. True *obesa* is mainly an ARC species and not realiably known from the Med.

Dall, 1881 placed his ***arcuata*** in *Neaera* (= *Cuspidaria*). However, in 1886 he questioned inclusion of this rare species in *Cuspidaria*. *Arcuata* is definitely not a typical *Cuspidaria*.

Knudsen (1967) reported ***gigantea*** from Tanzania, Natal and the Maldives, all localities obviously not accepted by Poutiers & Bernard (1995). Recently a large valve, 52.5 mm, about 600 m off W. Madagascar has been studied which represents undoubtledly this species. Thus, *gigantea* may be found widely distributed throughout the IND from Africa to Japan. ***C. capensis*** is a smaller, more compressed, fragile SAF species, not as yet known from Natal. ***C. elephantina*** from Taiwan is somewhat similar, but with a higher and straight rostrum. *C. gigantea* is still the largest family member with a stunning 60 mm from Japan or 62.5 mm from NW. Australia. As stated by many authors, Prashad's *Cuspidaria gigantea* is not preoccupied by *Neaera gigantea* Verrill, 1884 (= *Myonera*); Okutani (2000 pl. 520 fig. 8) ***C. kawamurai*** Kuroda, 1948 is the same.

3 large *Cuspidaria*, all reaching more than 40 mm, ***chinensis***, ***nobilis*** and ***hindsiana*** are easily confounded. HIG01 has the types of the 2 former, LAN00 has all three well illustrated from Taiwan. *Chinensis* has the roughest ribbing, and *hindsiana* the shortest rostrum as adult, in addition to the most fragile valves. Lamprell & Healy's *hindsiana* form NW. Australia, 1030 m appears indeed to represent this species. This would then significantly enlarge the distribution and if correct, also the known bathymetric range. The largest *hindsiana* specimen seen is from Taiwan, slightly more than 40 mm. On the other hand, Poutiers & Bernard (1995 fig. 61 «*nobilis*») illustrated instead *chinensis* from the Philippines. *C. nobilis* has been described from Korea. Habe (1964) compared these two species. As far as is known, *nobilis* is confined to East China and Japanese waters, but not reliably recorded from the Philippines. Typical **consimilis** has a reddish-orange, somewhat shorter rostrum, than the whitish *nobilis*. However, as stated by virtually all Japanese authors, these differences intergrade and almost all red and all white specimens are known throughout its range. *Consimilis* is without doubt a synonym of *nobilis*. The largest *nobilis* came from the EChi, around Taiwan, growing up to 52.9 mm. *C. chinensis* is more widely distributed and well known from the Philippines, China and Japan. It measures more than 53 mm (Mindanao, 200 m).

Lamprell & Healy (1998) confounded some species on their pl. 231. Their sp. 681 *exarata* is instead the rare ***C. erma*** of Cotton. Their sp. 686 «*nobilis*» from NSW to S. Qld is not the Japanese species, but seems to represent instead a huge ***exarata***, which is widely distributed in SAU. According to Iredale & McMichael (1962) both large Australian cuspidariids *exarata* and *latesulcata* occur in NSW Lamprell & Healy sp. 680 seems to be ***C. angasi*** as well. May (1958), Cotton (1961) and Allan (1962) have to be compared.

Poutiers & Bernard (1995) illustrated ***C. corrugata*** Prashad, 1932 from the Philippines, but stated slight differences to Prashad' species. The type of the rare ***C. teramachii*** Kuroda, 1948 from Tosa Bay, Shikoku is depicted in HIG01 B1439. This seems to be the same as Poutier & Bernard's Philippine *corrugata*. Whether Prashad's species described from a juvenile is indeed the same or only a closely related species could not be verified. For the time being Poutiers & Bernard's interpretation is followed, and *teramachii* is considered a synonym. In the Philippines this species is known to reach almost 30 mm.

Knudsen (1967) analysed ***C. approximata*** and ***brachyrhynchus*** and stated them distinct. It appears that Oliver (1995 sp. 1273 «*approximata*») illustrated instead *brachyrhynchus* from Oman. *Appoximata* was misidentified by Melvill & Standen (1907) as well. Smith's *approximata* is reliably known from EAfr, Tanzania and from the Andaman Sea. Barnard's Natal report from 45 m is still doubtful.

C. macrorhynchus and ***suganumai*** are very close, as stated by Knudsen (1967). However, Poutiers & Bernard (1995) separated them and restricted *suganumai* to Japan. The former occurs bathyal, the latter sublittoral. Consequently, Okutani (2000 pl. 520 fig. 7) «*macrorhynchus*» from Japan is instead *suganumai*.

All evidence points that ***steindachneri*** and ***hirasei*** are also two distinct species. Unfortunately, Knudsen (1967), who synonymized them, only had Red Sea material. The former is depicted in Sturany (1899), the type material is in Vienna. *Steindachneri* appears restricted to the Red Sea. Nothing similar is known from India or Indonesia, thus, excluding a continous distribution. The type of the latter is depicted in HIG01 B1434s. Body and rostrum differ from the Red Sea species.The specimens illustrated by Poutier & Bernard (1995 figs. 48-49 «*steindachneri*») from the Philippines are instead identified as *hirasei*. *C. hirasei* ranges from the Philippines to Japan. Obviously, Lan (2000) came to the same conclusion, whereas Okutani (2000 pl. 519 fig. 5 «*steindachneri*») from Japan is instead *hirasei*.

Cuspidaria bicarinata (Jeffreys, 1882) is considered a valid, uncommon Northeast Atlantic species. The type is depicted in JEFF82 pl. 71 fig. 1. Jeffreys gave various NE. Atlantic localities, a type locality was not designated. Poutiers & Bernard (1995) gave a Northeast Atlantic distribution, a bathymetric range of 1262-2004 m and placed it in *Cuspidaria*. The type material is in USNM and BMNH (WAR80). However, Jeffreys himself used this name earlier for another species ***Neaera striata var. bicarinata*** Jeffreys, 1876 (WAR80, p. 51). As far as is known, this earlier name was never used as valid name (e.g. Abbott, 1974; Tebble, 1976; Poppe & Goto, 1993; Poutiers & Bernard, 1995; Salas, 1996; Repetto et al., 2005). CLEMAM (12/06) listed *Neara striata var. bicarinata* Jeffreys, 1882 p. 939, pl. 70 fig. 1 as synonym of *Cardiomya striata*. However, this erroneous reference cross-matched the name of the earlier, with the publication date and reference of the latter species, which is not a *Cardiomya*. Based on ICZN Art. 23.9.2. ***Neara bicarinata*** Jeffreys, 1882 is here declared as valid and is considered as **nomen protectum** and the older *Neaera striata var.*

bicarinata Jeffreys, 1876 is considered a nomen oblitum.

C. truncata Hedley, 1905 from SE. Australia, does not appear to fit well into *Cuspidaria* and may merit distinction. The European ***C. jugosa*** and ***C. elliptica*** appear also doubtfully placed in *Cuspidaria* and the type material should be reanalyzed.

TS3: ***Soyomya*** is often treated as subgenus of *Cuspidaria*. However, the surface sculpture is unique within this family. ***S. kurohijii*** has been described from a few valves from Izu Isl., off Japan and later ***S. clathrata*** from 2 specimens from New Caledonia. This species was recently found to be quite common in Philippine waters 60-250 m. The remarkable variability in shape makes it difficult to keep *clathrata* apart. Thus, *Soyomya* is understood as monospecific and *kurohijii* a locally quite common, widely distributed, sublittoral species. The largest specimens seen is 23 mm, the maximum size reported is 25.2 mm (Philippines).

TS4: ***Plectodon***: Marshall (2002) stated, that neither the Japanese ***ligula***, nor the S. Australian ***brazieri*** have granules; both were earlier placed in *Plectodon* by Poutiers & Bernard (1995).

However, the extant Japanese species taken to represent Yokoyama's fossil is minutely granulate and as such correctly placed here.

P. brazieri is indeed not a typical *Plectodon* in surface sculpture, but according to Allen & Morgan *brazieri* has a *Plectodon*-type hinge. Originally, Smith, 1885 placed *brazieri* in an unnamed group F, standing alone. *Brazieri* merits further consideration.

The BMNH syntypic valves of ***Cuspidaria braziliensis*** from 73 m off Rio proved to represent instead a *Plectodon*. However, from morphology, biogeography and habitat I fail to perceive it other than a large end of range ***P. granulatus***.

TS5: ***Leiomya***: The type of ***P. tanabensis*** is depicted in HIG01 B1450-1 and was considered the same as Gould's ***adunca***. On the other hand, the European ***N. inflata*** also placed here by Poutiers & Bernard (1995) does not appear congeneric, but belongs to *Rhinoclama* (see there). As far as is known, *Leiomya* is monospecific.

Leiomya is superficially similar to ***Pseudoneaera*** and *tanabanesis* was indeed originally placed there. However, *Leiomya* has a typical bifid anterior cardinal in the right valve.

TS6: ***Pseudoneaera***: (see also *Austroneaera* for *thaumasia*). Nordsieck, 1969 created ***Jeffreysomya*** for some superficially similar, but generically distinct species. The type species ***Neaera truncata*** Jeffreys, 1982 was placed in *Pseudoneaera* by Poutiers & Bernard (1995). However, *truncata* is neither in shape, nor in dentition a typical *Pseudoneaera* as exemplified by its type species ***thaumasia***, or by the congeneric ***semipellucida***, ***minor*** and ***wellmani***. Unless genetic data demonstrate a very close affinity, Nordsieck is followed and the type species *Jeffreysomya truncata* is generically separated.

On the other hand, Japanese authors use *Jeffreysomya* for *periplomoides*. The type of ***Cuspidaria periplomoides*** is depicted in HIG01 B1471. Poutiers & Bernard (1995) placed *periplomoides* with some doubt in *Pseudoneaera*. However, *periplomoides* does neither fit the type of *Pseudoneaera*, nor is it close to *Jeffreysomya truncata*. This huge species represents instead an **undescribed** group.

In N. Borneo, Sabah-Sarawak border, 72-94 m almost a dozen *Pseudoneaera* have been dredged. They varied in size between 5 and 6.5 mm. In size they intermediate *thaumasia* and *minor*. However, Thiele & Jaeckel (1931) and Poutiers & Bernard (1995) separated these two. Due to the stronger commarginal sculpture, somewhat more rostrate shape and the shallower habitat the illustrated Borneo specimens have been classified as *minor*. Nonetheless, it is not excluded that ***minor*** becomes a synonym of ***thaumasia***, once more material becomes available.

TS7: ***Austroneaera*** was synonymized with *Rhinoclama* by Allen & Turner (1981) and neither recognized as valid by Poutiers & Bernard (1995). However, Krylova (1994) demonstrated it to be distinct and Coan et al. (2000) recognized ***Austroneaera*** generically, with a few small, rounded, ovate-trigonal, rather smooth species. Their view is shared. Krylova (1994) attributed the species. In addition to the NZ species, she placed here also ***abrupta***, which fits quite well and is also known from off Mauritania, Nouakchott in 900-1200 m. She also placed here ***dorsirecta***, as earlier indicated by Cotton (1961).

Most *Austroneaera* occur around NZ and two have been newly described by Maxwell (2002).

As consistently placed by Japanese authors and by Poutiers & Bernard (1995), true Japanese ***semipellucida*** is a typical *Pseudoneaera*, very close in size, inflation, dentition, commarginal sculpture and habitat to the type species. The type species of *Pseudoneaera*, has been studied in NHMW. The maximum size of *P. thaumasia* Sturany, 1899 is 8 mm and not 80 mm as erroneously stated by Oliver (1992).

However, *Austroneaera "semipellucida"* Coan, Scott & Bernard, 2002 non Kuroda, 1948 is a distinct NW. American species and a true *Austroneaera* instead of a *Pseudoneaera*. It is here renamed as ***Austroneaera coanscotti***. *A. coanscotti* has been well characterized and illustrated in Coan et al. (2000 pl. 119). The illustrated specimen is SBMNH 140067, type locality is Washington, Pacific County, Finger Little Willapa, from Dover Sole stomachs. As indicated by Coan et al., the known distribution is Baranof Isl., Alaska, 55°N-Tilamook, Oregon, 45.6°N. The bathymetric range of *coanscotti* is 155-823 m. The maximum size is 5 mm. All specimens analyzed were within these limits. The American species reaches less than half the size of the Japanese *semipellucida*. The largest US specimen analysed is 4.8 mm (Washington, 230 m), whereas the largest Japanese specimen studied is 12.5 mm (Honshu, 250 m). The Japanese *semipellucida* is much more inflated and has a very fine, dense commarginal sculpture. *A. coanscotti* is rather compressed and virtually smooth. The dentition is distinct with a small anterior tooth in the left valve in *semipellucida*, whereas in *Austroneaera* the left valve is edentate. Both laterals in the right valve of *coanscotti* are elongate, whereas the anterior lateral in *semipellucida* is knobby. This is also visible in the small type species of *semipellucida* (HIG01 B1451) and also described for *P. thaumasia* by Sturany, 1899. The new name honours two truly outstanding bivalve experts who contributed most significantly to our knowledge of the rich E. Pacific bivalve fauna.

TS8: ***Rhinoclama***: ***N. tasmanica*** Tenison-Woods, 1876 was not included in *Rhinoclama* by Krylova (1994). Iredale & McMichael (1962) reported it from NSW and included it in *Cuspidaria*. Bernard & Poutiers (1995) included *tasmanica* with question mark in *Pseudoneaera*. However, it is neither close to the type species of *Cuspidaria*, nor of *Pseudoneaera*. In dentition and shape *tasmanica* appears closest to *Rhinoclama* and is tentatively placed here.

Marshall (2002) analyzed ***aupouria*** and considered it closer to *Rhinoclama* instead of *Austroneaera*, where it has been formerly placed by Krylova (1994).

Krylova included here also the NZ ***trailli***, whereas most other authors place this small species in *Cuspidaria*. However, *trailli* seems to fit in *Rhinoclama* and Krylova is followed.

The European ***Neara inflata*** Jeffreys, 1882 was variously placed: in *Halonympha* (EAS85), in *Cuspidaria* (SAL96), in *Leiomya* (POU95). A specimen is illustrated in Salas (1996 fig. 121-2). Dall (1886) who had access to Jeffreys' USNM collection stated from hinge the closest relations to his *Rhinoclama* and pointed to close affinities to *R. teres*. Dall's course is followed.

TS9: ***Myonera***: The two currently known ***Rengea*** match in surface sculpture, shape, dentition and more solid texture not into the quite uniform group of *Myonera* and are here generically separated. As such, modern Japanese authors are followed.

It appears that Allen & Morgan (1981) confounded various distinct species with the Caribbean type species ***paucistriata*** (e.g. *angularis*, *dispar*). Their material should be reanalyzed. With regards to the type species *Myonera paucistriata* Knudsen (2005) is followed with a mainly bathyal W. Atlantic distribution from S. Carolina to British Guyana and recently also to Brazil. In Europe the similar ***angularis*** occurs, which ranges into abyssal, and may count for some of Allen & Morgan's deep water Atlantic records. ***Myonera dispar*** is instead considered a valid, endemic Hawaiian species, similar to ***garretti*** from Colombia.

Furthermore, I do not share the view that the Japanese specimen illustrated as "*dispar*" is conspecific with the Hawaiian species, as proposed by Okutani (2000 pl. 521 fig. 29 "*dispar*"). Instead the bathyal Japanese species seems conspecific with Smith's ***bicarinata***. However, the type material in ZSI, India M59/1 should be compared for confirmation.

In addition, I do even less share the opinion that the abyssal Oregon species illustrated as "*paucistriata"* is the same as the Hawaiian, the Indo-Pacific or the Caribbean species, as proposed by Coan et al. (2000). The Oregon species from 3585 m illustrated in Coan et al. (2000 pl. 121 "*paucistriata*") seems to represent an **unnamed** *Myonera*. Obviously, Poutiers & Bernard (1995) came to similar conclusions and considered both, *bicarinata* and *dispar* as valid, biogeographically restricted species.

Knudsen (1982)'s ***limatula*** record from sublittoral Saba Bank appear instead referable to *lamellifera* (KNU05 fig. 17). *Limatula* itself is a mainly bathyal Atlantic species.

The Floridan ***Myonera*** (***?***) ***pretiosa*** described from a 6 mm single left valve has been unresolved for more than 100 years. Its specific and generic identity is open. The USNM-type should be restudied.

TS10: ***Cardiomya***: Poutiers & Bernard (1995) together with Japanese authors considered ***Kurodamya*** as valid subgenus for a few species completely devoid of ribs on the anterior slope, and a slightly distinct dentition. Poutiers & Bernard attributed here ***fortisculpta***, ***fallax***, ***levifrons*** and ***semicostasta***. Newly described from Taiwan is *Cardiomya* (*Kurodamya*) *taiwanica* Okutani & Lan, 1999. However, Allen & Turner (1981) stated anatomy of *Kurodamya* identical to *Cardiomya*. Furthermore, some *Cardiomya* have only very weak radials, whereas in others (***C. balboae*** and ***C. didyma***) the anterior portion is smooth. Thus, Allen & Turner (1981), Coan et al. (2000) and Lan (2000) is followed in considering *Kurodamya*-characters as specifically, but not subgenerically important.

Following Poutiers & Bernard (1995) ***fortisculpta*** and ***alcocki*** are understood as distinct species. Knudsen (1967) just analyzed *alcocki* material. As far as is known, *alcocki* does not occur in Japan, but is known from the Red Sea to Taiwan (LAN00 sp. 11 as ***multicarinata***). *Alcocki* is quite variable, *C. multicarinata* and *C. persculpta* as well as *C. potti* (Red Sea) have been earlier synonymized by various authors with *alcocki*. ***C. chunfui*** Lan, 2000 sp. 12 from Taiwan might be a further synonym with very weak radials. In Taiwan and Japan *C. fortisculpta* occurs (type HIG01 B1463; Okutani, 2000 pl. 521 sp. 26 as *alcocki*).

C. gouldiana and ***C. singaporensis*** were both originally described with 3 radiating lines on the rostrum. *Singaporensis* was characterised by Hinds as smaller, with less ribs and a shorter rostrum. In 1845, Hinds figured *gouldiana*, but not *singaporensis*. A BMNH-specimen closely matching *gouldiana* and here understood to represent Hinds' type is illustrated in HIG01 B1453. In N. Borneo 2 closely similar species were dredged in 70-90 m. One species could be identified as *gouldiana*, the other with less, but broader ribs and slightly shorter rostrum may represent *singaporensis*. Xu (1990 fig. 3) seems to match *singaporensis*. As such Robba et al. (2002)'s *singaporensis* interpretation is not correct, but seems instead to represent *gouldiana*. Whether *C. pulchella* from the Red Sea is indeed conspecific, as concluded by Poutiers & Bernard (1995), could not be verified.

Lan (2000 fig. 8) illustrated a large ***Cardiomya sinica*** Xu, 1980 from Taiwan as ***C. gouldiana***. However, following most modern authors, these two seem distinct. *C. sinica* grows larger, has some less ribs and a shorter rostrum.

Overall, the Japanese *Cardiomya* appear over-named. Okutani (2000 pl. 521 fig. 20) only illustrated his ***sagamiana***. ***C. tosaensis*** Kuroda, 1948 (type HIG01 B1454) described earlier within the range of *sagamiana* was not treated. Poutiers & Bernard (1995) synonymized these two and this course is followed.

Okutani (2000 pl. 521 fig. 21) ***reticulata*** and fig. 22 ***nipponica*** illustrated two closely related species from Japan. Higo et al. (1999) synonymized Okutani's *nipponica* with Kuroda's earlier *reticulata*. The type of *nipponica* is depicted in HIG01 B1456s. Considering the variability within *Cardiomya*, this course is followed.

Okutani (2000 pl. 521 fig. 24) depicted ***C. robiginosa*** from Sagami Bay. The type is found in HIG01 B1460. Whereas Coan et al. (2000) characterized the rostrum in

behringensis as short, this feature is attributed in Japanese literature to *robiginosa*. Obviously, this is a variable feature. Considering range and variability in *C. behringensis*, *C. robiginosa* is considered the same, following here Poutiers & Bernard (1995) and Coan et al. (2000).

Cardiomya curta (Jeffreys, 1876) is treated by most authors as valid, uncommon European species. However, Jeffreys himself used this name earlier for another species (WAR80, p. 52). This earlier name has been used and is now considered a synonym of *cuspidata* (CLEMAM; POU95). Thus, ***Cardiomya cadiziana*** is here proposed as **nom**. **nov**. *Neaera curta* Jeffreys, 1876 non *Neara cuspidata var*. *curta* Jeffreys, 1865. Jeffreys, 1876 was considered nom. nud. by Poutiers and Bernard (1995), but Warén (1980) listed it as recognizable. Allen & Morgan recognized it as of 1876, and Jeffreys (1883) stated it as sufficiently described by him in 1876. The type of *curta* is depicted and described more precisely in JEFF82 pl. 71 fig. 10. This is the type species ***Spathophora***, SD Keen in Moore, 1969 which is a junior synonym of *Cardiomya*. A type locality was not designated. In 1882 a variety of localities, some dubious, were mentioned by Jeffreys. Thereof Porcupine station 28 (36.5°N, 7.3°W, off Cadiz) is herein selected. This is in the area, where this species has been refound and has been illustrated by Salas (1996 fig. 135-136). *Cadiziana* is renamed after a locality, where it certainly occurs.

Neaera multicostata was synonymized with the earlier ***striata*** by Jeffreys (1883). No argument was found to divide them again. Furthermore, CLEMAM synonymized Smith's unique ***C***. ***greenii***, whereas Poutiers & Bernard (1995) kept these separate. Size, habitat and biogeography of *greeni* are within the range of *striata*. As a somewhat stronger rostrate *striata* form is not excluded, CLEMAM is followed.

The BMNH type of ***Neara concinna*** Hinds, 1843 described from unknown locality, 5.5 mm, single valve, is without doubt a *Cardiomya*. Similar sized *C. tosaensis* should be compared.

The type of ***Neara casta*** Hinds, 1843 described from New Guinea has not been located in BMNH. However, this species has been depicted and is localized.

Cuspidaria (***?***) ***monosteira*** Dall, 1890 has the shape of *Bathyneaera*, close to *globulosa*, but the dentition of *Cardiomya*. Likely, a new genus is needed to accommodate this uncommon species.

TS11: Most ***Bathyneara*** have been reported from disjunct localities, e.g. ***tillamookensis***, originally from Oregon also from the Azores and the Angola Basin; ***disa***, originally from deep abyssal Oregon also from the Indian Ocean, Japan and the Caribbean. ***Demistriata***, originally from bathyal Atlantic has been synonymized with the Indian Ocean hadal ***hadalis*** and also reported from Antarctic to Arctic, making it a truly cosmopolitan species.

Many *Bathyneara* records refer to deeper abyssal or even hadal habitats. Usually, in these depths species are restricted to trenches or trench systems and not widely distributed. Furthermore, cosmopolitan species are exceedingly rare exceptions within BIVALVIA and mostly due to human interference. These *Bathyneara* specimens should be reanalyzed with modern methods. It would not be surprising, if many more, morphologically similar *Bathyneara* live other than just the 8 species, which were accepted by Krylova (1993).

However, as little more than a doubt is suspected and Krylova had ample material, her views are presented.

TS12: **PROTOCUSPIDARIINAE**: At present more than 20 protocuspidariids are known, of which many undescribed. Important is Krylova (1995).

Apparently *Multitentacula* are exceedingly rare. All species listed have been described by Krylova, 1995.

Her locality data of *M. amoena* are copied from *parilis*. Obviously, ***M***. ***amoena*** is from 5060 m in the Kuril Trench about 45°N and 150°E

6.78 LYONSIELLIDAE

TU1: ***Lyonsiella***: Many authors considered *Lyonsiella* as closely related to *Policordia*. However, modern phylogenetic data shows a distinct picture (DRE03; HARP). *Lyonsiella* appears related to cuspidariids, whereas *Policordia* appears related to verticordiids and poromyids.

Seguenza included generically quite distinct species in *Laevicordia*. The type designation *V*. (*Laevicordia*) ***orbiculata*** Seguenza, 1876, SD Soot-Ryen, 1966 refers to an extinct form, somewhat similar to *Lyonsiella*. No confirmation was found that ***orbiculata*** described as Italian fossil is living today. ***Laevicordia*** seems best reserved for the fossil type species only.

The species attributed by Soot-Ryen to *Laevicordia* have been placed elsewhere by subsequent authors. Most species listed as *Laevicordia* by Poutiers & Bernard (1995) do not seem to differ anatomically from *Lyonsiella*. Most are here included in *Lyonsiella*, following mainly Allen & Turner (1974).

The juvenile ***Lyonsiella compressa*** Allen & Turner, 1974 has been identified by CLEMAM as synonym of *Lyonsia norwegica* which makes Scarlato & Starobogatov, 1983's ***Rectilyonsiella*** a synonym of *Lyonsia*.

Poutiers (1995) analyzed the MNHN type of ***Mytilimeria compressa*** Locard, 1898 from the Canary Basin, 3700 m and stated it lucinoid.

Pecchiolia sinuosa Jeffreys, 1882 was described from fragments from Porcupine station 16 (e.g. off W. Ireland, 1490 m). Poutiers & Bernard (1995) considered it a valid species also found in the Mediterranean and gave a range of 1200-2500 m. It is not excluded that Repetto et al. (2005 sp. 1696) depicted instead of *compressa* Locard true *sinuosa*.

TU2: ***Allogramma***: Phylogenetic results (e.g. HARP) demonstrate a comparatively close relation between ***L***. ***abyssicola*** (i.e. type species of *Lyonsiella*) and the bathyal ***A***. ***formosum*** (i.e. type species of *Allogramma*). ***Allogramma*** does therefore not belong in LYONSIIDAE but in LYONSIELLIDAE.

Morton (2003) even synonymized these two genera. However, the genetic relations do not appear that close to justify this proposal. In addition, *Allogramma* forms a morphologically well recognizable group.

L. formosum is not just the type species of *Allogramma*, but also of the junior *Spinolyonsiella*. As such ***Spinolyonsiella*** is an objective synonym of *Allogramma*. However, the placement of Scarlato & Starobogatov in or near *Lyonsiella* was fitting.

At present 3 typical bathyal *Allogramma* and 2 as yet **undescribed** abyssal species are discernible.

Whereas the bathyal Atlantic ***A***. ***formosum*** and the bathyal West Pacific ***A***. ***oahuense*** are better known, the Indian Ocean species are poorly understood. Jaeckel & Thiele, 1931 described ***Lyonsia elegans*** which is an *Allogramma*. ***Lyonsia*** (***Allogramma***) ***annandalei*** Ray, 1952 also from the Indian Ocean is considered the same; it is likely that Ray's material was part of the Investigator voyages. As such, the type of ***Lyonsia jucunda*** Smith, 1896 from the Andaman Isl., located in ZSI, should be analyzed. It may possibly be the same as *annandalei* and likely the earlier name for *elegans*.

On the other hand, ***Lyonsiella cf. formosa*** Poutiers, 1984 from the nearby Mozambique Channel, lives much deeper and is without oblique ridges. It is perceived as **undescribed** IND *Allogramma*.

Furthermore, as stated by Poutiers (1984 and 1995), Allen & Turner's deep water abyssal *Allogramma "formosa"* (ALL74 fig. 43) is not the bathyal species described by Jeffreys, 1882 (see also EAS85 pl. 6 figs. 3-3b; Poppe & Goto, 1993 pl. 24 fig. 11; SAL96 fig. 102). Comparing with Jeffreys' OD, Allen & Turner's abyssal species is as yet **undescribed**.

Finally, Barnard (1964 p. 571) stated a right valve of *Lyonsia formosa* from SAF, Cape Point from about 1800 m which seems to belong into this group.

TU3: As originally described, the monospecific ***Bentholyonsia*** is also placed close to *Allogramma* by modern authors. Morton (2003) treated it in-depth.