Notes on molluscs from NW Borneo. 3. A revision of *Taurasia* (Gastropoda, Muricidae) and *Preangeria* (Gastropoda, Buccinidae) with comments on *Semiricinula* from NW Borneo[1]

J.G.M. (Han) RAVEN
Roelofsstraat 12, NL-2596 VN Den Haag, The Netherlands
Associate, Naturalis Biodiversity Center, Leiden, The Netherlands
e-mail: schelp56@hotmail.com

Key words: gastropods, Rapaninae, Ergalataxinae, Pisaniinae, *Orania*, Europe, Pacific, South East Asia, Malaysia, Brunei, Sarawak, Sabah

ABSTRACT

New material from NW Borneo further clarifies the differences between *Taurasia* and *Preangeria*, their habitat, distribution and fossil record. *Taurasia* occurs in shallow water rocky environments. It has a single extant species in the West Pacific which occurs since the Miocene, and five extinct species in Europe. It is demonstrated that *Taurasia pendopoensis* Beets, 1985 has a labral tooth, belongs to the genus *Preangeria* and is a synonym of *Tritonidea praeundosa* Vredenburg, 1924; *Preangeria praeundosa* (Vredenburg, 1924) is introduced as comb. nov.. *Preangeria* is restricted to deep water soft bottom environments. It has a single extant species and four or five extinct species in SE Asia. In addition comments are added on the species of *Semiricinula* from Borneo where the genus is represented by four extant species, some of which have been present since the Miocene, and one additional species which is herein attributed to *Orania*.

INTRODUCTION

During the 19th and early 20th centuries a number of Muricidae and Buccinidae species (Miocene to Recent) occurring in South East Asia was described as representatives of the genera *Acanthina* Fischer von Waldheim, 1807, *Acantinella* Shuto, 1969, *Nucella* Röding, 1798, *Purpura* Bruguière, 1789, *Preangeria* Martin, 1921 and *Tritonidea* Swainson, 1840. Their classification remained problematic as insufficient information was available on the differences between these genera and because material was scarce both in number of samples and number of specimens. Beets (1985) provided a first overview. He grouped all South East Asian species in the six genera mentioned earlier in the genus *Taurasia* Bellardi, 1882 (Muricidae), which was based on Miocene faunas from western Europe and described two new species. Beets' paper was published in the 1984 volume of Scripta Geologica which was not issued until 1985 (see Winkler Prins, 1996: 15).

In his revision of the genera *Preangeria* and *Taurasia* Vermeij (1998) placed all species with a labral tooth (a blunt or sharp, downward projecting tooth on the abapical part of the outer lip) in *Preangeria*. The other species were left in *Taurasia*, except for *Taurasia pendopoensis* Beets, 1985 and *Tritonidea praeundosa* Vredenburg, 1924 which were provisionally allocated to *Eosipho* Thiele, 1929 (Bouchet & Warén, 1986). From both *Taurasia* and *Preangeria* a single extant species is known.

In this paper all species of *Taurasia* and *Preangeria* are illustrated, demonstrating substantial variation in shape, in sculpture and in number of denticles and plications within the aperture. The literature comprises contradictory data on the stratigraphic intervals from which samples were collected and the age of those. In this paper data from more recent publications have been used to adjust the geological age of several samples previously recorded, but further work on the stratigraphy is required.

During the preparation of this paper the author experienced difficulties with the classification of several other Rapaninae and Ergalataxinae from NW Borneo, especially *Semiricinula konkanensis* (Melvill, 1893) has a very similar shape and sculpture to the types of *Taurasia niasensis* and can be confused with *Orania nodosa* (Hombron & Jacquinot, 1848). Only when the actual specimens were observed side by side marked differences (especially in size and in colour and sculpture inside the aperture) became evident and eventually it was concluded all these are species of *Semiricinula* and *Orania*. There are many erroneous records of *Semiricinula*. Therefore in this paper the species from Borneo are described and illustrated, next to photographs of type material. A further revision of *Semiricinula* to review the geographical and stratigraphic distribution of all species is recommended.

[1] For No. 2 is this series see: Raven, J.G.M. & Vermeulen, J.J., 2007. Notes on molluscs from NW Borneo and Singapore. 2. A synopsis of the Ellobiidae (Gastropoda, Pulmonata). — Vita Malacologica 4: 29-62.

MATERIALS AND METHODS

This study is based on material collected by the author – supplemented by a revision of the type material of many of the species deposited in NBC and photos of type material deposited in MNHN, MRSN, NMW, USNM and UZM, data from literature, from internet and provided by others.

For several samples reference is made to outcrops in the Miri area of Sarawak (Malaysia). Most of these are described in Wannier et al. (2011).

Measurements were made by the autor, provided by others or taken from literature. The measurements are as detailed as possible, i.e. in tenths of millimetres. In some cases however, measurements were rounded off in millimetres.

Abbreviations used:

ACRSD	Andaman Coast Research Station for Development, Ranong, Thailand
AMS	Australian Museum, Sydney, Australia
DMNH	Delaware Museum of Natural History, Delaware, USA
IFSM	International Fossil Shell Museum, Utrecht, The Netherlands
MNHN	Muséum national d'Histoire naturelle, Paris, France
MPU	Museo di Paleontologia dell'Università "La Sapienza" di Roma, Italy
MRSN	Museo Regionale di Scienze Naturali, Turin, Italy
NBC	Naturalis Biodiversity Center, Leiden, The Netherlands
NHMUK	Natural History Museum, London, United Kingdom
NMW	National Museum of Wales, Cardiff, UK
P	G. Poppe, Cebu, Philippines (as recorded on conchology.be)
R	J.G.M. Raven, The Hague, The Netherlands
RGM	Rijksmuseum van Geologie, collection in NBC
RMNH	Rijksmuseum voor Natuurlijke Historie, collection in NBC
USNM	Unites States National Museum, Philadelphia, USA
UZM	University Zoological Museum, Copenhagen, Denmark
ZMA	Zoologisch Museum Amsterdam, collection in NBC

SYSTEMATICS

Family Muricidae
Subfamily Rapaninae Gray, 1853 (sensu Kool, 1993)
Taurasia Bellardi, 1882

Type species: *Purpura subfusiformis* d'Orbigny, 1852 by original designation.

Taurasia is the original name of the city Torino in Italy.

Remarks. — Bellardi, 1882: 194 described the genus *Taurasia*. Based on both the European and Asian material he reviewed Beets (1985: 40) stated: "Its main distinctive feature is the possession of a curious set of columellar folds – while *Nassa* shows a single weak fold along its siphonal canal – [...] one comparatively strong adapical fold (or two in the type species, *T. subfusiformis*) on the siphonal fasciole and a few abapical ones which are more oblique and weaker than the former.".

The European species have a considerable variation in axial ornamentation: there may be ribs, inflations, or no such ornaments (Pl. 1). The main distinctive feature of the genus is the possession of a set of columellar folds: one or two comparatively strong adapical folds on the siphonal fasciole and a few abapical ones which are more oblique and weaker than the former (best visible in Pl. 2 Fig. 9). However, Vermeij (1998) grouped all species with a labral tooth in *Preangeria* (Buccinidae). The columellar folds are therefore not unique to *Taurasia*, they also occur in other genera, including *Nassa* Röding, 1798 as already noted by Beets (1985). There is no recent review of the European species grouped under *Taurasia*. In this paper an overview of available information is given, but a further review based on more material is recommended. Based on the material reviewed *Taurasia* typically has a thick shell with rather flat whorls, an aperture with narrow adapical canal and well developed siphonal canal. The columella has a markedly curved upper part between the parietal ridge and well developed columellar folds – if not visible in adults it is visible in juveniles. It occurs in shallow water rocky environments. The genus has a single extant species in the West Pacific which occurs since the Miocene and five extinct species in Europe.

Cossmann & Peyrot (1924: 257-258, pl. 13 figs 31-32) described *Taurasia sacyi* with the type locality Léognan, Aquitaine, France from the Early Miocene, Burdigalian. It is also known from the Oligocene. Beets (1985) followed this classification. However, the shell (Pl. 1 Fig. 8) is quite different from *Taurasia* and misses key characteristics of that genus, in particular the columellar folds. It is broader (H 15 mm, W 10 mm) with a high spire but more inflated whorls with marked radial inflations (6 on the final whorl) with feeble spiral riblets that are most marked on the inflations and least in the interspaces. The aperture is quite round without adapical canal but with a marked siphonal canal. Vokes (1989: 63) considers this a species of *Attiliosa* Emerson, 1968 (Muricinae). The species is therefore excluded from *Taurasia*.

Csepreghy-Meznerics (1956: 445, pl. 6 figs 1-4) described *Taurasia szobensis* with the type locality "Large outcrop" at Szob, Hungary, Miocene, Badenian (Langhian equivalent), Sámsonháza Formation. The holotype (Pl. 1 fig. 12) is in the Hungarian Natural History Museum, Budapest (coll. nr. M.61.4309, Palfy et al. 2008: 110 – this number differs from the original because during the revolution in 1956 much of the inventory of the museum was lost in a fire). The specimen is clearly a juvenile with a very small and thin shell. The sculpture is formed by a large number of fine spiral granulose sculpture and regular protrusions along the periphery. The columella has marked folds but the regularly placed varices demonstrate this is juvenile *Bufonaria* Schumacher, 1817 – and thus belongs to the Bursidae. It is possible this is a known

Bufonaria species but it is beyond the scope of this paper to investigate that further.

Sacco, 1904 introduced the subfamily Taurasinae to replace Bellardi's (1882) subfamily Purpurellinae, which is considered invalid because its type genus is a junior homonym (Bouchet & Rocroi, 2005: 168).

Taurasia subfusiformis (d'Orbigny, 1852)

Pl. 1 Fig. 1

Purpura fusiformis Michelotti, 1847: 218-219, pl. 16 fig. 17 (non Blainville, 1832).
Purpura subfusiformis d'Orbigny, 1852: 79, No. 1458. Replacement name (see below).
Taurasia subfusiformis (d'Orbigny, 1852) – Bellardi, 1882: 194-195, pl. 11 fig. 31.
Taurasia subfusiformis var. *paucicostulata* Sacco, 1890: No. 3076; Sacco, 1904: 75, pl. 17 figs 20-21.
Taurasia subfusiformis var. *profundecanaliculata* Sacco, 1890: No. 3077; Sacco 1904: 75 pl. 17 figs 22-23.

Types and localities.
Purpura fusiformis Michelotti, 1847: "La Colline de Turin" (Colli Torinesi), E of Turin, Italy, Middle Miocene (Holotype: MPU).
Taurasia subfusiformis var. *paucicostulata* Sacco, 1890: Colli Torinesi, multiple localities mentioned (Syntypes: MRSN and Michelotti collection in MPU).
Taurasia subfusiformis var. *profundecanaliculata* Sacco, 1890: Colli Torinesi, multiple localities mentioned (Syntypes: MRSN and Michelotti collection in MPU).

Description. — Up to 38 mm high with a high acute spire with almost flat whorls and a marked spiral sculpture formed by alternating broad ribs and even broader interspaces with a fine riblet. The aperture is about half the shell height, without sculpture along its edge but inside has 10 elongated denticles. The narrow upper part of the aperture forms an adapical canal. The columella has a parietal ridge and several columellar folds.

Range. — Aquitaine, France (Aquitanian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Remarks. — The name proposed by Michelotti (1847: 218) is a homonym of *Purpura fusiformis* Röding, 1798. D'Orbigny proposed a replacement name. Recent literature refers to d'Orbigny (1852: 79) in which the author mentions *Purpura fusiformis* d'Orbigny, 1848, without mentioning the title of the relevant paper. It was not possible to locate this description, therefore the date 1852 is maintained.

The shell is variable, with Bellardi (1882) describing a larger variety A with weaker spiral ribs and a variety B with shorter, less acute spire. Sacco (1890) named these varieties *paucicostulata* and *profundecanaliculata* but these are normal intraspecific variations and therefore herein not accepted as separate taxa.

Taurasia coronata Bellardi, 1882

Pl. 1 Figs 6-7

Taurasia coronata Bellardi, 1882: 195, pl. 11 figs 32-33.
Taurasia coronata var. *pernodulosa* Sacco, 1890: No. 3079.
Taurasia coronata Bellardi, 1882 – Cossmann, 1903: 77.
Taurasia coronata var. *pernodulosa* Sacco, 1890 – Cossmann & Peyrot, 1924: 255-257, pl. 14 figs 53-54.

Types and localities.
Taurasia coronata Bellardi, 1882: Baldissero Torinese, Colli Torinesi, E of Turin, Italy (The holotype has been lost, pers. comm. Dr. Daniele Ormezzano).
Taurasia coronata var. *pernodulosa* Sacco, 1890. Colli Torinesi, multiple localities mentioned (MRSN and Michelotti collection in MPU).

Description. — This species is smaller and broader than *T. subfusiformis* (H 23 mm, W 12 mm) with more inflated whorls and with radial inflations, but with similar alternating wider and finer spiral ribs. The aperture and columella are very similar.

Range. — Aquitaine, France (Aquitanian and Burdigalian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Remarks. — Bellardi states this is a rare species. Bellardi (1882) also described a variety A (his fig. 33) which is larger (H 30 mm, W 20 mm) with smaller inflations and a more marked alternating wider and finer spiral ribs. Sacco (1890) named this variety *pernodulosa* but it is considered to represent normal intraspecific variation and therefore herein not accepted as separate taxon.

Taurasia heteroclita (Grateloup, 1845)

Pl. 1 Figs 9-10

Turbinella heteroclita Grateloup, 1845: explanatory text of pl. 23 and pl. 23 fig. 12bis.
Purpurella canaliculata Bellardi, 1882: 193-194, pl. 11 fig. 35.
Simplicotaurasia canaliculata Bellardi, 1882 – Sacco, 1890: No. 3081.
Taurasia canaliculata (Bellardi, 1882) – Cossmann, 1903: 77.

Types and localities.
Turbinella heteroclita Grateloup, 1845: Faluns jaunes de Saint-Paul; Dax, Aquitaine, France (Holotype: Université de Bordeaux, France).
Purpurella canaliculata Bellardi, 1882: Baldissero Torinese, E of Turin, Piedmont, Italy; Langhian/Helvetian, Miocene (Holotype: MPU, Rome).

Description. — This is a medium sized species (H up to 40 mm) with a short spire of slightly concave whorls that have a sharp but waving periphery at ⅔rd from the base. The surface is covered by regular spiral ribs. The aperture is about ⅔rd the shell height, has no sculpture along its edge but inside has about 10 elongated denticles with the lower one much lower placed

than in most species of the genus (resulting from the very wide siphonal canal). The narrow upper part of the aperture forms a narrow adapical canal. The columella has a markedly curved upper part between the parietal ridge and three columellar folds.

Range. — Aquitaine, France (Aquitanian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Remarks. — This species was described by Grateloup in his Atlas. The publication date of the atlas is based on Lesport et al. (2012). In their description of the new species *Taurasia sacyi*, Cossmann & Peyrot (1924: 257) compare the species to "*T. heteroclita*" which they clearly interpreted as belonging to the genus *Taurasia*.

Bellardi (1882: 193) introduced the genus *Purpurella* (non Dall, 1872) and the subfamily Purpurellinae with *Purpurella canaliculata* as only species. Cossmann (1903: 76-77) synonymised the genus *Purpurella* with *Taurasia*, as he did not agree with Bellardi's interpretation that the type specimen did not have columellar folds. Bellardi selected the holotype of *Purpurella canaliculata* from the Michelotti collection. That collection moved from MRSN to the MPU in Rome and is no longer easily accessible (pers. comm. Dr. D. Ormezzano).

Based on the similarity of the published figures of both taxa they are considered to represent a single species. The key difference observed is that in the figured specimen of *Purpurella canaliculata* the last two whorls are attached at a lower point. This species was overlooked by Beets (1985).

Range. — Aquitaine, France (Aquitanian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Taurasia nodosa Bellardi, 1882

Pl. 1 Fig. 11

Taurasia nodosa Bellardi, 1882: 195, pl. 11 fig. 34.
Taurasia nodosa (Bellardi, 1882) – Cossmann, 1903: 77.

Types and localities.
Taurasia nodosa Bellardi, 1882: Baldissero Torinese, Colli Torinesi, E of Turin, Italy (Holotype: MRSN BS.014.05.006).

Description. — A relatively large and broad species (H 40 mm, W 22 mm). It differs from *T. subfusiformis* by having a larger shell, more inflated whorls and a lower spire, marked radial inflations and notably no spiral ribs. The aperture has a shorter and narrower adapical canal and 14 plications inside.

Range. — Aquitaine, France (Aquitanian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Remarks. — According to Bellardi this is a rare species.

Taurasia pleurotoma (Grateloup, 1832)

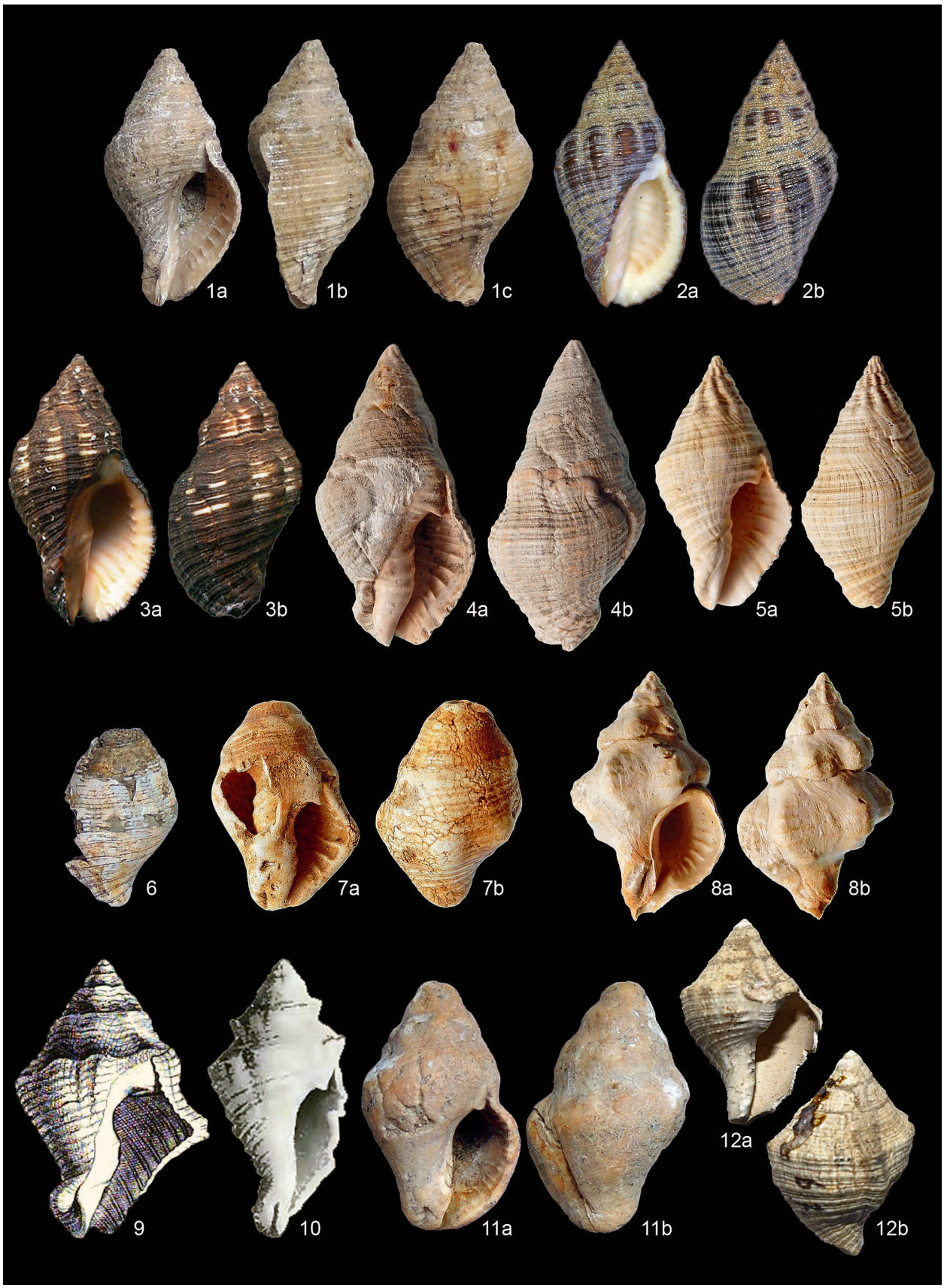
Pl. 1 Figs 4-5

Turbinella pleurotoma Grateloup, 1832: 336.
Turbinella pleurotoma Grateloup, 1832 – Grateloup, 1845: pl. 22 fig. 5.
Turbinella pleurotoma var. *minor* Grateloup, 1845: pl. 22 fig. 11.
Turbinella multistriata Grateloup, 1845: explanatory text of pl. 22 and pl. 22 fig. 16.
Taurasia pleurotoma (Grateloup, 1832) – Cossmann & Peyrot, 1924: 253-255, pl. 14 figs 5-7.
Taurasia pleurotoma var. *infundibulata* Cossmann & Peyrot, 1924: pl. 14 fig. 25.

Types and localities.
Turbinella pleurotoma Grateloup, 1832: Faluns jaunes de Saint-Paul, Dax, Aquitaine, France; (Holotype: Université de Bordeaux, France).
Turbinella pleurotoma var. *minor* Grateloup, 1845: pl. 22 fig. 11. Faluns jaunes de Saint-Paul, Dax, Aquitaine, France.
Turbinella multistriata Grateloup, 1845: Faluns jaunes de

PLATE 1

Fig. 1. *Taurasia subfusiformis* (d'Orbigny, 1852), Colli Torinesi, E of Turin, Piedmont, Italy; Langhian/Helvetian, Miocene, specimen figured in Bellardi, 1882: pl. 11 fig. 31 (H 29 mm, Bellardi & Sacco Collection BS.014.05.001, MRSN, photos Dr Daniele Ormezzano). **Figs 2-3.** *Taurasia striata* (de Blainville, 1832). **2.** Piasau Beach, Miri (S92.01), Sarawak, Malaysia, with hermit crab, 1992-1997, leg. R (H 39.2 mm, R T0606). **3.** Marau Sound, Guadalcanal, leg. He Jing (H 39.2 mm, shellspecimen.net, photo He Jing). **Figs 4-5.** *Taurasia pleurotoma* (Grateloup, 1832). **4.** Mérignac, Aquitaine, France, Aquitanian, Miocene, leg. Piet Hessel (H 48 mm, coll. IFSM 11340, photos Rudi Hessel). **5.** St. Martin d'Oney, Aquitaine, France, Aquitanian, Miocene, leg. Piet Hessel (H 23 mm, IFSM 23831, photos Rudi Hessel). **Figs 6-7.** *Taurasia coronata* Bellardi, 1882. **6.** Colli Torinesi, E of Turin, Piedmont, Italy; Langhian/Helvetian, Miocene (not the holotype, which has been lost), (H 20 mm, Bellardi & Sacco Collection BS.014.05.005, MRSN, photo Dr Daniele Ormezzano). **7.** St. Paul les Dax, Aquitaine, France, Burdigalian, Miocene, leg. Piet Hessel (H 29 mm, IFSM 12813, photos Rudi Hessel). **Fig. 8.** *Attilliosa sacyi* (Cossmann & Peyrot, 1924), St. Martin d'Oney, Aquitaine, France, Aquitanian, Miocene, leg. Piet Hessel (H 17 mm, IFSM 19214, photos Rudi Hessel). **Figs 9-10.** *Taurasia heteroclita* (Grateloup, 1845). **9.** Holotype of *Turbinella heteroclita*. Dax, Aquitaine, France from Faluns jaunes de Saint-Paul, Aquitanian, Miocene (H unknown, from Grateloup, 1845 pl. 23 fig. 12bis). **10.** Holotype of *Purpurella canaliculata* Bellardi, 1882, Baldissero Torinese, E of Turin, Piedmont, Italy; Langhian/Helvetian Miocene (H 40 mm, from Bellardi, 1882: pl. 11 fig. 35). **Fig. 11.** *Taurasia nodosa* Bellardi, 1882, Holotype, Baldissero Torinese, E of Turin, Piedmont, Italy; Langhian/Helvetian Miocene (H 38 mm, Bellardi & Sacco Collection BS.014.05.006, MRSN, photos Dr Daniele Ormezzano). **Fig. 12.** *Bufonaria szobensis* (Csepreghy-Meznerics, 1956), Holotype of *Taurasia szobensis* from "Large outcrop" at Szob, Hungary, Miocene, Badenian (Langhian equivalent), Sámsonháza Formation (H 16 mm, Csepreghy-Meznerics collection in the Hungarian Natural History Museum, Budapest M.61.4309, photos Dr. Alfréd Dulai).


1a
1b
1c
2a
2b
3a
3b
4a
4b
5a
5b
6
7a
7b
8a
8b
9
10
11a
11b
12a
12b

Saint-Paul, Dax, Aquitaine, France (Holotype: Université de Bordeaux, France).

Taurasia pleurotoma var. *infundibulata* Cossmann & Peyrot, 1924: Léognan, Aquitaine, France (coll. de Sacy).

Description. — Shell with a high spire. Initial whorls with a wrinkled surface due to the presence of radial inflections which disappear on the later whorls. Later whorls with a sculpture of broad spiral ribs and wider interspaces with 1-2 fine riblets (as in *T. subfusiformis*). Aperture slightly less than half the shell height, with some grooves and wrinkles along its edge and up to 12 plications inside with the lower one much lower placed as in *T. heteroclita*. The narrow upper part of the aperture forms an adapical canal. The columella has a markedly curved upper part between the parietal ridge (as in *T. heteroclita*) and three well developed columellar folds and two weaker folds extending over the broad callus.

Range. — Aquitaine, France (Aquitanian and Burdigalian, Early Miocene) and Piedmont, Italy (Langhian, Middle Miocene).

Remarks. — The outline of this species reminded Grateloup of a turrid, hence the name *Turbinella pleurotoma*; the name *Pleurotoma* Lamarck, 1811 is now considered a synonym of *Turris* Batsch, 1789. Grateloup (1845) also described a variety *minor* and Cossmann & Peyrot (1924) a variety *infundibulata* which are considered to represent normal intraspecific variation and therefore herein not accepted as separate taxon. Cossmann & Peyrot (1924: 253) recognised *T. multistriata* described by Grateloup from the same outcrop as synonym.

Taurasia striata **(de Blainville, 1832)**

Pl. 1 Figs 2-3, Pl. 2 Figs 1-14, Textfig. 1, Table 1

Non *Buccinum striata* Martyn, 1784 from New Zealand (which in the 19th century has also been referred to as *Purpura striata* Martyn, 1784).

Buccinum strigosum Gmelin, 1791: 3494 no. 103. Non *Buccinum strigosum* Gmelin, 1791: 3476 (= *Galeodea echinophora* (Linnaeus, 1758), in Cassidae).

Purpura striata de Blainville, 1832: 231-232.

Purpura striata Quoy & Gaimard, 1833, 2: 562-563, pl. 37 figs 12-14.

Purpura buccinea Deshayes, in Lamarck, 1844, X: 92-93.

Purpura flammea Mørch, 1852: 90 (no. 1705).

Taurasia buccinea (Deshayes, in Lamarck, 1844) – Beets, 1985: 42.

Taurasia niasensis Beets, 1985: 43-44, pl. 2 figs 1-3.

Taurasia striata (Quoy & Gaimard, 1833) – Houart, 1996: 387.

Types and localities.

Buccinum strigosum Gmelin, 1791: type locality not mentioned (Syntype: UZM; illustrated in Cernohorsky, 1974: 178, fig. 51).

Purpura striata de Blainville, 1832: Dorey Harbour (now Manokwari) Irian Jaya, Indonesia (two syntypes from the Quoy & Gaimard collection: MNHN-IM-2000-0255).

Taurasia niasensis Beets, 1985: Limestone mountains (old barrier reef) of Cudrubaho, East of Kampong Bawanauru, Nalawe Valley, Nias Island, about 200 m altitude (Loc. 64), leg. Schroeder (Holotype: RGM 315256).

Material examined. — **Recent**: THAILAND, RANONG (ANDAMAN SEA): rocky shore close to Prapat Beach of Suksamran district, leg. Kasae Sahato (ACRSD, 3 sp.); MALAYSIA, SARAWAK (SOUTH CHINA SEA): Temasya beach / Pantai Tanjung Batu, Bintulu, dead under submerged rock in shallow water at low tide, iii.2014, leg. Mohammad Marzuki (Marzuki ME0004213, 1 sp.); Bungai beach, Tanjung Batu, 6 km W of Bekenu (S92.28a), 1 sp. alive on rocks low in the tidal zone and one old specimen on the beach, leg. R, not kept; Hawaii Beach, Kampong Ra'an, S of Miri (S92.04), alive on driftwood fixed low on the beach, ix.1993, leg. R (R, T2182, 7 sp.); Tanjong Lobang, Miri (S92.21), lower part of the littoral zone, alive on rocks and on wood, abundant, 1992-1997, leg. R (R T0710, 26 sp); Piasau Beach, Miri (S92.01), on beach carried by hermit crabs, 1992-1997, leg. R (R T0606, 5 sp.); BRUNEI: Jerudong Beach, Jerudong, Muara (S93.27a), Holocene sand dredged from about 15 m depth along linear clastic coastline, 1993-1997, leg. R (not kept) (several sp.); 1 km W of Tanjong Batu, Muara (S96.24a), collected on the beach, around 1990, leg. R. Villar (PNHS, 4 sp.); MALAYSIA, SABAH (SOUTH CHINA SEA): Sabang, Kota Kinabalu, i.1962, leg. Mary Saul (National Museum Cardiff PR32576 and PR32656 – as *Purpura* (*Cronia*) *buccinea*) – also ZMA.MOLL.27595, 1 sp.); Pantai Dalit, Tuaran (S97.18a), alive on rocks low in tidal zone, v.1997, leg. R (R T4145, 1 sp.); MALAYSIA, SABAH (SULU SEA): Berhala Island, Sandakan, 10.ii.1963, leg. Mary Saul (ZMA.MOLL.27595, 1 sp.); INDONESIA, SUMATRA (INDIAN OCEAN): Pulau Weh, Aceh, leg. He Jing (shellspecimen.net, 3 sp; shellsfromchina.com 144537-144544, 85111, 89949 – 10 sp. of which the first five are now in R T8184 2 sp.; NCB 3 sp); Meulaboh harbour, Aceh, 16.ii.2011, leg. Gras & Regter (ZMA.MOLL.348701, 2 sp.); Sibolga Beach, 1953, leg. J.P. van Niel (ZMA.MOLL.29736, 1 sp.); INDONESIA, EAST KALIMANTAN: 14 km N of Mahakam river mouth, iii.1973, leg. R. Lockyer [AMS, C244930, C244933]; INDONESIA, MALUKU: 1930, ex coll. A.J. Duymeer van Twist (ZMA.MOLL.29763, 1 sp.); 1920, ex coll. Schepman (ZMA.MOLL.29154, 2 sp.); Ceram, leg. H. Bartstra (ZMA.MOLL.225672.1, 6 sp.); INDONESIA, IRIAN JAYA: no locality, early 20th century, leg. Hoedt (ZMA.MOLL.29737, 3 sp.); Wasiar, Wandaman Bay, 1955, leg. G.V. Hansen (ZMA.MOLL.29735, 3 sp.); Japna Island, Schouten Group, iii.1943, leg. E.L. Troughton [AMS, C244932]; PAPUA NEW GUINEA: North Coast 5°12'30"S, 145°47'00"E, 1919, leg. Capt. W. Burrows [AMS, C45679]; New Britain, Tala Sea, 1961 [AMS 74495]; Rabaul market, New Britain, 1973, leg. "locals" [AMS, C244931]; Kihili, Bougainville Islands, 1904 [AMS, C17482]; PHILIPPINES, DAVAO: Luban, leg. J. Mulder (RMNH.MOL.198747, 2 sp); PHILIPPINES, MINDANAO: 80°44'0.39"N 13°12'40.74"E, Aliguay Island, sand, sandy gravel and mud at 150-200 m, 2010 (P 595937, 1 sp.); SOLOMON ISLANDS: Marau Sound, Guadalcanal, leg. He Jing (shellspecimen.net, 1 sp.); 8°00'00"S, 158°00'00"E, 1877 [AMS, C35887]; Mikari harbour, San Cristobal Island, 1873, leg. J. Brazier [AMS, C7505]; AUSTRALIA, NORTHERN TERRITORY: Daly River mouth, 1990 [AMS, C245100]; Darwin [Queensland Museum,

MO22562]. Fossil. – **Holocene**: MALAYSIA, SARAWAK: temporary outcrop 300 m SE of Canada Hill, Miri (F94.01), smooth form, Holocene, 6350 ± 70BP, deposits of intertidal rocks, leg. R (R H1108, 4 sp.); INDONESIA, SULAWESI: Cave Panganrejang Tudeja, Bonthain, layer A-B, smooth form, 1937, leg. Dr. P.V. van Stein Callenfels (ZMA. MOLL.29764, 1 fr.); **Plio-Pleistocene** (Presumed): INDONESIA, SUMATRA (INDIAN OCEAN):, Limestone mountains (old barrier reef) of Cudrubaho, East of Kampong Bawanauru, Nalawe Valley, Nias Island, about 200 m altitude (Loc. 64), ribbed form, leg. Schroeder (RGM315256, 1 sp., holotype of *T. niasensis*); Alasa, alongside river of the Murij, Nias Island (Loc. 42), ribbed form, leg. Schroeder (RGM315257, 1 sp., paratype of *T. niasensis*); Dawrenam, Malawi,

Locality	Height (mm)	Width (mm)	# whorls	# plications	# inflations	Remarks
Tanjong Lobang, Miri, Sarawak	43.5	21.7	5.25+	9	10	R T0710, apex damaged
	40.3	20.7	5+	10	11	
Bakam, Sarawak	40.3	19.3	7+	8	9	R T2182, apex damaged
Irian Jaya, Indonesia	47.8	26.0	4.5+	9	10	ZMA.MOLL.29737, first two specimens apex damaged
	50.3	23.7	6+	7	10	
	45.2	21.7	7	9	10	
Schroeder loc. 64	33.1	16.5	6+	8	7	RGM 315256, Holotype of *T. niasensis*, ribbed form, apex damaged, aperture partially damaged. Not fully grown, drill hole near apex
Schroeder loc. 42	22.9	12.4	4+	8	7	RGM 315257, Paratype of *T. niasensis*, ribbed form, apex damaged, aperture damaged, worn (rolled)
Schroeder loc. 100	21.9	12.3	4.5+	8	7	RGM 315258, Paratype of *T. niasensis*, ribbed form, apex damaged, aperture damaged
	22.1	12.0	4.5+	7	7	
Schroeder loc. 102	30.8	14.9	6+	8	8	RGM 315259, Paratype of *T. niasensis,* smooth form, worn and overgrown with calcareous algae, but aperture fully grown
Pulau Weh, Sumatra, Indonesia	50.7	28.7	5.5+	12	10	144541; R T8184, ribbed form, apex damaged
	46.5	26.6	5.5+	10	8	144537; R T8184, ribbed form, apex damaged
	40.8	22.4	5+	9	9	144540; R T8184, intermediate form, apex damaged
	49.6	24.3	5.5+	10	8	144539; NCB, ribbed form, apex damaged
	48.7	28.4	5+	10	10	144538; NCB, ribbed form, apex damaged

Table 1. Measurements of *Taurasia striata*.

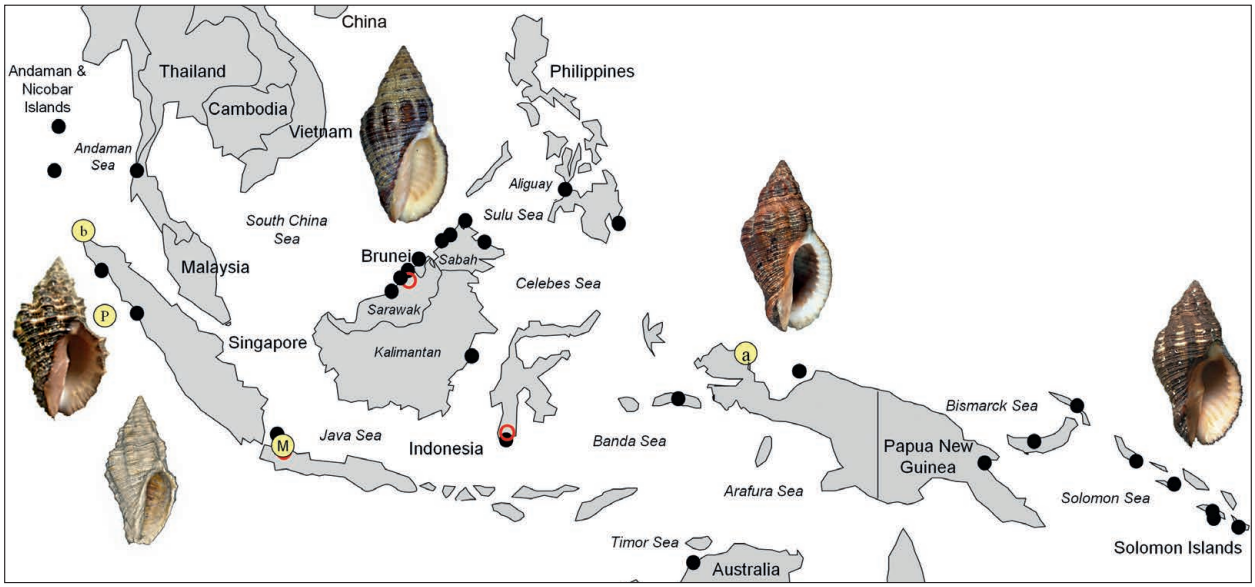
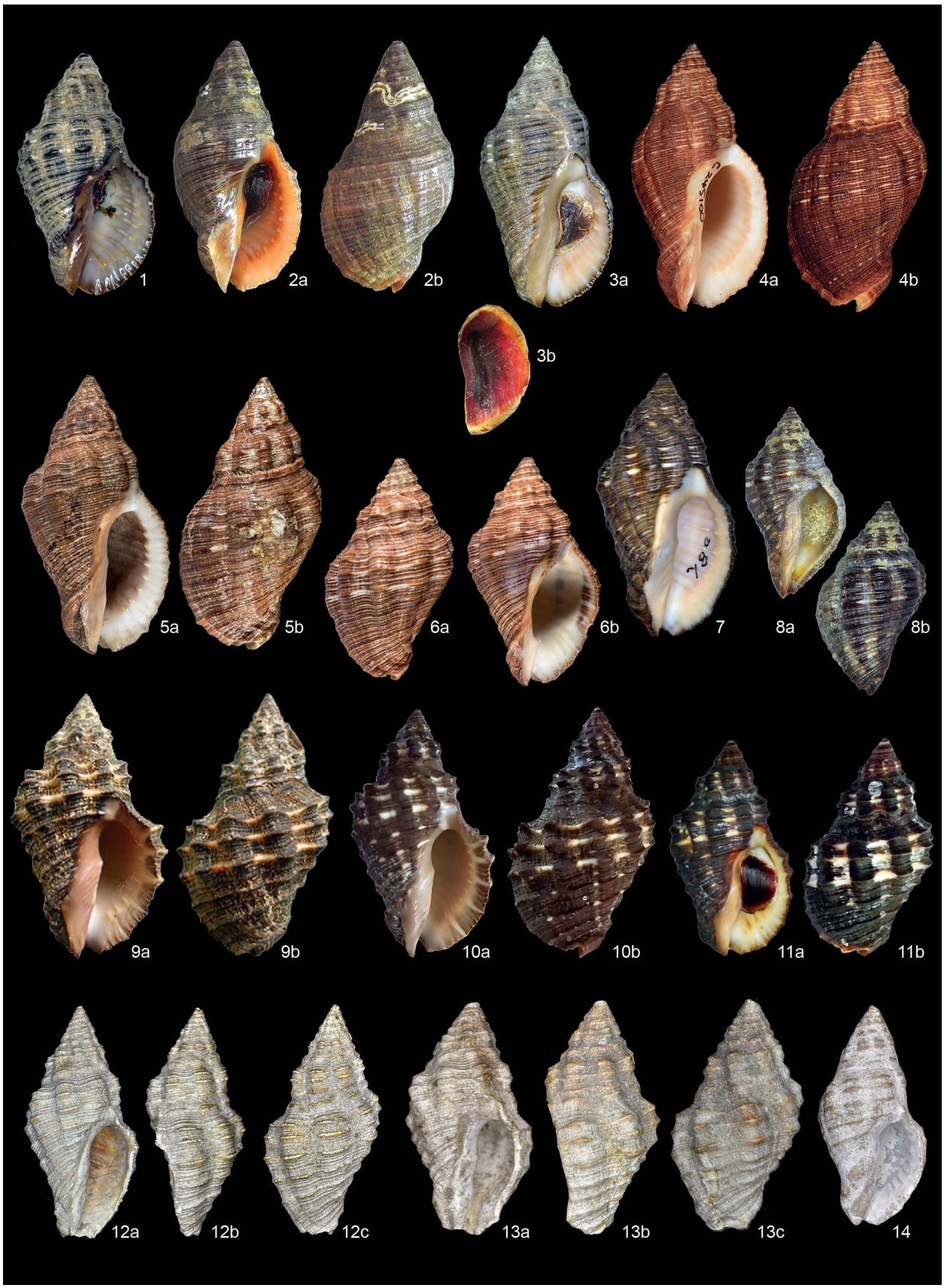


Fig. 1. Distribution of *Taurasia striata*. Recent material: solid dots; (a) type locality in Irian Jaya; (b) Pulau Weh, Sumatra, ribbed form. Open red circles: Holocene; (P) type locality of *Taurasia niasensis*, Plio-Pleistocene; (M) Miocene. The figured shells are reproduced from Pls 1-2.


1
2a
2b
3a
4a
4b
3b
5a
5b
6a
6b
7
8a
8b
9a
9b
10a
10b
11a
11b
12a
12b
12c
13a
13b
13c
14

Nias Island (Loc. 100), ribbed form, leg. Schroeder (NRGM315258 (2 sp., paratypes of *T. niasensis*); Hilidraonolasi, upper course of the Siuani River, Nias Island (Loc. 102), smooth form, leg. Schroeder (RGM315259, 1 sp., paratype of *T. niasensis*); **Miocene**: INDONESIA, JAVA: Nyalindung, ribbed form, Middle Miocene, Preangerian, Nyalindung Formation (Dharma, 2005, several sp.). For measurements see Table 1.

Description. — Shell up to 5 cm high, generally slender. The 7-10 axial ribs can be broad and rounded (Pl. 1 Fig. 2) or narrow and rounded (Pl. 2 Fig. 5), narrow and angular (Pl. 2 Fig. 4) or narrow and vague (Pl. 1 Fig. 3), or even absent (Pl. 2 Fig. 2). The shape varies as the whorls may be smoothly rounded or develop a shoulder, and the aperture can be relatively smaller (Pl. 2 Fig. 3) or larger (Pl. 2 Fig. 4). The shell is typically dark brown but in the axial depressions the main spiral ribs may be white. This colour is never present on the axial ribs. The colour of the aperture and callus varies from grey through pale yellow or salmon to bright orange. As mentioned by de Blainville (1832: 231 "Opercule de Pourpre") the operculum has a lateral nucleus (Pl. 2 Fig. 3b).

Habitat. — In northern Sarawak this species is common in the lower part of the littoral zone, mostly on sandstone rocks, but also on pieces of driftwood lodged between rocks or between the sand on the lowest parts of the beach. A thriving population lived in an intertidal rocky area at the southern part of Tanjong Lobang, Miri, Sarawak, Malaysia, now largely covered in concrete. Material from a Holocene outcrop behind Canada Hill confirms the species lived in the Miri area since it became flooded due to the Holocene sea level rise (around 6350 ± 70 BP as indicated by a C14 dating of another mollusc species from the same outcrop). Records from other localities are also from intertidal to shallow subtidal environments, on rocks or wood, always limited to very few individuals. Everson (1996) reports the species as *Thais buccinea* found snorkelling in the mouth of the Lungga River in the Solomon Islands, on a silty log.

Range — This species is frequently described as occurring from the Solomons to the Philippines (e.g. Beets, 1985: 42) but few mention specific localities. Additional localities: Luban, Davao, Philippines; material in NBC (Beets, 1985: 42); Ambon, Maluku, Indonesia (Houart, 1996); Seribu Islands, Java Sea, western Indonesia (Dharma, 2005: 170, pl. 60 fig. 10); Ross Island and Bumula Creek, Little Andaman in the Andaman Islands, India and Malacca, Car Nicobar, Nicobar Islands, India (Subba Rao & Surya Rao, 1993: 103-104, pl. 12 figs 3-4); various localities in Papua New Guinea and Northern Territory in Australia (The Atlas of Living Australia http://biocache.ala.org.au).

The species is missing from the checklist of Muricidae from the South China Sea (Tan, 2000) but the material recorded below extends its distribution to include NW Borneo (Sarawak, Brunei and Sabah; the first records from the South China Sea), W Sumatra (Indian Ocean) and W Thailand (Andaman Sea), see Fig. 1.

On internet several sources refer to other localities that cannot be verified and based on photos presented, some are clearly based on species of other genera. Spry (1961: species 155) records the species as *Thais buccinea* from Kawe and Mjimeuna in Tanzania which would be a substantial westward extension of its distribution, but the species is not figured and therefore this record remains unconfirmed. The National Museum of Natural History / Smithsonian Institution database (http://collections.nmnh.si.edu/search) comprises a large number of records of "*Purpura buccinea*" with localities in the Indian Ocean: Sri Lanka, India, Pakistan, Somalia, Seychelles, Madagascar, South Africa. Photographs of a selection of these samples were kindly made by Dr. Christopher Meyer which leaves no doubt they all concern *Purpura bufo* Lamarck, 1822. It is likely Spry's record concerns the same species – he does not mention *Purpura bufo* which is widespread in the region.

The records (as *Thais buccinea*) from Pulau Mandidarah and Kudat from the Sulu Sea, Sabah, Malaysia in the database of The Academy of Natural Sciences Philadelphia (ANSP) are trusted as the shells were collected and identified by Mary Saul who knew this species well as is evidenced by her samples and labels in other collections (e.g. those donated to ZMA and now present in Naturalis). The ANSP database also records a sample donated by Mrs. Elaine Phillips from Kampung Tajau (N of Kota Kinabalu) from the South China Sea coast of Sabah, Malaysia.

PLATE 2

Figs 1-14. *Taurasia striata* (de Blainville, 1832). **1.** Sabang, Kota Kinabalu, Sabah, Malaysia, i.1962, leg. Mary Saul (H 40.0 mm, ZMA.MOLL.27595). **2.** Rocky shore close to Prapat Beach of Suksamran district, Ranong, Thailand, 16.ii.2015, leg. Kasae Sahato (H 43.1 mm, coll. ACRSD, photo Kasae Sahato). **3a.** Hawaii Beach, Kampong Ra'an (S92.04), S of Miri, Sarawak, Malaysia, on driftwood fixed low on beach, ix.1993, leg. R (H 40.3 mm, R T2182). **3b.** Operculum. **4.** Daly River mouth, Northern Territory, Australia (H 48.2 mm, AMS C245100; Photo Dr. Mandy Reid, © Australian Museum, Sydney). **5-6.** Types, Manokwari (Dorey Harbour), Irian Jaya, Indonesia, leg. Quoy & Gaimard (MNHN-IM-2000-0255, photos M. Caballer, MNHN, Project E-RECOLNAT: ANR-11-INBS-0004, © Muséum national d'Histoire naturelle, Paris). **5.** Holotype, H 44.9 mm. **6.** Paratype, H 41 mm. **7.** Luban, Davao, Philippines, leg. J. Mulder (H 42.5 mm, ZMA.MOLL.198747). **8.** Piasau Beach, Miri (S92.01), Sarawak, Malaysia, with hermit crab, 1992-1997, leg. R (H 16.8 mm, T0606). **9-11.** Pulau Weh, Sumatra, leg. He Jing (H 49.3, 45.1 and 47.0 mm, shellspecimen.net, photos He Jing). **12.** Holotype of *Taurasia niasensis* Beets, 1985, East of Kampung Bawonauru, Nias, Sumatra, Indonesia (Loc. 64), ribbed form, Plio-Pleistocene, leg. Schroeder (H 33.4 mm, RGM315257). **13.** Paratype of *Taurasia niasensis*, Nias, Sumatra, Indonesia (Loc. 100), ribbed form, Plio-Pleistocene, leg. Schroeder (H 21.9 mm, RGM315258). **14.** Paratype of *Taurasia niasensis*, Nias, Sumatra, Indonesia (Loc. 102), smooth form, Plio-Pleistocene, leg. Schroeder (H 30.8 mm, RGM315259).

Thus far the species was only known from recent material. In this paper also Holocene material is presented. The synonymisation with *T. niasensis* adds a supposed Plio-Pleistocene record and Dharma (2005: pl. 134 figs 18a-b) adds a Miocene record. The recorded "earliest Miocene to recent" occurrence of this species in Vermeij & Carlson (2000: 25, table 3) refers to the genus, rather than the species.

Remarks. — The name *Buccinum strigosum* Gmelin, 1791 appeared twice in Gmelin's work. First on p. 3476; this is a junior synonym of *Buccinum echinophorum* Linnaeus, 1758 now in Cassidae as *Galeodea echinophora* (Linnaeus, 1758). Already de Blainville (1832: 231) mentioned this synonymy. As *Buccinum strigosum* Gmelin, 1791: 3476 is a junior homonym of *Buccinum strigosum* Gmelin, 1791: 3494, Gmelin's name cannot be used. The first available name is the one given by de Blainville (1832).

Although de Blainville mentioned three syntypes of *Purpura striata*, Fischer-Piette & Beigbeder, 1943: 433 only saw two specimens of which they assigned the larger one as holotype and the other as paratype.

The holotype of *T. niasensis* was collected from barrier reef deposits (as is marked on a label accompanying the specimen). The specimen has a drill hole near the apex indicating it was killed by a carnivore mollusc. The specimens from localities 42 and 102 are smoother but also rolled as it is typical for many shells found on the beaches of coral reef lagoons (own observations). This species therefore appears to be associated with coral reefs.

A single specimen has been recorded from 150-200 m water depth near Aliguay Island in the Philippines (conchology. be, more details above). Another specimen about which less details are available was recorded as dredged at 80-120 m also near Aliguay Island (topseashells.com; this specimen was sold). It is very unlikely, however, that this species lives in such deep-water environment. The species has been recorded alive on logs (pers. obs.; Everson, 1996) and could have reached this habitat on a floating log (either the animal fell off a floating log or the log sank with the animal on it). In addition, many records of shells collected at Aliguay Island come from fishermen and are unreliable as even terrestrial shells are reported as having been collected from deep water near Aliguay Island (pers. comm. Henk Dekker).

Deshayes introduced *Purpura buccinea* as a replacement name for *Purpura striata* as he thought Martyn's name had precedence. He probably overlooked de Blainville's paper.

The name given by Deshayes is frequently used (as *Thais buccinea* (Deshayes)). Quoy & Gaimard prepared a manuscript describing many new species including *Purpura striata*. De Blainville referred to this manuscript, but as his paper was published in 1832 and Quoy & Gaimard's paper in 1833, de Blainville is now recognised as author of this species (Houart, 2015).

Based on fossil material (assumed Plio-Pleistocene from Nias Island, Sumatra), Beets (1985) described a new species *Taurasia niasensis* with conspicuous spiral ribs and a slight shoulder. Beets' holotype (Pl. 2 Fig. 12) is not fully grown, even though it is the largest specimen (33 mm), and the aperture is thin. Only the paratype (Pl. 2 Fig. 14) from locality 102 is fully grown – but that specimen is rather smooth. Dharma (2005: 338, pl. 134 fig. 18) figured a specimen from the Miocene at Nyalindung, Java, Indonesia. It has a very similar shape to the specimens from Nias Island but includes adults as he reports a height varying between 32 and 48 mm.

The first recent specimens with a similar shape have been collected at Pulau Weh, Aceh, Sumatra, Indonesia (Pl. 2 Figs 9-11; recorded by He Jing on shellspecimen.net with additional specimens figured on shellsfromchina.com) recorded as *Semiricinula muricoides* (de Blainville, 1832). The adapical and abapical folds on the siphonal fasciole demonstrate this is a *Taurasia*. The shell is up to 5 cm high and markedly broader than the fossil specimens and therefore also has a wider aperture. The aperture has a salmon colour like some other populations. There are six spiral ribs with several finer riblets in between each pair of ribs; the upper three ribs are strongest, with node-like inflations, whereas the lower three are weaker and slightly wider spaced. The shell has a mid-brown to dark grey colour, the spirals are darker brown on the protuberations and cream coloured in between. Within this population there are also shells closer to the smooth form (Pl. 2 Fig. 11). Some of these shells were purchased: two are in the author's personal collection and three were donated to NCB. At two other localities in NW Sumatra (Meulaboh Harbour and Sibolga Beach) only smooth specimens occur.

Most shells reviewed (in collections, publications and in internet) are rather smooth, but the occurrence of populations with axial ribs (e.g. Pl. 2 Figs 4-7) and the variation in the population at Pulau Weh demonstrates these are forms within a single species. Such variation is frequent in other Rapaninae (e.g. see below for *Semiricinula konkanensis*). The holotype and paratype of *T. striata* from Manokwari in Irian Jaya are ribbed but also relatively slender (recent; Pl. 2 Figs 5-6). Also the type material of *T. niasensis* from several closely located outcrops on Nias Island, Sumatra (Plio-Pleistocene) comprises ribbed and smooth specimens (Pl. 2 Figs 12-14).

Semiricinula **von Martens, 1904**

Type species: *Purpura muricina* de Blainville, 1832.

Remarks. — De Blainville already recognised a group he described as "Les P. Semi-Ricinules" (de Blainville, 1832: 211) which are generally spiny but of which the aperture has denticles only on the internal part of the right side. Lamy (1918) and Fischer-Piette & Beigbeder (1944) have reviewed the type specimens in the MNHN, Paris, France.

The shells have spiral ribs of varying strength – typically the second and the third ribs from the suture are double, with finer riblets in between. The main ribs form protuberations. The crossing coarse axial ribs cause a regular pattern of elongate nodules. Fine scaly sculpture (following the growth lines) on parts of the shell.

Aperture elongate and glossy with marked denticles that extend inwards as plications. The columella has a comparatively strong adapical fold on the siphonal fasciole and two abapical folds that are more oblique. The shell typically has a dark brown background colour, with elongate whitish spots in the axial depressions on the main spiral ribs. Operculum elongate triangular, with a lateral nucleus.

The size of species in this genus is quite variable with local populations of particularly large or small specimens. Whereas the recent material from NW Borneo has all been collected in the intertidal/shallow subtidal rocky areas, the fossils collected by the author are from the middle to outer shelf environments at water depths of 50 m or more. Possible explanations are given under *S. muricoides* (de Blainville, 1832).

***Semiricinula muricina* (de Blainville, 1832)**

Pl. 4 Figs 1-3, Textfig. 2d

Purpura muricina de Blainville, 1832: 218-219, pl. 10 figs 2-4.
Purpura infumata Hombrom & Jacquinot, 1848: 85-86, pl. 22 figs 3-4.

Types and localities.
Purpura muricina de Blainville, 1832: "Des mers Australes, d'où elle a été rapportée par MM. Quoy et Gaymard" (10 syntypes MNHM-IM-2000-0165).
Purpura infumata Hombrom & Jacquinot, 1848: Samoa, French Polynesia (2 syntypes MNHM-IM-2000-996).

Material examined. — **Recent**: MALAYSIA, SARAWAK: Tanjong Lobang, Miri, alive in littoral zone between rocks, xii.1992, leg. R (R T1735, 21 sp.); French Polynesia: Afashiti, Tahiti (as *S. muricoides*) leg. He Jing (shellsfromchina.com, 2 sp.).

Description. — Shell up to 30 mm high (the type specimens are 25 mm high) with strong spiral ribs and five well marked and well-rounded denticles in the aperture, uppermost one can be weak in some specimens. Denticles present even in very young specimens, in adults visible at regular intervals along the plications inside the aperture. Aperture is bluish inside with a purple edge.

Range. — Confirmed records from Borneo to Samoa and Tahiti.

Remarks. — The species has been recorded from a single locality in NW Borneo where there was a thriving population. It is not certain the species still lives here as a large part of the rocky area has disappeared under concrete.

***Semiricinula muricoides* (de Blainville, 1832)**

Pl. 3 Figs 1-11, Textfig. 2a, Table 2

Purpura muricoides de Blainville, 1832: 219, pl. 10 fig. 5 (Non *Purpura muricoides* Hombron & Jacquinot, 1848).
Morula borneensis W.H. Dall, 1923: 304-305.
Semiricinula muricoides (de Blainville, 1832). – Claremont et al., 2013.

Types and localities.
Purpura muricoides de Blainville, 1832: "D'Amboine et des côtes de la Nouvelle-Zélande, d'après MM. Quoy et Gaimard" (the seven syntypes in MNHN-IM-2000-163 are all labelled as originating from New Zealand).
Morula borneensis W.H. Dall, 1923: Samoa. Also Labuan Island, Sabah is mentioned (5 syntypes from latter locality in USNM 336237).

Material examined. — **Recent**: SINGAPORE: Changi Beach, leg. He Jing (shellspecimen.net, 1 sp.); MALAYSIA, SARAWAK: Tanjung Batu, Bintulu (S92.09), sandstone rocks in littoral zone, iv.1992, leg. R (R T0837, 17 sp.); BRUNEI: Penanjong Beach, Tutong (S13.05), sandstone rocks in littoral zone, xi.2013, leg. R., not collected; rocks near cape, Jerudong, Muara (S93.27b), sandstone rocks in littoral zone, ix.1993, leg. R (R T3132, 10 sp.); MALAYSIA, SABAH (SOUTH CHINA SEA): Kampong Pohon Batu, Labuan (S93.24b) coral reef lagoon, under coral slabs in intertidal zone, vii.1995/iii.1997, leg. R (R T2821, 7 sp; R T4005, 2 sp.); Tanjong Layang Layangan, Labuan

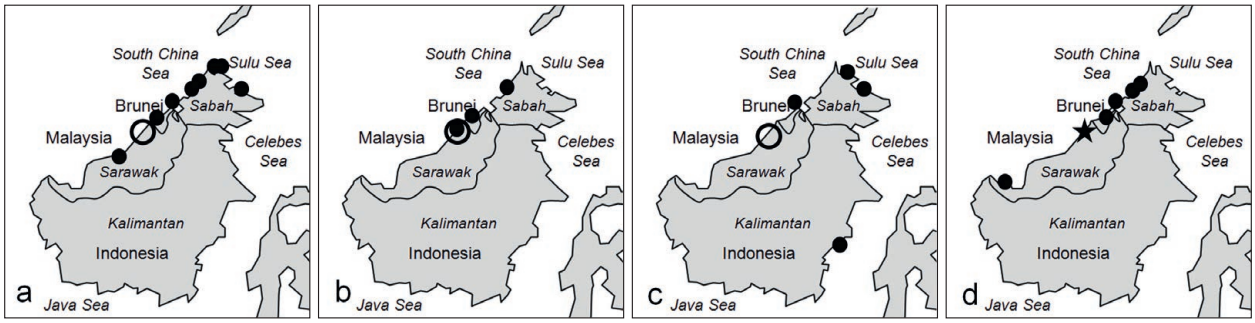


Fig. 2. Confirmed records from Borneo island of *Semiricinula* species and *Orania nodosa*. Each of these species has a much larger distribution but individual records need to be checked. Full dots – recent populations, open circles – fossils from the Miocene. (a) *S. muricoides*, (b) *S. konkanensis*, (c) *S. turbinoides*, (d) *Orania nodosa* and *S. muricina* (star).

(S93.23d), alive on mangrove trees in coral lagoon, vi.1993, leg. R (R T1482, 5 sp.); Membedai, Labuan (S93.22b), sandstone rocks in littoral zone, vi.1993, leg. R (R T3131, 2 sp.); 1 km N of Tanjung Aru, Labuan (S93.26a), sandstone rocks in littoral zone, vi.1993, leg. R (R T1943, 13 sp.); Labuan Island, leg. W.E. Crane (Dall, 1923: 304-305); Kampong Beringgis, Kinarut (S96.23b), rocks in littoral zone, with muddy brackish water influx, v.1996, leg. R (R T3304, 10 sp); Tanjung Aru, Kota Kinabalu (S92.16a), sandstone rocks in littoral zone, vi.1992, leg. R (R T0877, 9 sp.); Tanjung Aru, Kota Kinabalu (S92.16d), rocks in mud flat north of hotel, brackish water influx, vi.1992, leg. R (R T2338, 12 sp.); Tanjung Aru, Kota Kinabalu, 19.iv.1999, leg. H.H. Kool ZMA.MOLL.65426, 2 sp.); Pantai Dalit, 8.iv.2000, leg. H.H. & S.P. Kool (ZMA.MOLL.55369, 7 sp); SABAH (SULU SEA): Pantai Bak Bak, 20 km N of Kudat, 4.xii.2000, leg. H.H. & S.P. Kool (ZMA.MOLL.55408, 2 sp.); Malawali Canal, iii.1962, leg. M. Saul (ZMA.MOLL.35831, 1 sp.; ZMA.MOLL.35830, 2 sp.); Sandy Plain, Sandakan, v.1963, leg. M. Saul (ZMA.MOLL.27590, 2 sp.); Batu Sapi, Sandakan, vi. 1963, leg. M. Saul (ZMA.MOLL.27589, 2 sp.); Karimanting, Sandakan, 8.iii.1963, leg. M. Saul (ZMA.MOLL.27587, 2 sp.); Fossil: **Miocene**: MALAYSIA, SARAWAK (SOUTH CHINA SEA): Beraya-Bekenu Seacliffs, Locality F97.08, km 3.55-3.60 (outcrop A), leg. R (R F4113, 2 sp.); Miri-Bekenu Road, Locality F05.04 (km 28.5 left, leg. R (R F4219, 1 sp). For measurements see Table 2.

Description. — Shell (Pl. 3 Figs 1-3) with five to six conspicuous spiral ribs and a slight shoulder. Main ribs smooth and occur in pairs that wave over axial inflations. Finely serrated secondary spirals occur between the primary ones. Edge of the outer lip sharp with interior grooved. Within the aperture between each pair of ribs there is a corresponding rounded denticle which continues inward as plication – resulting in 4-5 denticles and plications. The plications alternate with grooves (which on the outside are expressed as spiral ribs). The grooves are well expressed along the whole edge of the outer lip, whereas the basal plications are rather inconspicuous. Aperture ovoid, adapical canal rather narrow and marked by a parietal ridge on the inner lip. The siphonal canal not well defined, yet deeply notched.

Dark brown to purplish colour but in the axial depressions (and locally on the protuberations) the main spiral ribs are cream coloured. The edge of the aperture is typically dark purple, inwards becoming dark orange-brown, turning pale bluish grey beyond the denticles. The orange-brown colour continues inward on the denticles and plications, albeit in a paler shade than on the edge. Other specimens have white denticles and plications (e.g. Pl 3 Fig. 1).

Range. — This species lives in the western Pacific where it has a wide distribution, from Singapore to Ambon (Indonesia).

Locality	Height (mm)	Width (mm)	# whorls	# plications	# inflations	Remarks
Tanjong Aru Kota Kinabalu – brackish influx	29.2	15.8	6+	4	8	R T2338, apex damaged
	27.8	16.2	6+	4	7	
	27.5	15.2	6+	4	8	
Tanjong Layang Layangan – mangroves	22.2	11.9	6+	4	8	R T0877, apex damaged
	18.1	10.8	4.5+	4	8	
Beraya – Bekenu outcrops	18.1	11.3	6+	4	7	R F4113, mangrove type, apex damaged; fossil
	18.5	10.5	5+	4?	7	

Table 2. Measurements of *Semiricinula muricoides.*

PLATE 3

Figs 1-9. *Semiricinula muricoides* (de Blainville, 1832). **1-3.** Typical form. **1-2.** "New Zealand", syntypes 2 and 3 out of 7, leg. de Blainville (MNHM-IM-2000-0163, photos M. Caballer MNHN, Project E-RECOLNAT: ANR-11-INBS-0004, © Muséum national d'Histoire naturelle, Paris). **1.** H 28.8 mm. **2.** H 20.7 mm. **3.** Kampong Pohon Batu, Labuan Island, Sabah, Malaysia, leg. R (H 24.4 mm, R T4005). **4-6.** Brackish water form. Tanjung Aru, Kota Kinabalu, Sabah, Malaysia, mud flat with brackish water influx, leg. R (R T2338). **4.** H 29.1 mm. **5.** H 27.8 mm. **6.** H 27.4 mm. **7-11.** Mangrove form. **7-8.** Tanjong Layang Layangan, Labuan Island, Sabah, Malaysia, leg. R (R T1482). **7.** H 22.1 mm. **8.** H 18.1 mm. **9.** Beraya-Bekenu Seacliffs, km 3.55-3.60 (outcrop A), Sarawak, Malaysia, leg. R (H 18.5 mm, R F4113). **Figs 10-11.** Syntypes of *Morula borneensis* W.H. Dall, 1923. Labuan Island, Sabah, Malaysia (USNM 336237, photos Dr. Christopher Meyer). **10.** H 25 mm. **11.** H 19 mm. **Figs 12-18.** *Semiricinula konkanensis* (Melvill, 1893). **12, 18.** Syntypes from Mumbay, India (NMW 1955.158.00318, photos Harriet Wood, © Amgueddfa Cymru – National Museum Wales). **12.** H 27.5 mm. **18.** H 28 mm. **13.** Tanjung Aru, Kota Kinabalu, Sabah, Malaysia, intertidal rocks, leg. R (H 15.4 mm, R T0877). **14.** Cape Sai, Karon Bay, SW Phuket, Thailand, leg. R (H 20.1 mm, R T4262). **15.** Tanjong Lobang, Miri, Sarawak, Malaysia, leg. R (H 27.1 mm, R T1738). **16.** Piasau Beach, Miri, Sarawak, Malaysia, leg. R (H 24.7 mm, R T1667). Inhabited by hermit crab. This specimen has 6 denticles in the aperture and shows the typical colouring. **17.** Temporary outcrop 300 m SE of Canada Hill, Miri, Sarawak, Malaysia, Holocene, 6350 ± 70 BP, deposits of intertidal rocks, leg. R (H 26.7 mm, R H1246).


1a
1b
2a
2b
3a
3b
4a
4b
5
6
7a
7b
8a
8b
9a
9b
9c
9d
10
11
12a
12b
12c
13
14
15a
15b
15c
16
17a
17b
18

It is unlikely that the syntypes really originate from New Zealand as no other records from this country are known (e.g. the species is not mentioned in Powell, 1979), Ambon is more likely correct. The error may be due to inclusion of *Paratrophon* Finlay, 1926 specimens in the type series in MNHN (Tan, unpublished data). Further study is needed to describe the range more precisely.

Remarks. — In his original description de Blainville (1832) states that this species can be confused with *S. muricina*, but can be differentiated by never having clear protuberations, whilst having clearer spiral ribs, less and coarser axial ribs, always having four rather than five denticles in the aperture whereas the growth lines are much less scaly.

Specimens living on mangrove trees (Pl. 3 Figs 7-8) at Tanjong Layang Layangang, Labuan (Sabah) and also the syntypes of *P. borneensis* from Labuan (Pl. 3 Figs 10-11). have a slightly different shell: stronger protrusions, thicker and more yellowish-brownish coloured aperture.

In NW Borneo *S. muricoides* is a widely distributed species that occurs in large numbers in a range of environments, most commonly on rocks in the intertidal zone (locally sympatric with *S. konkanensis* and *Orania nodosa*, e.g. at Jerudong, Brunei and Kota Kinabalu, Sabah) but locally also where there is brackish water influx and on mangroves growing in coral lagoons. The specimens from brackish water are substantially larger than those living in rocky parts of the intertidal zone, possibly due to the much higher competition for food in the latter. This is best noted around the Tanjung Aru Hotel south of Kota Kinabalu (Sabah, Malaysia) where the specimens in brackish water (Pl. 3 Figs 4-6) reach 29 mm and those in the rocky area only 1.5 cm whereas there is only 0.3 km between both populations.

In the Miocene deposits outcropping at the Beraya-Bekenu Seacliffs and along the Miri-Bekenu road (both S of Miri, Sarawak) three specimens of *S. muricoides* were collected (Pl. 3 Fig. 9) that are very similar to the form living on mangrove trees. Interestingly, the Miocene specimens were collected from two outcrops of fossil-rich mudstones (i.e. a soft bottom substrate) within the Miri Formation that are interpreted to have been formed at water depths of 50 m or more (at each outcrop a specimen of *Preangeria praeundosa* was collected). As *Semiricinula* species appear to be restricted to intertidal/shallow subtidal rocky areas, it is possible the shells reached the deeper water soft bottom environment on floating wood originating from estuaries. The presence of floating wood is demonstrated by the fossils of oysters that attach to wood found in the same outcrops. At one of these outcrops also two specimens of *S. turbinoides* were found, which live in similar shallow water environments (own observations).

***Semiricinula konkanensis* (Melvill, 1893)**

Pl. 3 Figs 12-18, Textfig. 2b, Table 3

Ricinula (*Sistrum*) *konkanensis* Melvill, 1893: 54-55, pl. 1 fig. 5.
Pentadactylus (*Morula*) *smithi* Schepman, 1892: 103-104.
Semiricinula konkanensis – Kumbhar & Rivonker, 2012: 193-194.

Types and localities.
Ricinula (*Sistrum*) *konkanensis* Melvill, 1893: Mumbai, India (Syntypes in NHMUK 1893.2.16.12 and 1878.1.28.238; 2 syntypes as *Drupa konkanensis* in NMW 1955.158.00318).
Pentadactylus (*Morula*) *smithi* Schepman, 1892: Cilacap, Java, Indonesia (syntypes in NBC).

Material examined. — **Recent**: THAILAND, PHUKET (ANDAMAN SEA): Cape Sai, Karon Bay, SW Phuket (S97.22a), rocky area along S end of beach, intertidal rocks with pools, inhabited by hermit crab, vi.1997, leg. R (R, T4262, 1 sp.); INDONESIA, JAVA: Cilacap, leg. B.N. Overdijk (syntypes of *Pentadactylus smithi* in NBC); Cilaut eureum (Tjilaoet eureum), South Java, 1931, leg. L. De Priester (RMNH.MOL.132589, 1 sp); Central and West Java (Dharma 2005: pl. 60 figs 5a-b); MALAYSIA, SARAWAK: Tanjong Lobang, Miri (S92.21), middle and lower part of the littoral zone, alive under stones and on wood, leg. R (R T1738, 19 sp.); Piasau Beach, Miri (S92.01), carried by hermit crabs, leg. R (R, T1667, 5 sp.); BRUNEI: rocks near cape, Jerudong, Muara (S93.27b), sandstone rocks in littoral zone, ix.1993, leg. R (R T8183, 1 sp.); MALAYSIA, SABAH (SOUTH CHINA SEA): Tanjung Aru, Kota Kinabalu (S92.16a), sandstone rocks in littoral zone, vi.1992, leg. R (R T0877, 3 small sp.); Tanjung Aru, Kota Kinabalu, 19.iv.1999, leg. H.H. Kool (ZMA.MOLL.55358, 4 small sp.); Pantai Dalit, 8.iv.2000, leg. H.H. & S.P. Kool (ZMA. MOLL.55369, 3 small sp.);
Fossil: **Holocene:** MALAYSIA, SARAWAK (SOUTH CHINA SEA): temporary outcrop 300 m SE of Canada Hill, Miri (F94.01), Holocene, 6350 ± 70BP, deposits of intertidal rocks, leg. R (R. H1246, 6 sp.);

Locality	Height (mm)	Width (mm)	# whorls	# plications	# inflations	Remarks
Tanjong Lobang, Miri	27.2	14.4	5+	6	9	R T1738, apex damaged
	25.7	13.5	6.25	6	10	
	30.3	15.5	6+	6	10	
Piasau Beach, Miri	24.8	12.6	6+	6	9	R T1667, apex damaged
Cape Sai, Karon Bay	20.2	12.3	4.5+	6	8	R 4262, apex damaged

Table 3. Measurements of *Semiriricula konkanensis.*

Sungai Baong temporary outcrop, 250 m WNW of public pool, Miri (F95.01), Holocene, 1645 ± 30 BP, sandy subtidal deposits, leg. R (R H1584, 2 sp., worn by waves). For measurements see Table 3.

Description. — Shell (Pl. 3 Figs 12-18) with six to seven conspicuous spiral ribs, each a single rib with broad or narrow pointed protuberations. Secondary spirals occur between the primary ones. Edge of the outer lip sharp with interior grooved. Aperture narrowing inward. Within the aperture between each pair of ribs there is a corresponding denticle which continues inward as narrow plication – resulting in 5-6 denticles and plications. Aperture ovoid, adapical canal rather narrow and marked by a parietal ridge on the inner lip.

Greyish colour with dark coloured protuberations. In between the protuberations the ribs can be cream coloured. The edge of the aperture is typically dark purple, inwards becoming pale bluish grey or cream coloured, typically with white denticles.

Range. — This species is known from Mumbai (formerly known as Bombay, India) to Java (Indonesia) and Sabah (Malaysia). Most specimens imaged as *S. konkanensis* are from the NW part of the Indian Ocean (on the internet e.g. on gastropods.com; in literature e.g. Bosch et al., 1995: 121 fig. 480 as *S.* cf. *konkanensis*). These are specimens of *Ergalatax martensi* (Schepman, 1892) (Red Sea, Gulf of Aden) and *E. junionae* Houart, 2008 (Persian Gulf, Gulf of Oman) – see Houart (2008). Also the specimens from South Africa recorded as *S. konkanensis* in Houart et al. (2010: 268) belong to a different species (Roland Houart, unpublished data).

Remarks. — Amongst the material of *Semiricinula* from NW Borneo a population living at Tanjong Lobang, Miri, Sarawak, Malaysia (Pl. 3 Figs 15-16) stands out as it has similar coloured shell and aperture as *S. muricoides* but also some key differences:

- Spiral sculpture: six to seven spiral ribs, each being a single rib with pointed protuberations that form a very regular pattern (vs. double flat ribs);
- 5-6 denticles and plications in the aperture, plications narrow, in *S. muricoides* they can be double and therefore extra broad;
- Aperture narrowing inward, whereas in *S. muricoides* the lip often folds outward.

A single specimen with the same characteristics was collected at Jerudong (Brunei) besides several 'typical' *S. muricoides*; also a single specimen with a slightly broader shape (Pl. 3 Fig. 14) at Cape Sai, Karon Bay (Phuket, Thailand). Some very small specimens were collected at Tanjung Aru, Kota Kinabalu and at Pantai Dalit (Sabah, Malaysia) each within a large population of 'typical' *S. muricoides*. One of the specimens from Kota Kinabalu has a paired denticle in the aperture (Pl. 3 Fig. 13). Such paired denticles were also observed in two specimens of *S. muricoides* at the same locality. Paired denticles are frequent in *S. turbinoides*.

Pentadactylus (*Morula*) *smithi* Schepman, 1892 is known to occur at Cilacap, Java, Indonesia (Tan, unpublished data; for a figure see van der Bijl et al., 2010: 87, fig. 216) which clearly is the same species, although it has wider spaces and therefore longer yellowish radial ribs between the protuberations. Van der Bijl (1994) describes how Schepman struggled with the identification of this species. Schepman sought advice from E.A. Smith at the NHMUK (at that time known as BM(NH)) after whom he named the species. Specimens from other localities in Java are very similar (NBC and Dharma, 2005: pl. 60 figs 5a-b).

It was the photograph of one of the syntypes of *S. konkanensis* (Melville, 1893) from the NHMUK shown by Roland Houart that demonstrated that all these specimens are in fact *S. konkanensis*. In this paper two syntypes from NMW are illustrated of which one (Pl. 3 Fig. 12) is similar to the specimen from Miri (Pl. 3 Fig. 16) but has broader protuberations; the other syntype (Pl. 3 Fig. 18) is not yet fully grown. The specimen from Goa, India in Kumbhar & Rivonker (2012: 193-194, fig. 4) has very narrow spiral ribs with several even finer riblets in the interspaces, with an overall greyish colour, only the protuberations showing as interrupted darker lines. This is similar to other specimens from the same population in Miri (e.g. Pl. 3 Fig. 15). Kumbhar & Rivonker (2012) also present data on radula and operculum. Therefore the material from NW Borneo, Java and Mumbai is all considered to represent *S. konkanensis*.

A thriving population lived in an intertidal rocky area at the southern part of Tanjong Lobang, Miri, Sarawak, Malaysia, now largely covered in concrete. It lived sympatric with *S. muricina*, *Orania nodosa* and *Taurasia striata*. Material from a Holocene outcrop behind Canada Hill (Pl. 3 Fig. 17) confirms this species and *Taurasia striata* have lived in the Miri area since it became flooded due to the Holocene sea level rise (around 6350 ± 70 BP as indicated by a C14 dating of another mollusc species from the same outcrop).

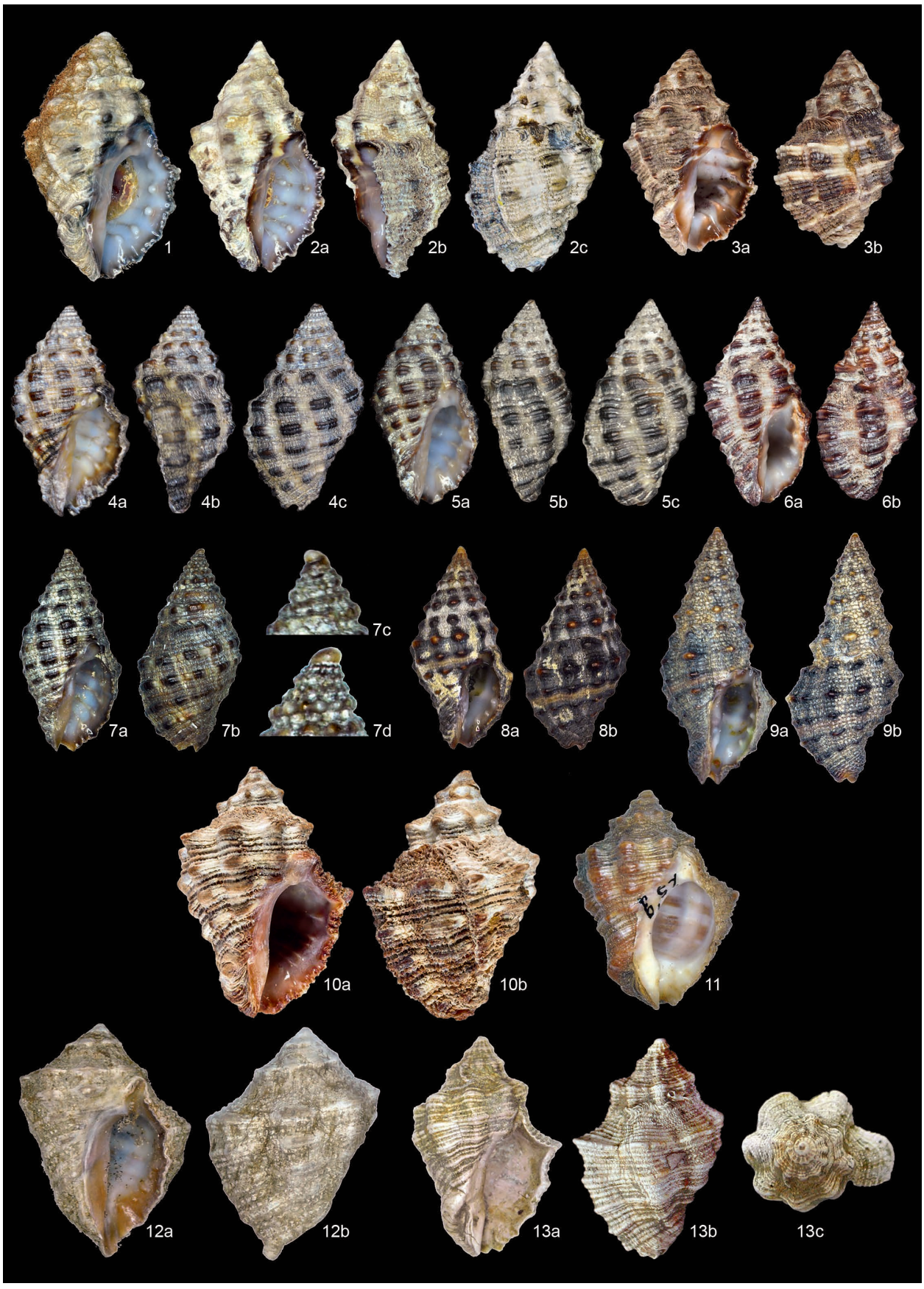
***Semiricinula turbinoides* (de Blainville, 1832)**

Pl. 4 Figs 10-13, Textfig. 2c

Purpura turbinoides de Blainville, 1832: 217 *Purpura turbinoides* Quoy & Gaimard, 1833: pl. 39 figs 4, 6.
?*Purpura foliacea* Conrad, 1837: 268, pl. 20 fig. 24.

Types and localities.
Purpura turbinoides de Blainville, 1832: Vanikoro, Solomon Islands (4 syntypes MNHN-IN-2000-219).
?*Purpura foliacea* Conrad, 1837: "Island of Atooi" = Hawaii, USA (Syntypes in NHMUK).

Material examined. — **Recent**: INDONESIA, WEST KALIMANTAN (SOUTH CHINA SEA): Natuna Islands (Dharma, 2005: 170, pl 60 fig. 9); MALAYSIA, SABAH (SULU SEA): Malawali Canal, xii.1963, leg. M. Saul (ZMA.MOLL.35835, 5 sp.; ZMA.MOLL.35832, 3 sp.); Mandidarah Island, iii.1962, leg. M. Saul (ZMA.MOLL.35837, 2 sp.); INDONESIA, EAST KALIMANTAN (STRAITS OF MAKASSAR): Balikpapan, leg. F.J. Faber (RMNH.MOL.131795,


1
2a
2b
2c
3a
3b
4a
4b
4c
5a
5b
5c
6a
6b
7a
7b
7c
7d
8a
8b
9a
9b
10a
10b
11
12a
12b
13a
13b
13c

1 sp.); Fossil: **Miocene**: MALAYSIA, SARAWAK: Beraya-Tusan Seacliffs, Locality F97.08, km 3.55-3.60 (outcrop A), leg. R (R F4112, 2 sp.); Miri-Bekenu Road, outcrop F06.07 (km 30.1 left), leg. R (R F4345, 1 sp)

Description. — Shell (Pl. 4 Figs 10-13) with low spire, large aperture (more than half the shell height) and a strong shoulder, in some specimens resulting in a shape close to that of a kite. Four primary double spiral ribs and marked finer interstitial ribs with deep grooves in between. The axial inflations can line up to form axial ribs (most conspicuous in view from the apex (Pl. 4 Fig. 13c) or separate protuberations). Typical muricid scaly sculpture throughout. Edge of the outer lip wavy with interior grooved. Five to six elongated denticles within, frequently in pairs, which continue inward as fine plications. Colour greyish to brown, between the protuberations elongated white blotches on the primary and secondary spiral ribs. The edge of the aperture varies from purple to yellow or white, typically cream coloured inside.

Range. — Indo-Pacific. Recent records from Borneo are from the Sulu Sea and Straits of Makassar. Miocene specimens from the South China Sea (herein). The website "Mollusques de l'île de la Réunion" (see references) reports the species from Réunion Island in the SW Indian Ocean.

Remarks. — This is a variable species. It is much broader with a low spire, resulting in an almost kite-shaped outline. In specimens from NW Borneo the sculpture is weakly developed resulting in relatively smooth shells or with low protuberations. In specimens from the Philippines these protuberations can be much stronger developed.

Purpura foliacea Conrad, 1837 from Hawaii appears to be a synonym (Roland Houart, unpublished data; also listed in WoRMS).

In the Miocene deposits outcropping at the Beraya-Bekenu Seacliffs and along the Miri-Bekenu road (both S of Miri, Sarawak) three specimens of *S. turbinoides* were collected (Pl. 4 Fig. 13). As discussed under *S. muricoides* this species typically lives in intertidal rocky areas and its occurrence in deeper water deposits is likely due to transport on floating wood.

Subfamily Ergalataxinae Kuroda, Habe & Oyama, 1971

Another species thus far considered a representative of *Semiricinula* and close to *S. konkanensis* is herein treated as a species of the subfamily Ergalataxinae Kuroda, Habe & Oyama, 1971, likely of *Orania* Pallary, 1900. Further study is required to confirm this allocation.

***?Orania nodosa* (Hombron & Jacquinot, 1848)**

Pl. 4 Figs 4-7, Textfig. 2d

Purpura nodosa Hombron & Jacquinot, 1848: 86, pl. 22 figs 5-6 *Semiricinula nodosa* (Hombron & Jacquinot, 1848) – Claremont et al., 2013.

Types and localities.

Purpura nodosa Hombron & Jacquinot, 1848: Solomon Islands (Two syntypes MNHN-IM-2000-0160).

Material examined. — **Recent:** MALAYSIA, SARAWAK: Damai beach, NW of Santubong (S93.20a), abundant between rocks in littoral zone, i.1993, leg. R (R T1312, 21 sp.); BRUNEI: Jerudong, Muara (S93.27b), abundant alive on rocks in littoral zone at cape, ix.1993, leg. R (R T1813, 22 sp.); MALAYSIA, SABAH (SOUTH CHINA SEA): Kampong Pohon Batu to Kampong Batu Manikar, Labuan (S93.24b), alive on rocks bordering lagoon behind barrier reef, iii.1997, leg. R (R T4004, 3 sp); N of Membedai, Labuan (S93.22a), alive in rocky area in littoral zone, 19.vi.1993, leg. R (R T1412, 5 sp.); Tanjung Aru, Kota Kinabalu (S92.16b), alive on rocks, near Tanjung Aru Beach Hotel, leg. R (R T8182, 2 sp.); Pulau Mamutik, Kota Kinabalu (S97.33), dead, on littoral rocks, ix.1997, leg. R (R T4172,1 sp.); Pantai Dalit, Tuaran (S97.18a), alive on rocks low in tidal zone, v.1997, leg. R (R T4172, 6 sp.).

Description. — The shells have spiral ribs of varying strength. On the last whorl there are six main ribs, the second and the third from the suture being pairs of ribs, with two to four finer riblets in between. The main ribs form protuberations, with the crossing 7 to 8 coarse axial a regular pattern of elongate

PLATE 4

Figs 1-3. *Semiricinula muricina* (de Blainville, 1832). **1-2.** Tanjong Lobang, Miri, Sarawak, Malaysia, leg. R (R T1735). **1.** H 29.4 mm. **2.** H 26.9 mm. **3.** "Des mers Australes" (Syntype 2 out of 10, H 24.8 mm, leg. Quoy & Gaimard, MNHM-IM-2000-0165, photos M. Caballer MNHN, Project E-RECOLNAT: ANR-11-INBS-0004, © Muséum national d'Histoire naturelle, Paris). **Figs 4-7.** *Orania nodosa* (Hombron & Jacquinot, 1848). **4.** Pantai Dalit, Tuaran, Sabah. Malaysia, leg. R (H 18.2 mm, R T4172). **5, 7.** Jerudong, Brunei, leg. R (R T1813). **5.** H 16.7 mm. **7.** Specimen with angle between protoconch and teleoconch, H 14.8 mm. **6.** Solomon Islands (holotype, H 18.4 mm, leg. Hombrom & Jacquinot, MNHM-IM-2000-0160, photos M. Caballer MNHN, Project E-RECOLNAT: ANR-11-INBS-0004, © Muséum national d'Histoire naturelle, Paris). **Figs 8-9.** *Orania dharmai* Houart, 1995, Tanjong Lobang, Miri, Sarawak, Malaysia (S92.21), middle and lower part of the littoral zone, alive under stones, leg. R (R T0708). **8.** 13.8 mm. **9.** 20.4 mm. **Figs 10-13.** *Semiricinula turbinoides* (de Blainville, 1832). **10.** Vanikoro (syntype 4 out of 4, H 19.2 mm, leg. de Blainville, MNHM-IM-2000-0219, photos M. Caballer MNHN, Project E-RECOLNAT: ANR-11-INBS-0004, © Muséum national d'Histoire naturelle, Paris). **11.** Balikpapan, East Kalimantan, Indonesia, leg. Faber (H 22.4 mm, RMNH.MOL.131795). **12.** Mandidarah Island, Sabah, Malaysia, leg. Mary Saul (H 29.6 mm, ZMA.MOLL.35837). **13.** Beraya-Bekenu Seacliffs, km 3.55-3.60 (outcrop A), Sarawak, Malaysia, leg. R (H 16.6 mm, R F4112).

nodules results. The protuberations form slightly forward inclined rows which in many specimens continue over several whorls. There are well-developed squamous growth increments on the finer riblets. Protoconch paucispiral (1-1¼ whorl), smooth, with a weakly keeled (up to 30 degrees) last protoconch whorl (Pl. 4 Fig. 7).

Aperture elongate and glossy, with an opening at the anterior side for the siphonal canal and an anal canal on the posterior side. Outer lip irregular, with sharp protrusions for each of the main spiral ribs, from which a shallow groove extends slightly inward. The five elongate denticles are positioned in between each pair of grooves. They extend inwards as plications, with elongate nodes coinciding with the axial depressions on the outside of the shell. The columella has a comparatively strong adapical fold on the siphonal fasciole and two abapical folds which are more oblique.

The shell has a dark brown background colour, with elongate whitish spots on the main spiral ribs. These spots occur in the axial depressions and never on the protuberations in between. The edge of the aperture is dark purple, inwards becoming dark orange-brownish, turning pale bluish grey beyond the denticles. The denticles and plications are dark orange-brownish, albeit that the elongate nodes are paler in colour.

Range. — Very different species have been reported as *O. nodosa* (e.g. Dharma, 2005: pl. 60 fig. 8 is *S. muricina*) therefore every record requires confirmation. However, as this paper records specimens from NW Borneo (Sarawak, Brunei and Sabah) and the type locality is Solomon Islands, this species clearly inhabits a large part of the Western Pacific.

Remarks. — Compared to the syntypes (Pl. 4 Fig. 6) the specimens from NW Borneo have a higher number of axial ribs (7-8 on the final whorl, compared to 5) and most populations have small specimens: those from Jerudong (Brunei) only reach about 13 mm, those at Damai Beach, Santubong (Sarawak) 18 mm, but at Pantai Dalit, Tuaran (Sabah, Pl. 4 Fig. 4) they reach 21 mm. The species lives sympatric with *S. muricoides* at Jerudong (Brunei), Kampong Pohon Batu and Membedai, both on Labuan Island and at Kota Kinabalu and Pantai Dalit, Tuaran (all in Sabah), and also with *S. konkanensis* at Jerudong and Kota Kinabalu.

Claremont et al. (2013) identified *Purpura nodosa* as a species of *Semiricinula*. However, study of the radula of a specimen from Papua New Guinea proves it to be an ergalataxine species, probably belonging to *Orania* (Roland Houart, unpublished data). Maybe Claremont et al. (2013) analysed a specimen of *S. konkanensis* (Melvill, 1893) misidentified as *"S." nodosa*. Both species can have similar looking shells, however based on a specimen from Sri Lanka *S. konkanensis* has a typical rapanine radula (Kumbhar & Rivonker (2012: 193-194, fig. 4). Juvenile specimens of *O. dharmai* Houart, 1995 are remarkably similar (indicating the allocation to *Orania* is justified), but can be differentiated by the more pointed protuberations and a slightly yellowish band between the 3rd and 4th row of spirals (counting from the apex) as illustrated on Pl. 4 Figs 8-9.

At Jerudong (Brunei) a large shell inhabited by a hermit crab was found with two specimens of *O. nodosa* near the edge of the aperture, which could be commensalism if the molluscs benefit from the ability of the hermit crab to move around more rapidly than the molluscs, but probably is just a coincidence.

Family Buccinidae
Subfamily Cominellinae Gray, 1857
Genus *Preangeria* Martin, 1921

Preangeria, as genus in Cancellariidae: Martin (1921: 450).
Type species: by SD Wenz (1943: 1356): *Preangeria angsanana* Martin, 1921.
Synonym: *Acantinella* Shuto (1969) – type species *Acanthina javana* Martin, 1899.

Remarks. — The characteristics of the genus have been described in detail by Vermeij (1998: 26-27; 2006: 86). Key characteristics: a moderately small shell (height up to 30 mm), with rounded whorls, numerous low axial ribs, sharp cords of a single size, a narrowly elongate aperture, parietal tooth absent, outer lip indeterminate, its edge convex and finely crenulated, with nine to ten long lirae extending into the aperture on inner side of outer lip, a sharp labral tooth, a distinct fascicle, and without umbilical slit. Operculum with terminal nucleus, periostracum thick, radula has square central tooth with larger outer and smaller inner cusp. In addition it can be noted the shell is relatively thin and the aperture does not have a clear siphonal canal, the upper part of the columella is curved (if not visible in adults it is visible in juveniles).

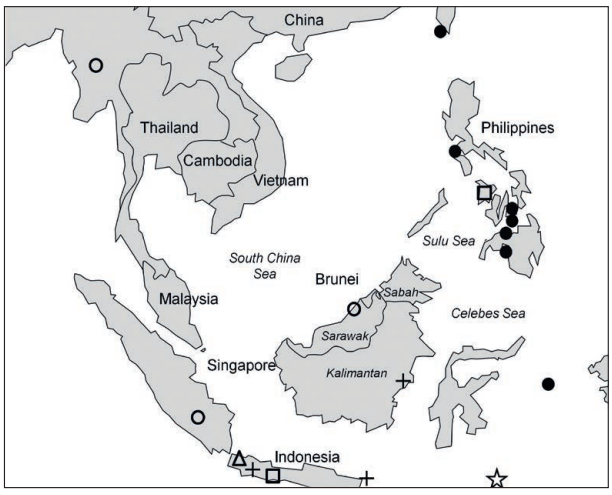


Fig. 3. Distribution of *Preangeria* species. Solid dots indicate Recent *Preangeria dentata*. The other symbols indicate fossil material: a star for *P. dentata*, circles for *P. praeundosa*, squares for *P. javana*, a triangle for *P. angsanana* and *P. sundaica*, plus signs for *P. talahabensis*.

The presence of a large labral tooth on the outer lip is a criterion for its placement close to *Cantharus* Röding, 1798 (Vermeij, 2006: 72; Vermeij & Bouchet, 1998: 472-473). The radula with tricuspid central tooth and bicuspid lateral teeth, however, is almost identical to *Eosipho* Thiele, 1929 and *Manaria* E.A. Smith, 1906. Therefore the genus is better placed in the Cominellinae Gray, 1857. The shape of the shell, its sculpture and habitat is also close to *Eosipho*.

Also the individual species are well described in Beets (1985), therefore in this paper the focus is on additional information.

Preangeria angsanana Martin, 1921

Pl. 5 Fig. 1, Textfig. 3, Table 4

Preangeria angsanana Martin, 1921: 450, pl. 53, fig. 17
Taurasia angsanana (Martin, 1921) – Beets, 1985: 41.
Preangeria angsanana Martin, 1921 – Vermeij, 1998: 25-34.

Types and localities.
Preangeria angsanana Martin, 1921: Ciangsana, Java, Indonesia (Holotype RGM9753).

Material examined. – Fossil: **Miocene**: INDONESIA, JAVA: Ciangsana, Middle Miocene – Preangerian, Nyalindung Formation, leg. H. Martin-Icke (RGM9753, 1 sp. – holotype). For measurements see Table 4.

Description. — Shell with six whorls forming a high spire. Numerous alternating coarser and finer spiral riblets. This is the species of the genus with strongest axial inflations and the only one with a clear shoulder. Columella with an adapical fold and three finer and more oblique abapical ones. The plications inside the aperture are more irregular than in the other species of the genus: for each axial inflation there is a corresponding set of six elongate denticles, but not all of these are connected through plications. There is a single 7th denticle above the others, but there is no plication related to it, nor are there other such denticles further inside the aperture.

Range. — Middle Miocene.

Remarks. — This species, type of the genus, is known from only one specimen. In this specimen the aperture is damaged right where the labral tooth would be present. The presence of such tooth can be observed clearly in earlier growth lines through a marked protuberation of about 1 mm wide, the central part of which forms a narrow (⅓ mm wide) but marked groove.

Preangeria dentata (Schepman, 1911)

Pl. 5 Fig. 2, Textfig. 3

Tritonidea dentata Schepman, 1911: 303, pl. 19 fig. 8.
Tritonidea burcki Koperberg, 1931: 102-103, pl. 3 fig. 39.
Axymene philippinensis Petuch, 1979: 8, figs 14-15.
Eosipho dentatus (Schepman, 1911) – Bouchet & Warén, 1986: 470, figs 17, 58-61.
Preangeria dentata (Schepman, 1911) – Vermeij, 1998.

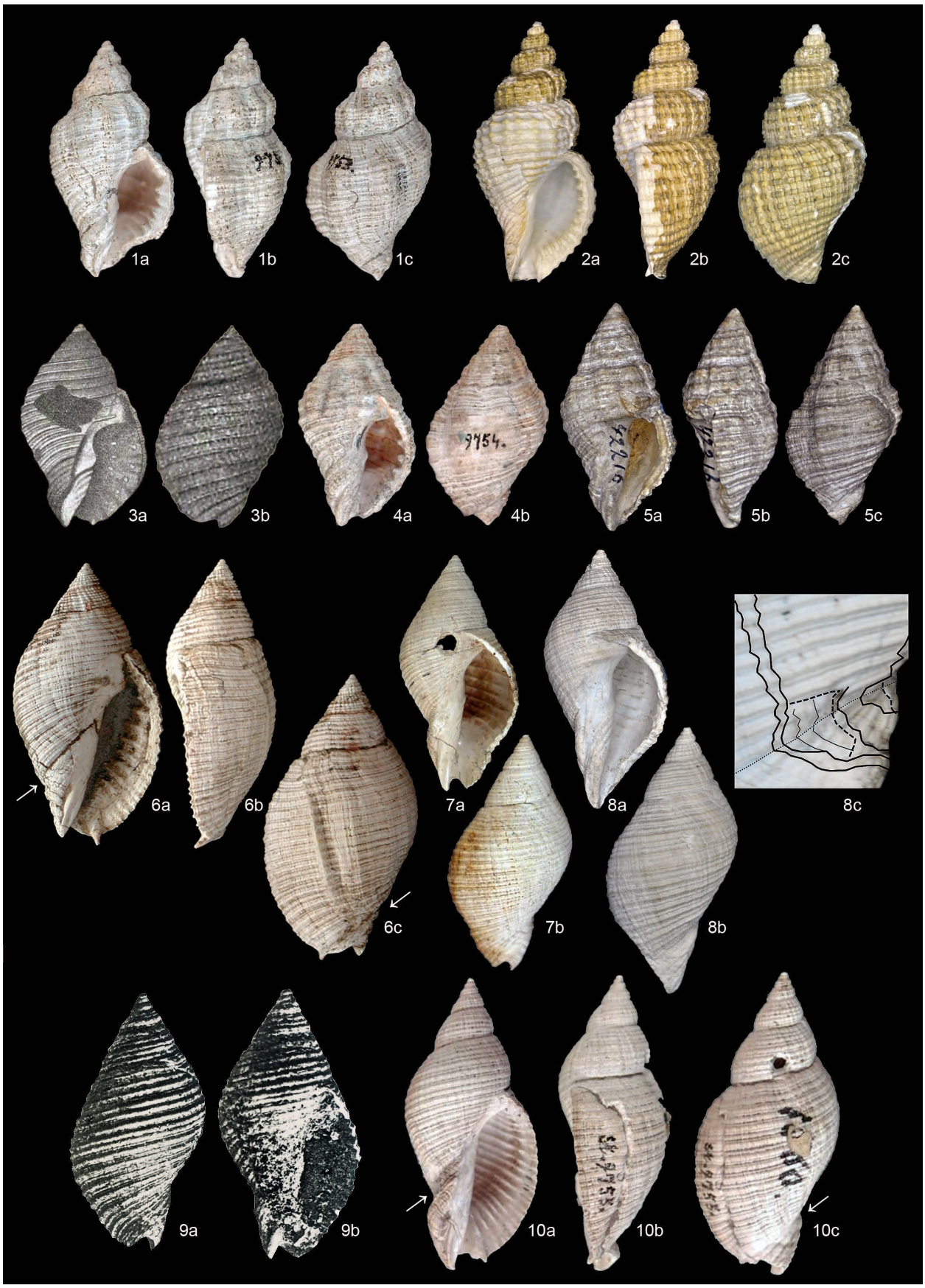
Types and localities.
Tritonidea dentata Schepman, 1911: SIBOGA station 116 (72 m depth), west of Kuandang Bay entrance, Sulawesi, Indonesia (Holotype: ZMA.MOLL.311032).
Tritonidea burcki Koperberg, 1931: between Niki Niki and Horst Pené (Locality 2), East Nusa Tenggara, Timor, Indonesia. Plio-Pleistocene (Syntypes in NBC).
Axymene philippinensis Petuch, 1979: off Panglao (250 m depth), Bohol, Philippines (Holotype DMNH 126394).

Material examined. — **Recent:** INDONESIA, SULAWESI (CELEBES SEA): Siboga station 116, W of Kuandang Bay entrance (00°55'5"N, 122°42'5"E), 72 m depth, dredged, 7.xii.1899, leg. Siboga expedition (ZMA.MOLL.36710, Holotype; ZMA.MOLL.311032, 1 sp.); PHILIPPINES, BOHOL (BOHOL SEA): Panglao (in Vermeij, 1998); Balicasag Island tangle nets 50-230 m 1999-2011 (P, 115078, 145055,633458, 4 sp); off Balicasag Island, (Richer de Forges & Bouchet, 1998), 470-566 m, Panglao expedition 2005 (MNHM-IM-2007-32120, 1 sp.); Off Pamilacan Island, Panglao (Richer de Forges & Bouchet, 1998), 219-240 m, Panglao expedition 2005 (MNHM-IM-2007-32656, 1 sp.) and numerous other records from same expedition Panglao2005 Stn CP2389 to 784-786 m (MNHN); MASBATE (VISAYA SEA): Masbate, from fishermen, 2005 (P 247742, 1 sp.); CEBU (VISAYA SEA): Mactan Island, Punta Engaño, lumen lumen, 60-80 m, 2003 (P, 201069, 1 sp.); MINDANAO (SULU SEA): Aliguay Island, offshore, 50-150 m, 2003-2005 (P, 133536, 133537, 133538, 133539, 133540, 268895, 280558, 485150, 8 sp.); MINDANAO (CELEBES SEA): Balut Island, South Mindanao, tangle nets, 150 m, 2008 (P, 487311, 1sp.); TAIWAN: Stn CP170, 22°12'N-120°25'E, 330-405m, SW coast, campagne TAIWAN 2002, Shrimp Trawler "Chenging", coll. Chan, Cosel & Richer-IRD 27MAY2002 (MNHN); Fossil: **Plio-Pleistocene**: INDONESIA, TIMOR: between Niki Niki and Horst Pené (Locality 2), East Nusa Tenggara (Holotype, NBC, 1 sp); **Miocene:** Nono Fatu Feku (Locality 6), Amanuban, middle Upper Miocene (Paratype, NBC, 1 sp.).

Description. — Shell with elongate shape and white colour. Besides the labral tooth it has 11 denticles inside the aperture,

Locality	Height (mm)	Width (mm)	# whorls (proto-conch, teleoconch)	# plications	# inflations	Remarks
Ciangsana	28.4	15.0	5.75 (2.5 - 3.25)	6	8	RGM 9753, Holotype, aperture partially damaged

Table 4. Measurements of *Preangeria angsanana.*


1a
1b
1c
2a
2b
2c
3a
3b
4a
4b
5a
5b
5c
6a
6b
6c
7a
7b
8a
8b
8c
9a
9b
10a
10b
10c

with very weak lamellae. On the outer side of the shell the labral tooth leaves a 1.5 mm wide zone with a very narrow (1/5 mm) groove in the middle. Holotype with pale coloured periostracum.

Range. — Late Miocene to Recent.

Remarks. — This is a rare deep water (50 to 786 m) species. Besides the type locality Vermeij (1998: 27) mentions records from the Sulu Sea (Philippines) and New Caledonia. Recently multiple specimens of up to 30 mm long have been collected from various localities in the Philippines (as *Eosipho dentata* on conchology.be and as *Preangeria dentata* in Poppe (2008: 36, pl. 313 fig. 2) and on the MNHN Portal) at 50-786 m depth, including living specimens and one with a dark brown periostracum.

Despite more specimens becoming available, thus far nothing is known about its life. The morphologically similar *Eosipho smithi* Schepman, 1911 and *Calagrassor hayashii* (Shikama, 1971) have been recorded from sunken wood at several hundreds of metres depth (East China Sea, China – conchology.be), whilst other species of *Eosipho* – from other parts of the world – have been found in association with deep water hydrothermal seeps (e.g. Fraussen et al., 2012).

Preangeria javana (Martin, 1899)

Pl. 5 Fig. 10, Textfig. 3, Table 5

Acanthina javana Martin, 1899: 137, pl. 21, fig. 315.
Acantinella javana (Martin, 1899) – Shuto, 1969: 109-111, pl. 11 fig. 3.
Taurasia javana (Martin, 1899) – Beets, 1985: 42.
Preangeria javana (Martin, 1899) – Vermeij, 1998: 26.

Types and localities.

Acanthina javana Martin, 1899: Selacau Parungponteng, Java, Indonesia (Holotype RGM 9755).

Material examined. — Fossil: **Miocene**: INDONESIA, JAVA: Selacau Parungponteng along the Ci Longgan (locality No. 1560), Middle Miocene – Preangerian, Selacau beds, leg. R.D.M. Verbeek-Fennema (RGM 9755, 1 sp. – holotype); PHILIPPINES: Panay Island, Late Miocene – Odengian, Upper part of the Dingle Formation, leg. Shuto (Kyushu University Museum GKL-6982, 1 sp.); Panay Island, Iloilo Basin, Bagacay, Malitac River near rail track (loc. SAV-563), Late Miocene – Odengian, Dingle Formation (Philippines Bureau of Mines, ?sp.). For measurements see Table 5.

Description. — A high spired, slender shell with seven slightly convex and smooth whorls. Large number of spiral ribs, broader and narrower ones alternating, with narrow grooves in between, crossed by numerous growth lines. Columella with adapical fold and five weaker abapical ones. Aperture with some wrinkles inside, giving way to numerous plications. Marked labral tooth.

Range. — Middle – Late Miocene.

Remarks. — The species was described based on a single specimen from Java. Since then more specimens have been collected from the Dingle Formation on Panay Island, Philippines (Shuto, 1969; Samariego et al., 1979 pl. 5 fig. 55). This deposit consists of limestone reefs or lenses interbedded with marls, sands and clays (Samariego et al., 1979: 76). Sample SAV-563 comprising this species was described as mudstone. This appears to be a deep water facies. Shuto considered the formation as Miocene, but Foraminifera appear to indicate a Pliocene age (Kajiwara & Matsukama, 2005: 153).

Locality	Height (mm)	Width (mm)	# whorls (proto-conch, teleoconch)	# plications	Remarks
Selacau	31.3	13.2	7+ (1.5+ - 5.25)	16	RGM 9755, Holotype, apex damaged, borehole on dorsal side

Table 5. Measurements of *Preangeria javana.*

PLATE 5

Fig. 1. *Preangeria angsanana* Martin, 1921. Ciangsana, Java, Indonesia, Miocene, leg. H. Martin-Icke (holotype, H 28.2 mm, RGM 9753). **Fig. 2.** *Preangeria dentata* (Schepman, 1911) Kuandang Bay, Celebes Sea, Sulawesi, Indonesia, Siboga expedition (holotype, H 16 mm, ZMA. MOLL.36710). **Fig. 3.** *Preangeria sundaica* (Oostingh, 1935). Cibeureum, Java, Indonesia, Miocene (holotype, H 26.5 mm, leg. Koolhoven, Bandung Geological Museum – figure from Oostingh, 1935: 82). **Figs 4-5.** *Preangeria talahabensis* Martin, 1921. **4.** Ci Talahab, Java, Indonesia, Miocene, leg. H. Martin-Icke (holotype, H 24.6 mm, RGM 9754). **5.** Mandul Island, Indonesia Middle Miocene (paratype, H 23.1 mm, RGM 42216). **Figs 6-9.** *Preangeria praeundosa* (Vredenburg, 1924). **6.** Beraya-Tusan Seacliffs, Miri, Sarawak, Malaysia (loc. F97.08), Miocene, leg. R (H 29.5 mm, R F4025), arrows indicating the groove formed on the dorsal side at the centre of the labral tooth. **7-8.** Pendopo, Pelembang, Sumatra, Indonesia, Miocene, **7.** Holotype of *Taurasia pendopoensis* Beets, 1985 (juvenile), leg. Huysse (H 29.4 mm, RGM 315253). **8.** Paratype of *Taurasia pendopoensis* (juvenile), leg. Huysse (H 17.7 mm, RGM 315254). **8c.** Detail of the dorsal side of the shell with the growth lines (thick solid lines) showing the presence of a labral tooth. The dotted line marks the narrow groove. Note the frequency of damage (striped lines) and repairs (thin solid lines). **9.** Dalabe, SE of Thamangyi, Magway, Myanmar, Miocene (holotype of *P. praeundosa*, H about 15 mm, figure from Vredenburg, 1924: pl. 2 fig. 1). **Fig. 10.** *Preangeria javana* (Martin, 1899). Selacau (= Parungponteng), Java, Indonesia, Miocene, leg. Verbeek (holotype, H 30.4 mm, RGM 9755), arrows indicating the groove formed on the dorsal side at the centre of the labral tooth.

***Preangeria praeundosa* (Vredenburg, 1924) comb. nov.**
Pl. 5 Figs 6-9, Textfig. 3, Table 6

Tritonidea praeundosa Vredenburg, 1924: 70, pl. 2 fig. 1.
Taurasia pendopoensis Beets, 1985: 44-46, pl. 2 figs 7-12.
Eosipho pendopoensis (Beets, 1985) – Vermeij, 1998: 30-31.

Tritonidea praeundosa Vredenburg, 1924: Dalabe, SE of Thamangyi, Magway, Myanmar (location of types unknown to the author).
Taurasia pendopoensis Beets, 1985: Pendopo, Sumatra, Indonesia (Syntypes in RGM).

Material examined. — Fossil: **Miocene**: MYANMAR: Dalabe, SE of Thamangyi, Magway, Early Miocene, Aquitanian, Kama Beds, leg. Vredenburg (1 sp.); INDONESIA, SUMATRA: Pendopo, 10 miles E of Talang Akar, Palembang, Miocene – presumably Preangerian, border between Lower and Upper Telissa, leg. Huysse (RGM315253 holotype of *T. pendopoensis*, RGM315254 paratype 1 of *T. pendopoensis*, RGM315255 paratype 2 of *T. pendopoensis*). MALAYSIA, SARAWAK (SOUTH CHINA SEA): Beraya-Tusan Seacliffs S of Miri, outcrop A – km 3.55-3.60 km (F97.08), Middle Miocene – Serravallian, marine shale interval within the Miri Formation, leg. R (R F4025, 1 sp.); Miri-Bekenu road outcrop km 28.5 left (F05.04) Middle Miocene – Serravallian, marine shale interval in the Miri Formation e.g. R (R F4228, 1 fr.). For measurements see Table 6.

Description (modified from Beets, 1985). — Intermediate sized shell, buccinoid, with 6.5 moderately convex whorls. Sutural canal narrow, with an inward sloping base, narrower near the aperture. Thin outer lip with a very small anal notch and a broad labral tooth. Inner lip with a heavy callus. Umbilicus narrow, at the upper and left side surrounded by a raised fasciole, which is separated from the body whorl by a narrow furrow representing the backside of the labral tooth. On the fasciole there is a strong groove, dividing the fasciole in a narrower (⅓) anterior and broader (⅔) posterior part. The inner side of the fasciole is broad and smooth. The uppermost part of the fasciole approaches the aperture at about ½ of its height.

Range. — Middle Miocene.

Remarks. — Beets (1985: 44) stated this species resembles *T. javana*, but is plumper, has less inflated whorls and a less constricted basal part of the last whorl while, finally, a basal labral tooth is absent altogether. On the same page he confirms: "The growth lines indicate unequivocally that no basal labral tooth was present." Based on the apparent lack of axial sculpture and labral tooth, Vermeij (1998) placed this species provisionally in *Eosipho* Bouchet & Warén, 1986.

Beets was right in his observation this species is close to *Preangeria javana*. However, checking the original material deposited in NBC it is evident from their thin shells and their apertural area that none of the specimens (holotype and two paratypes) seen by him is fully grown. In addition all are damaged at the peristome – as a result of which the labral tooth is lacking. Beets was wrong, however, in stating the growth lines indicate the absence of a labral tooth. The presence of such tooth is clearly reflected in the growth lines of these specimens. Pl. 5 Fig. 8c also shows that the tooth regularly breaks – followed by gradual repair.

At the Beraya-Bekenu Seacliffs outcrop, SW of Miri, Sarawak, Malaysia a specimen was collected that has a very similar shape but is fully grown and undamaged (besides being slightly compressed which makes it appear plumper). This specimen shows a well-developed labral tooth that is broader than those in *P. dentata* and *P. javana*. The labral tooth leaves a clear groove which is even markedly visible on the callus (as a mud filled streak).

The limited material available indicates this species is much broader than *T. javana*, has less inflated and much more overlapping whorls, with less denticles and corresponding plications (about 10 vs. about 15) in the aperture, whereas the labral tooth is clearly broader and longer.

Beets (1985: 46) considered *Tritonidea praeundosa* Vredenburg, 1924 (p. 70, pl. 2 fig. 1, here reproduced as Pl. 5 Fig. 9) from the Kama Beds (Miocene, Aquitanian) at Dalabe (SE of Thamangyi, Magway, Myanmar) closely related, perhaps synonymous. That species is based on a single specimen of only 16.5 mm high, the thin shell indicating this is a juvenile. It's shape and sculpture are very similar to *P. pendopoensis*. Neither Vredenburg's description nor the photograph show a labral tooth. In close up the photograph shows the same sculpture and very similar growth lines as the smaller (similar sized) paratype 1 of *P. pendopoensis*, including the typical damage at the position of the labral tooth. Although it was not possible to review the type specimen itself, it is clear both rep-

Locality	Height (mm)	Width (mm)	# whorls (protoconch, teleoconch)	# plications	Remarks
Pendopo, Sumatra, Indonesia	29.4	15.4	5.75+ (0.75+ - 5)	9	RGM 315253, Holotype of *T. pendopoensis*, apex damaged, aperture damaged. Not fully grown, large borehole in last whorl
	17.7	9.6	6.5 (2.25 - 4.25)	9	RGM 315254, Paratype 1 of *T. pendopoensis.* Not fully grown
	23.9	10.9	5.5+ (1.25+ - 4.25)	8	RGM 315255, Paratype 2 of *T. pendopoensis*, apex damaged, aperture damaged. Not fully grown
Beraya-Bekenu Seacliffs, Sarawak	29.5	15.7	6.75 (1.5 - 5.25)	9	R F4025, fully grown

Table 6. Measurements of *Preangeria praeundosa.*

resent a single species, with Vredenburg's name having precedence. Beets quotes Vredenburg's paper as published in 1923, but the front page of the issue of the magazine clearly states it appeared in 1924. Vredenburg chose the name of this species based on his view it was an ancestor of *Buccinum undosum* Linnaeus, 1758, type species of the genus *Pollia* Gray, 1834 (and *Tritonidea* Swainson, 1840).

The specimen from the Miri Formation in Sarawak was collected in a fossil-rich mudstone interpreted as deposited at a water depth of 50 m or more. The type locality of *P. pendopoensis* consists of a marly clay with fine sand layers and comprises a fauna which is similar to that in the Miri Formation – common taxa comprising *Barycypraea murisimilis* (Martin, 1879), *Bufonaria* spec., *Siphonalia* spec., *Clavilithes* (*Clavilithes*) *verbeeki* (Martin, 1895), *Architectonica* spec., *Clementia papyracea* (Gmelin, 1791). It is therefore likely the Pendopo deposits were also formed in middle or deeper shelf waters – which fits with the habitat of recent *Preangeria* and not with that of *Taurasia*.

Preangeria sundaica (Oostingh, 1935)

Pl. 5 Fig. 3, Textfig. 3

Nucella (*Acanthinucella*) *sundaica,* Oostingh, 1935: 82, figs 3a-b.
Taurasia sundaica (Oostingh, 1935) – Beets, 1985: 46.
Preangeria sundaica (Oostingh, 1935) – Vermeij, 1998: 27, 31.

Types and localities.
Nucella (*Acanthinucella*) *sundaica,* Oostingh, 1935: Cibeureum, Java, Indonesia (Holotype in Museum Geologi, Bandung, Indonesia).

Material examined. — Fossil: **Miocene:** INDONESIA, JAVA: Map sheet 13, Locality 334, Cibeureum, Middle Miocene – Preangerian, Middle Bojongmanik Beds, leg. Koolhoven (Bandung Geological Museum, 1 sp.).

Description. — Rather globose shell with five whorls forming a short spire and twelve spiral ribs with fine intermediate riblets. Only on the initial whorls also radial sculpture is present. Aperture serrated, with small rounded denticles inside and a clear labral tooth. Strong adapical fold on the siphonal fasciole and four weaker abapical ones.

Range. — Middle Miocene.

Remarks. — This species is based on a single (probably not fully grown) specimen of which only a drawing is available (the holotype itself could not be inspected). No further specimens have been collected.

Beets (1985: 46) noted this species is very close to *P. talahabensis* and perhaps belongs to the same species as both have a similar shape and strong spiral sculpture. Beets noted *P. talahabensis* has axial ribs or inflations on all whorls whereas *P. sundaica* has finer axial riblets which disappear on the last whorl. Also *P. talahabensis* has two abapical columellar folds whereas the smaller specimen of *P. sundaica* has four. As both are common intraspecific variations in the Buccinidae it is indeed likely they belong to a single species, but inspection of Oostingh's holotype is recommended before drawing a final conclusion.

Preangeria talahabensis Martin, 1921

Pl. 5 Figs 4-5, Textfig. 3, Table 7

Preangeria talahabensis Martin, 1921: 451, 492, pl. 1 figs 18, 18a-b.
Preangeria talahabensis Martin, 1921 – Martin, 1928: 114, 124.
Taurasia talahabensis Martin, 1921 – Beets, 1985: 40-41, 46, Pl. 2 figs 4-6.
Taurasia talahabensis Martin, 1921 – Beets, 1987: 29.

Types and localities.
Preangeria talahabensis Martin, 1921: Ci Talahab, Java, Indonesia (Holotype RGM9754).

Material examined. — Fossil: **Miocene:** INDONESIA, JAVA: Ci Talahab, Middle Miocene – Preangerian, Nyalindung Formation, leg. H. Martin-Icke (RGM9754, 1 sp., holotype); Middle Miocene, Cilanang Beds, leg. ? (RGM, 1 sp.); INDONESIA, KALIMANTAN, 7 km W of junction of Sungai Sampajau and Sungai Sangkuliring (loc. 144), North Kutai, Kalimantan Timor, Middle Miocene – Preangerian, Gelingseh Beds, leg. Rutten (RGM42216, 1 sp.); Mandul Island, Kalimantan Timur, uncertain age / mixed collection of fossils, leg. Van Holst Pellekaan (RGM, 1 sp.). For measurements see Table 7.

Description. — Rather globose shell with short spire and about 10 primary spiral ribs with finer intermediate riblets. On the initial whorls also radial sculpture is present and on the later whorls axial inflations resulting in an undulated surface. Aperture serrated, with small rounded denticles and plications inside and a labral tooth. Strong adapical fold on the siphonal fasciole and two weaker abapical ones.

Range. — Middle Miocene.

Locality	Height (mm)	Width (mm)	# whorls	# plications	# inflations	Remarks
Ci Talahab	24.6	14.8	4+ (? – 4+)	4	8	RGM9754, Holotype, apex damaged, aperture damaged
Mandul Island	23.1	12.6	5.25+ (1+ - 4.25)	Unclear, likely 4	7	RGM42216, Paratype, apex damaged, aperture damaged

Table 7. Measurements of *Preangeria talahabensis*.

Remarks. — Besides *P. angsanana* this is the only species with marked axial inflations, albeit less strongly than in the type of the genus. The number of plications is very low: only 4 with elongate denticles corresponding with each inflation.

In both specimens the aperture is damaged where the labral tooth would be present. The presence of such tooth can be observed clearly in earlier growth lines through a marked protuberation of about 1 mm wide, the central part of which forms a narrow (1/4 mm wide) but marked groove.

DISCUSSION AND CONCLUSION

The stratigraphic range table (Textfig. 4) summarises the available information. Clearly all three genera underwent fast radiation during the Miocene, but each evolved differently.

Claremont et al., 2012: 27 consider *Taurasia sacyi* Cossmann & Peyrot, 1923 from the Early Oligocene of Gaas, Espibos, Aquitaine, France is the oldest representative of the genus but this species is now considered to belong to *Attilliosa*. The shallow-water genus *Taurasia* appears during the Early Miocene with five species in the Aquitaine (France) which expand to Piedmonte (Italy) during the Middle Miocene. During the same stage a new species of the genus appears in SE Asia which could still be reached as the Tethys Ocean provided a passageway until the Middle Miocene during which it closed, causing the Middle Miocene Climate Transition (Hüsing et al., 2014). It is assumed representatives from this genus also lived in the area in between, but thus far there is no record. All European species became extinct during the Miocene but the Asian *T. striata* survived. Fossils from that species are very scarce and only known from a single outcrop in the Miocene of NW Java, a few outcrops on Nias Island (Plio-Pleistocene) and the Holocene of S Sulawesi and NW Borneo. There appears to have been a massive expansion of its distribution during the Holocene (or possibly the Pleistocene) extending to a substantial part of the West Pacific (Textfig. 3). During the Miocene and Plio-Pleistocene the majority of *Taurasia striata* shells have strong axial sculpture, but most recent populations have a smooth but thicker shell, probably as alternative way of strengthening against predators.

Vermeij (1998: 31) describes evolutionary trends in *Preangeria*. Some assumptions in that paper are incorrect and new facts are now available. All extinct *Preangeria* species have been recorded from the Middle Miocene (Preangerian), albeit *P. praeundosa* has also been recorded from the Early Miocene and *P. javana* from younger deposits which are of Late Miocene, possibly Pliocene age. The Middle Miocene age of the Nyalindung Formation from which *P. angsanana*, *P. javana* and *P. talabahensis* were collected is confirmed by Aswan et al. (2008: 321). Therefore there appears to have been a rapid radiation to five species with quite variable sculpture. Although most species have a slightly larger distribution, all species have been found in a relatively small area (NW Java and S Sumatra, Textfig. 3) where the genus probably originated. Remarkably, all these species have become extinct. The single extant species (*P. dentata*) is known from Indonesia and the Philippines, the only known fossils being from the Late Miocene and Plio-Pleistocene of Timor, Indonesia. Compared to the extinct species of the genus, *P. dentata* has reduced axial sculpture, a reduced parietal tooth and a broader aperture. Fossils from *Preangeria* are quite rare and thus far no specimens have been recorded with certainty from the Pliocene or Pleistocene.

Vermeij (1998: 31) stated there was a trend towards an increasing depth of habitat for *Preangeria*. However, in NW Borneo and Java *P. praeundosa* was collected from Middle Miocene deposits interpreted as representing a middle shelf environment (own observations) and in the Philippines *P. javana* was collected from a similar environment, all within the range of the extant species *P. dentata*. *P. angsanana*, *P. javana* and *P. talabahensis* were collected from the Middle Miocene Nyalindung Formation in Java, but no information is available about the precise stratigraphic interval within that formation. Aswan & Ozawa (2006) described depositional cycles within the same formation covering changes in water depth of about 30 metres. The deposits from which the Miocene specimens of *P. dentata* from Timor Indonesia have been collected are interpreted as having been deposited at about 250-300 m water depth (Koperberg, 1931: 154-155); those from the Plio-Pleistocene at 100-200 m (Koperberg, 1931: 157). Therefore *Preangeria* is interpreted as typical for deeper water soft bottom facies. Information on the occurrence of *Preangeria* in the stratigraphy of the Nyalingdung Formation would be valuable and could give new insights, especially as *Taurasia striata* (which is best known from rocky intertidal environments) was collected from the same geological formation.

The shallow water genus *Semiricinula* requires further study, but this paper demonstrates that at least two species are present since the Middle Miocene. There are at least eleven extant species in the Indo-Pacific (e.g. WoRMS database) of which

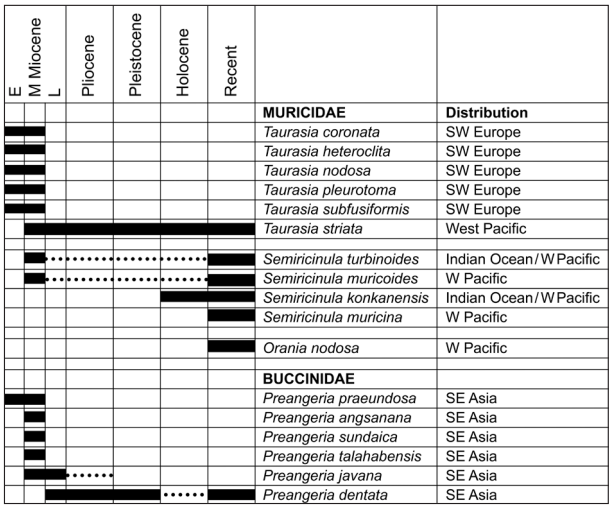


Fig. 4. Stratigraphic range of the species of *Taurasia* and *Preangeria* and the *Semiricinula* species discussed in this paper. The Miocene is subdivided into Early, Middle and Late.

two are only known from a small part of the Indian Ocean (*S. chrysostoma* (Deshayes, 1844) and *S. bozzettii* Houart & Héros, 2013), one occurs in the Indian Ocean and West Pacific (*S. turbinoides* (de Blainville, 1832)), three are widely distributed in the Indian Ocean and also reach Indonesia (*S. tissoti* (Petit de la Saussaye, 1852); *S. squamigera* (Deshayes, 1832); and *S. konkanensis* (Melvill, 1893)), whereas the other six species are restricted to the Western Pacific (*S. muricina; S. muricoides; S. fusca* (Küster, 1862); *S. hadrolineae* (Houart, 1996); and *S. squamosa* (Pease, 1868)).

In this paper additional material of this group has been listed and data collated that demonstrate that:

1 *Taurasia* typically has a thick shell with rather flat whorls, an aperture with narrow adapical canal and well developed siphonal canal. The columella has a markedly curved upper part between the parietal ridge and well developed columellar folds.
2 The distribution of *Taurasia striata* (de Blainville, 1832) is substantially larger than was known, with records from South Chinese Sea, Java Sea, Andaman Sea, the NE Indian Ocean and Australia. The species is much more variable than has been recognised so far, with smooth and ribbed forms. *Taurasia niasensis* Beets, 1985 is considered a synonym and thus extends the geological record to the Plio-Pleistocene. A sample from the Miocene of Java further extends the geological record.
3 In Europe *Taurasia* was represented by five species. Compared to Beets' list one species has been added whilst two species were moved to other genera.
4 *Taurasia szobensis* Csepreghy-Meznerics, 1956 from the Miocene of Hungary (not included in Beets' overview) is a juvenile *Bufonaria* Schumacher, 1817 (Bursidae).
5 The first adult specimen of *Taurasia pendopoensis* Beets, 1985 is recorded, from the Miocene of Sarawak, Malaysia. It has a labral tooth and therefore should be classified in *Preangeria*. It is considered a junior synonym of *Tritonidea praeundosa* Vredenburg, 1924 described from Myanmar. The correct name therefore is *Preangeria praeundosa* (Vredenburg, 1924).
6 *Semiricinula* can typically be differentiated from *Taurasia* and *Preangeria* by the double second and third ribs (not in *S. konkanensis*), the fine scaly sculpture, lack of an adapical canal and a low number of teeth in the aperture.
7 *Semiricinula konkanensis* (Melvill, 1893) occurs from India to Malaysia; records from the western Indian Ocean are from different species.
8 The first fossils of *Semiricinula muricoides* and *S. turbinoides* (de Blainville, 1832) have been recorded, from the Middle Miocene of Sarawak, Malaysia.
9 *Preangeria* has a relatively thin shell with marked labral tooth, rounded whorls with periostracum, an aperture without clear siphonal canal, the upper part of the columella is curved but there is no parietal ridge.
10 *Preangeria dentata* (Schepman, 1911) has a geological record from the Late Miocene.
11 Both *Taurasia* and *Preangeria* experienced substantial radiation during the Miocene, with each having a single extant species. In neither genus new species have originated since the Miocene.
12 *Taurasia* and *Semiricinula* occur in shallow water, typically in rocky areas in the intertidal zone, occasionally on wood. *Preangeria* lives in deeper soft bottom environments.

ACKNOWLEDGEMENTS

The following people have made an essential contribution to this paper by providing access to museum collections, be it physically or through the sharing of photographs.

Ronald Pouwer, Dr. Frank Wesselingh and Bram van der Bijl gave access to the collections of Naturalis Biodiversity Center, Leiden, The Netherlands which holds important collections from SE Asia including the K. Martin collection and part of the Mary Saul collection which were fundamental for this paper.

Specifically for this paper Dr. Daniele Ormezzano, Curator of the Sezione di Paleontologia, Museo Regionale di Scienze Naturali, Torino, Italy made photographs of various *Taurasia* species in the Bellardi and Sacco collections.

Rudi Hessel and Piet Hessel (International Fossil Shell Museum, Utrecht, The Netherlands) made photographs of various species from the Aquitaine, France specifically for this paper.

Dr. Philippe Bouchet and Virginie Héros of the Muséum National d'Histoire Naturelle (Paris, France) gave permission to use photographs of the syntypes of various species and provided further advice.

Dr. Christopher Meyer of the National Museum of Natural History (Smithsonian Institution, Washington, USA) made photographs of the types of *Morula borneensis* and of a selection of their many samples from the Indian Ocean registered as "*Thais buccinea*."

Dr. Alfréd Dulai of the Hungarian Natural History Museum, Budapest, Hungary specifically made photographs of the holotype of *Taurasia szobensis*.

Dr. Mandy Reid of the Australian Museum, Sydney, Australia specifically made photographs of the *Taurasia striata* specimens in their collection.

Mr. He Jing (Shanghai, China) gave permission to reproduce the photographs he uploaded on shellspecimen.net which were critical for understanding the variation within *T. striata*.

Roland Houart, Institut Royal des Sciences naturelles de Belgique, Brussels, Belgium; Koen Fraussen, Aarschot, Belgium; and Dr. Tan Koh Siang, Tropical Marine Science Institute, National University of Singapore, reviewed the manuscript and gave valuable comments and additional insights which have improved this paper.

The compilation and finalisation of this paper has been helped by digitisation and social media. Digitisation of collections by

various museums allows much easier access for researchers – this is a great effort that is very much appreciated. It includes the Bioportal of Naturalis Biodiversity Center (Leiden, The Netherlands) and an overview (Hoek Oostende et al., 2002) and photographs of the types in the K. Martin collection in the same museum (Leloux & Wesselingh, 2009; also accessible online); the photographing of types in the Muséum National d'Histoire Naturelle (Paris, France; also accessible online); the Atlas of Living Australia which links the databases of Australian museums and displays all results on summary maps, but also efforts by inspired individuals like Eddie Hardy who continues to update Hardy's Internet Guide to Marine Gastropods (gastropods.com) or people with mixture of scientific and commercial interests like Guido Poppe (conchology.be). Comparison of the real samples of course remains the most reliable method.

Many of the critical papers from the 19th and early 20th century could be consulted online, especially through Biodiversity Heritage Library. And it was through discussion fora on Facebook, specifically the Molluscs of Sundaland forum that allowed me to spot *Taurasia striata* from Thailand collected by Kasae Sahato and posted by Sahat Ratmuangkhwang (ACRSD, Ranong, Thailand) and get in touch with Mohammad Effendy Marzuki (Mukah, Sarawak, Malaysia) who collected the same species from Bintulu (Sarawak, Malaysia). As can be expected these digital sources should be used diligently as their key role is providing access and errors do creep in. Frequently misidentifications were noted with taxa belonging to a different species, or even genus or family. Only verifiable records have been used in this paper.

REFERENCES

ASWAN & OZAWA, T., 2006. Milankovitch 41000-year cycles in lithofacies and molluscan content in the tropical Middle Miocene Nyalindung Formation, Jawa, Indonesia. — Palaeogeography Palaeoclimatology Palaeoecology 235(4): 382-405.

ASWAN, SUPARKA, E., RIJANI, S., SUNDARI, D. & YAN PATRIANI, E., 2008. Asymmetrical condition of the Bogor Basin (West Jawa, Indonesia) during the Middle-Miocene to Pliocene based on taphonomic study of shellbed and its sequence architecture. — Bulletin Geological Survey of Japan 59 (7/8): 319-325.

ATLAS OF LIVING AUSTRALIA, biocache.ala.org.au – search on *Taurasia striata* (accessed 4 May 2016)

BEETS, C., 1985. Comments on *Acantinella, Preangeria* and *Taurasia* (Muricidae, Drupinae). — Scripta Geologica 74(1984): 39-47.

BEETS, C., 1987. Molluscan fauna of the Lower Gelingseh Beds s. str., Sangkulirang area, Kalimantan timur (East Borneo). — Scripta Geologia 82 (1986): 1-82.

BELLARDI, L., 1882. I molluschi dei terreni terziarii del Piemonte e della Liguria. Parte III. Gastropoda (Buccinidae, Cyclopsidae, Purpuridae, Coralliophilidae, Olividae). — Memorie della Reale Accademia delle Scienze di Torino, Serie Seconda, Classe di Scienze Fisiche, Matematiche e Naturali 34: 219-469.

BLAINVILLE, H.M. DE, 1832. Disposition méthodique des espèces récentes et fossiles des genres Pourpre, Ricinule, Licorne et Concholépas de M. De Lamarck et description des espèces nouvelles ou peu connues, faisant partie de la collection du Muséum d'Histoire naturelle de Paris. — Nouvelles Annales du Muséum d'Histoire Naturelle 1: 189-264.

BOSCH, D.T., DANCE, S.P., MOOLENBEEK, R.G., & OLIVER, P.G., 1995. Seashells of Eastern Arabia. 1-296, Motivate, Dubai, United Arab Emirates.

BOUCHET, P. & ROCROI, J.-P., 2005. Classification and Nomenclator of Gastropod Families. — Malacologia 47: 1-397.

BOUCHET, P. & WARÉN, A., 1986. Mollusca Gastropoda: Taxonomical notes on tropical deep water Buccinidae with descriptions of new taxa. — Mémoires du Muséum National d'Histoire Naturelle, Serie A 133: 457-517.

CERNOHORSKY, W.O., 1974. Type specimens of Mollusca in the University Zolological Museum, Copenhagen. — Records of the Auckland Institute and Museum 11: 143-192, figs 1-67.

CLAREMONT, M., HOUART, R., WILLIAMS, S.T. & REID, D.G., 2013b. A molecular phylogenetic framework for the Ergalataxinae (Neogastropoda: Muricidae). — Journal of Molluscan Studies 79: 19-29.

CLAREMONT, M., VERMEIJ, G.J., WILLIAMS, S.T. & REID, D.G., 2013. Global phylogeny and new classification of the Rapaninae (Gastropoda: Muricidae), dominant molluscan predators on the tropical rocky seashores. — Molecular Phylogenetics and Evolution 66: 91-102.

CONCHOLOGY.BE – search on *Eosipho* and on *Thais buccinea* (accessed 24 Dec 2015).

CONRAD, T.A., 1837. Description of new marine shells, from upper California. Collected by Thomas Nuttall, Esq. — Journal of the Academy of Natural Sciences of Philadelphia, First Series 7(2): 227-268, pls 17-20.

COSSMANN, M., 1903. Essais de paléoconchologie comparée, 5. 1-215, pls. 1-9. F.R. de Rudeval, Paris, France.

COSSMANN, M. & PEYROT, A., 1924. Conchologie Néogénique de l'Aquitaine (suite). — Actes de la Societé Linnéenne de Bordeaux 75(2/3): 71-318, pls. 8-18.

CSEPREGHY-MEZNERICS, I. 1956. A szobi és letkési puhatestı fauna [Die Molluskenfauna von Szob und Letkés]. — A Magyar Állami Földtani Intézet Évkönyve [Annales Instituti Geologici Publici Hungarici] 45(2): 361-477.

DALL, W.H., 1923. Notes on *Drupa* and *Morula*. — Proceedings of the Academy of Natural Sciences of Philadelphia 75: 303-306.

DHARMA, B., 2005. Recent & fossil Indonesian shells. 1-424. ConchBooks, Hackenheim, Germany.

EVERSON, G., 1997. Collecting in the Solomons – June 1996. — American Conchologist, 97 (2) through http://www.conchologistsofamerica.org/articles/y1997/9706_everson.asp.

FISCHER-PIETTE, E. & BEIGBEDER, J., 1944. Catalogue des types de gasteropodes marins conserves au Laboratoire de Malacologie. lll.-*Purpura* et genres voisins; Tritonidae. — Bulletin du Museum National d'Histoire Naturelle (ser. 2) 15(6): 429-436.

FRAUSSEN, K., J. SELLANES & P. STAHLSCHMIDT, 2012. *Eosipho zephyrus*, a new species (Gastropoda: Buccinidae) from deep water off Chile. — The Nautilus 126(1):33–37.

GMELIN, J.F., 1791. Vermes. In: GMELIN J.F. (Ed.) Caroli a Linnaei Systema Naturae per Regna Tria Naturae, Editio Decima Tertia, Aucta Reformata. Tome 1, Pars 6 (Vermes). 3021-3910. G.E. Beer, Lipsiae [Leipzig].

GRATELOUP, J.-P. S., 1832. Tableau des coquilles fossiles qu'on rencontre dans des terrains calcaires tertiaires (faluns) des environs de Dax, 6ème article. — Actes de la Société linnéenne de Bordeaux 5: 314-344.

GRATELOUP, J.-P. S., 1845-1847. Conchyliologie fossile des terrains tertiaires du bassin de l'Adour (environs de Dax), Tome I, Univalves. Atlas. I-XX, 1-12, 48 pls. Lafargue, Bordeaux, France.

HOEK OSTENDE, L.W. VAN DEN, LELOUX, J., WESSELINGH, F.P. & WINKLER PRINS, C.F., 2002. Cenozoic Molluscan types from Java (Indonesia) in the Martin Collection (Division of Cenozoic Mollusca), National Museum of Natural History, Leiden. — NNM Technical Bulletin 5: 1-130.

HOMBRON, J.B. & JACQUINOT, H., 1848 – Atlas d'Histoire Naturelle Zoologie par MM. Hombron et Jacquinot, chirurgiens de l'expédition, in Voyage au pole sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée exécuté par ordre du roi pendant les années 1837-1838-1839-1840 sous le commandement de M. Dumont-D'Urville capitaine de vaisseau publié sous les auspices du département de la marine et sous la direction supérieure de M. Jacquinot, capitaine de Vaisseau, commandant de la Zélée. 25ème Livraison, p. pls 14, 16, 19, 22.

HOUART, R., 1996. Results of the Rumphius biohistorical expedition to Ambon (1990). Part 5. Mollusca, Gastropoda, Muricidae. — Zoologische Mededelingen Leiden 70: 377-397.

HOUART, R., 2008. Rehabilitation of *Ergalatax martensi* (Schepman, 1892) (Gastropoda: Muricidae), senior synonym of *Ergalatax obscura* Houart, 1996, and description of *Ergalatax junionae*, new name for *Morula martensi* Dall, 1923. — The Nautilus 122: 99-106.

HOUART, R., 2015. *Taurasia striata* in World Register of Marine Species – (accessed 4 Jan 2016).

HOUART, R., KILBURN, R.N., & MARAIS, A.P., 2010. Muricidae, 176-270 in: MARAIS, A.P. & SECCOMBE, A.D. (eds) Identification guide to the seashells of South Africa. Volume 1. 1-376, Centre for Molluscan Studies, Groenkloof, South Africa.

HÜSING, S.K., ZACHARIASSE, W.-J., VAN HINSBERGEN, D.J.J., KRIJGSMAN, W., INCEO, M., HARZHAUSER, M., MANDIC, O. & KROH, A., 2014. Oligocene–Miocene basin evolution in SE Anatolia, Turkey: constraints on the closure of the eastern Tethys gateway. In: VAN HINSBERGEN, D.J.J., EDWARDS, M.A., & GOVERS, R. (eds) Collision and Collapse at the Africa-Arabia-Eurasia Subduction Zone. The Geological Society, London, Special Publications 311: 107–132.

INTERNATIONAL FOSSIL SHELL MUSEUM, www.fossilshells.nl, search on *Taurasia* (accessed 31 Jan 2016 and 28 March 2016)

KAJIWARA, T. & A. MATSUKAMA, 2005. Catalog is Molluscan Specimens at Kyushu University, Japan. 1. — Bulletin Kyushu University Museum 3: 107-206.

KANTOR, Y.I., PUILLANDRE, N., FRAUSSEN, K., FEDOSOV, A.E. & BOUCHET, P., 2013. Deep-water Buccinidae (Gastropoda: Neogastropoda) from sunken wood, vents and seeps: molecular phylogeny and taxonomy. — Journal of the Marine Biological Association of the United Kingdom 93(8): 2177-2195.

KOOL, S. 1993. Phylogenetic analysis of the Rapaninae (Neogastropoda: Muricidae). — Malacologia 35: 155-259.

KOPERBERG, E.J., 1931. Jungtertiäre und Quartäre Mollusken von Timor. I-IX, 1-165, pls 1-3. Algemene Landsdrukkerij, Den Haag, The Netherlands.

KUMBHAR. J.V. & RIVONKER, C.U., 2012. A new record of *Morula anaxares* with a description of the radula of three other species from Goa, Central West Coast of India (Gastropoda: Muricidae). — Turkish Journal of Fisheries and Aquatic Sciences 12: 189-197.

LAMARCK, J.B.P.A. de, 1844. Histoire naturelle des animaux sans vertèbres. Deuzième edition revue et augmentée de notes presentant les faits nouveaux dont la science s'est enrichie jusqu'a ce jour par mm. G. P. Deshayes et H. Milne Edwards. Tome X: 1-638. Baillière, Paris, France.

LAMY, E.D., 1918. Notes sur quelques espèces de Purpura déterminées par Blainville dans la collection du Muséum de Paris. — Bulletin du Muséum National d'Histoire Naturelle 24: 352-357

LELOUX, J. & WESSELINGH, F.P., 2009. Types of Cenozoic Mollusca from Java in the Martin Collection of Naturalis. — NNM Technical Bulletin 11: 1-765.

LESPORT, J.-F., CLUZAUD A. & VERHECKEN, A., 2012. Les publications du Docteur Jean-Pierre Sylvestre de Grateloup sur les mollusques fossiles du Bassin d'Aquitaine (S.-O. France): dates de parutions et commentaries. — Bulletin de la Societé Linnéenne de Bordeaux 147: nouvelle série 40(4): 417-485.

MARTIN, K., 1899. Die Fossilien von Java auf grund einer Sammlung von Dr. R. D. M. Verbeek und von anderen I. Band. Gastropoda: *Ocinebra-Telescopium*. — Sammlungen Geologisches Reichsmuseum Leiden, Neue Folge 1(1): 133-220, pl. 21-33.

MARTIN, K., 1921. Die Mollusken der Njalindungschichten, Gastropoda. – Sammlungen Geologisches Reichsmuseum Leiden, Neue Folge 1(2, 3): 446-470.

MARTYN, T., 1784 The Universal Conchologist, exhibiting the figure of every known Shell, with second title Figures of non-descript Shells collected in the different Voyages to the South Seas since the year 1764. 4 vols.

MELVILL, J.C., 1893. Descriptions of twenty-five new species of marine shells from Bombay. Collected by Alexander Abercrombie, Esq. — Memoirs and Proceedings of the Manchester Literary & Philosophical Society, 4th series 7: 52-67.

MICHELOTTI, G., 1847. Description des fossiles des terrains miocènes de l'Italie septentrional. Précis de la faune miocène de la Haute Italie. — Natuurkundige Verhandelingen Hollandsche Maatschappij der Wetenschappen Haarlem 3: 1-408.

MOLLUSQUES DE L'ÎLE DE LA RÉUNION http://vieoceane.free.fr/mollusques/intro_mollusque.htm (accessed April 2016).

MØRCH, O.A.L., 1852. Catalogus conchyliorum quæ reliquit D. Alphonso d'Aguirra & Gadea Comes de Yoldi: regis daniæ cubicullariorum princeps, ordinis dannebrogici in prima classe & ordinis caroli tertii eques. Fasciculus Primus. Cephalophora. 1-70. Locovici Kleini, Hafniae [København], Denmark.

MUSÉUM NATIONAL D'HISTOIRE NATURELLE – MOLLUSQUES. https://science.mnhn.fr/institution/mnhn/collection/im/item/search.

NATIONAL MUSEUM OF NATURAL HISTORY / SMITHSONIAN INSTITUTION DATABASE http://collections.nmnh.si.edu/search (accessed 2 April 2016)

NATURALIS BIODIVERSITY CENTER – BIOPORTAL. http://bioportal.naturalis.nl/

OOSTINGH, C.H., 1935. Einige neue Gastropoden aus dem Miocaen von Mittel-Bantam (Java). — De Ingenieur in Nederlandsch-Indië IV, Mijnbouw & Geologie 2(9): 79-83.

ORBIGNY, A. D', 1852. Prodrome de paléontologie stratigraphique universelle des animaux mollusques et rayonnées, III. 1-189. Victor Masson, Paris, France.

PÀLFY, J., DULAI, A., GASPARIK, M., OZSVÀRT, P., PAZONYI, P. & SZIVES, O., 2008. Catalogue of the invertebrate and vertebrate paleontological type specimens of the Hungrian Natural History Museum. 1-209. Hungarrian Natural History Museum, Budapest, Hungary.

PETIT DE LA SAUSSAYE, S., 1852. Description de coquilles nouvelles. — Journal de Conchyliologie 3: 162-165.

PETUCH, E.J., 1979. Twelve new Indo-Pacific gastropods. — Nemouria 23: 1-21.

POPPE, G.T., 2008. Philippine Marine Mollusks, 2. 1-848. ConchBooks, Hackenheim, Germany.

POWELL, A.W.B., 1979. New Zealand Mollusca – Marine, Land and Freshwater Shells. 1-500. Collins, Auckland, New Zealand.

QUOY, H.E.TH. & GAIMARD, P., 1833. Mollusques. Zoologie. In Voyage de découvertes de l'Astrolabe, exécuté par ordre du Roi, pendant les années 1826-1827-1828-1829, sous le commandement de M. J. Dumont d'Urville, vol. 2(2): 321-686.

RICHER DE FORGES, B. & BOUCHET, P., 1998. Benthic species from the tropical Pacific Institut de Recherche pour le Développement, Centre de Nouméa. Consulted through Ocean Biogeographic Information System (iobis.org/mapper) (accessed 5 Jan 2016).

SACCO, F., 1890. Catalogo paleontologico del bacino terziario del Piemonte. — Bolletino della Società Geologica Italiana 9: 185-340.

SACCO, F., 1904. I molluschi dei terreni terziarii del Piemonte e della Liguria, Parte XXX, aggiunte e correzione. i-xxxvi, 1-203, 31 pls. C. Clausen, Torino, Italy.

SAMANIEGO, R.M., TAGO, R.E. & FLORES, M.G., 1979. Fossil molluscs from the Iloilo Basin. — Journal of the Geological Society of the Philippines 24 (2): 68-119.

SCHEPMAN, M.M., 1892. Two supposed new species of *Pentadactylus*. — Notes from the Leyden Museum 15: 103-104.

SCHEPMAN, M.M., 1911. The Prosobranchia of the Siboga Expedition. Part IV. Rachiglossa. 49d: 247-364, 7 pls.

SHELLSPECIMEN.NET. record of *Semiricinula muricoides* by He Jing (accessed 27 March 2016).

SHUTO, T., 1969: 111 Neogene gastropods from Panay Island, the Philippines. Contributions to the geology and palaeontology of Southeast Asia, 68. — Memoirs of the Faculty of Science, Kyushu University, Series D, Geology 19(1): 1-250.

SPRY, J.F., 1961. The sea shells of Dar es Salaam: Gastropods (revised edition). — Tanganyika Notes and Records 56: 1-33 and Pl. I-VIII.

SUBBA RAO, N.V. & SURYA RAO, K.V., 1993. Contribution to the knowledge of Indian marine molluscs 3, Family Muricidae. — Records of the Zoological Survey on India, Occasional Paper 153: 1-133.

TAN, K.S., 2000. Species checklist of Muricidae (Mollusca: Gastropoda) in the South China Sea. — The Raffles Bulletin of Zoology, Supplement 8: 495-512.

THE ACADEMY OF NATURAL SCIENCES PHILADELPHIA, MALACOLOGY COLLECTION, http://clade.ansp.org/malacology/collections, search on *Taurasia striata* (on 07 Feb 2016).

TOPSEASHELLS.COM – search on *Thais buccinea* (accessed 24 Dec 2015).

VAN DER BIJL, A.N., 1994. De correspondentie tussen M.M. Schepman (1847-1919) en E.A. Smith (1847-1916). — Correspondentieblad der Nederlandse Malacologische Vereniging 280: 133-139.

VAN DER BIJL, A.N., MOOLENBEEK, R.G. & GOUD, J., 2010. Mattheus Marinus Schepman (1847-1919) and his contributions to malacology. 1-200. Netherlands Malacological Society, Leiden, The Netherlands.

VERMEIJ, G.J., 1998. The systematic position of *Tritonidea dentata* Schepman, 1911 (Gastropoda, Prosobranchia: Buccinidae). — Basteria 62: 25-34.

VERMEIJ G.J. 2006. The *Cantharus* group of pisaniine buccinid gastropods: review of the Oligocene to Recent genera and description of some new species of *Gemophos* and *Hesperisternia*. — Cainozoic Research 4(1): 71-96.

VERMEIJ, G.J. & CARLSON, S.J., 2000. The muricid gastropod subfamily Rapaninae: phylogeny and ecological history. — Paleobiology 26: 19-46.

VOKES, E.H., 1989. Neogene Paleontology in the northern Dominican Republic. 8. The Family Muricidae (Mollusca: Gastropoda). — Bulletins of American Paleontology, 97-332: 1-94, pls 1-12.

VREDENBURG, E., 1924. Indian Tertiary Gastropoda, V: Fusidae, Turbinellidae, Chrysodomidae, Strepturidae, Buccinidae Nassidae, Columbellidae, with short diagnoses of new species. — Records of the Geological Survey of India, 55(1): 52-77, pls. 1-5 [frequently quoted as published in 1923 but the volume is clearly marked 1924].

WANNIER, M., LESSLAR, P., LEE, C., RAVEN, J.G.M., SORKHABI, R. & IBRAHIM, A., 2011. Geological Excursions Around Miri, Sarawak. 1-308. EcoMedia, Miri, Malaysia.

WENZ, W., 1943. Gastropoda Teil 1. Allgemeiner Teil und Prosobranchia. In: O.H. Schindewolf (ed.). Handbuch der Paläozoologie. Berlin, Gebrüder Borntraeger. 6 (1) 6: 1201-1506, figs 3417-4211.

WINKLER PRINS, C.F., 1996. Dr C. Beets (1916-1995) and the 'Rijksmuseum van Geologie en Mineralogie'. — Scripta Geologica 113: 1-21.

WORLD REGISTER OF MARINE SPECIES, www.marinespecies.org (accessed 24 March 2016).

Accepted: 21 August 2016