

## The Recent Arcidae (Mollusca: Bivalvia) of southern Africa and Mozambique

by

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### SYNOPSIS

Thirty-one species are recorded for the region, three (*Barbatia (Calloarca) tetraquetra*, *B. (Destacar) colpodes* and *B. (Acar) petasion*) being described as new. *Arca ventricosa* Lamarck, 1819, *Barbatia setigera* (Reeve, 1844), *B. cibotina* (Melvill, 1906), *Arcopsis ornata* (Viader, 1951), *Samacar strabo* (Hedley, 1915) and *Anadara dautzenbergi* (Lamy, 1907) are recorded for the first time. *Arca lienardi* Viader, 1951 and *Striarca soyoae* Habe, 1958 are synonyms of *Barbatia cibotina*; *Arcopsis minabensis* Habe, 1981, and *Ribriarca okinawaensis* Noda, 1980 are synonyms of *Arcopsis ornata*; *Arca lactea* var. *gibba* Krauss, 1848 is a synonym of *Arcopsis symmetrica* (Reeve, 1844). *Barbatia setigera*, *B. agulhasensis*, (Thiele, 1925) and *Anadara africana* (Sowerby, 1904) are reinstated as valid species.

*Deltaodon* Barnard, 1962 is treated as a subgenus of *Samacar* Iredale, 1936 and *Ribriarca* Noda, 1980 as a synonym of *Arcopsis* von Koenen, 1885. The subfamily Anadarinae is regarded as a synonym of the Arcinae.

*Barbatia tetraquetra* proves to be incubatory.

### INTRODUCTION

Being a predominantly tropical group, the family Arcidae is not well represented in southern Africa. Barnard (1964) recorded only 17 species, this number is here increased to 31. Evidently even the more tropical coastline of Mozambique does not offer sufficiently extensive muddy backwater and coral reef habitats such as occur in the Western Pacific Arc, where maximum species-diversity occurs. The family is locally of no economic importance, although the larger *Anadara* species are consumed in Mozambique.

### BIOGEOGRAPHY

(1) Species-composition: Of the southern African and Mozambique Arcidae, 74% are tropical Indo-Pacific incursives (22% may prove to be restricted to the Indian Ocean), 19% are presumed Transkei/Mozambique endemics, and only 7% Cape endemics.

(2) Provincial composition: Total number of species known to occur in each subregion are as follows: Northern Mozambique—12; Southern Mozambique—19; Natal/Zululand—13; Transkei—9; Eastern Cape—7; Western Cape—2.

The apparent anomaly between figures for northern and southern Mozambique (where one would expect a southward *decrease* in number of species) may simply be due to inadequate sampling, but is more likely correlated with substrate availability. In south and central Mozambique conditions suitable for mud-dwelling species are produced by large rivers such as the Limpopo, Pungwe and Zambesi, which are absent from the coral coast of northern Mozambique.

## CLASSIFICATION

The latest attempt at standardising the classification of the Arcidae is that of Newell (1969). This, however, has not found general acceptance among malacologists. Unfortunately, apart from the old but still useful classification of Reinhart (1935), the only alternative systems are based on regional studies, mainly North American, Japanese and Australian. In essence, until consensus is reached, one is forced to select those aspects of each system which best fit one's local fauna. In the present revision a conservative approach is taken, in an attempt to deduce general patterns rather than to merely isolate aberrant or monotypic lineages.

At the subfamilial level, three groupings are generally recognised, here reduced to two. The subfamily Noetiinae, sometimes treated as a full family, has a distinctive ligament, and is certainly worthy of recognition. The subfamilies Arcinae and Anadarinae, however, must be synonymised. These are supposedly separated by the respective presence or absence of a byssal sinus, yet exceptions blur the dividing line. Even among the rather depauperate local Arcidae, *Anadara erythraeensis* and *A. mosambicana* have a distinct byssal sinus as in the 'Arcinae s.s.' while in some smaller species of *Barbatia* it is absent or indistinct ('subfamily Anadarinae'). The high adaptive significance of a byssal sinus suggests that parallelism and character-reversals would render any phyletic dichotomy in this character too nebulous for deduction of phylogeny.

## ABBREVIATIONS

AM = Australian Museum, Sydney; NM = Natal Museum; MN = R/V *Meiring Naudé*; SAM = South African Museum; BM(NH) = British Museum (Natural History); C.S.I.R. (Water Res.) = Council for Scientific and Industrial Research (Water Research); NMW = National Museum of Wales; v = valve.

## Key to genera of Arcidae in southern Africa and Mozambique

- 1 Ligament with conspicuous striae at right angles to hinge; muscle scars on myophores (Noetiinae) . . . . . 2
- Ligament with longitudinal or oblique striae; muscle scars rarely on myophores (Arcinae) . . . . . 3
- 2 More or less equilateral, ligament small, diamond-shaped or forming a transverse bar . . . . . **Arcopsis**
- Strongly inequilateral, ligament longitudinal and narrow . . . . . **Sheldonella**
- 3 Shell strongly twisted around hinge axis . . . . . **Trisidos**
- Shell not twisted . . . . . 4
- 4 Margins deeply crenulated; byssal sinus very narrow or absent, not indenting ventral margin; shell thick . . . . . **Anadara**
- Margins weakly or not crenulated; byssal sinus usually present, often indenting ventral margin; shell thin to moderately thick . . . . . 5
- 5 One or more anterior hinge teeth bifurcating, posterior teeth very oblique . . . . . **Samacar**
- Anterior hinge teeth not bifurcating . . . . . 6

- 6 Hinge line straight, ligamental area very wide and flat or barely declivous; often winged posteriorly . . . . . **Arca**
- Hinge line curved, ligamental area narrow and more or less declivous . . . . . 7
- 7 Small to medium-sized, thick-shelled, usually equivalve, hinge teeth only slightly oblique . . . . . **Barbatia**
- Tiny (rarely exceeding 5 mm), fragile, right valve clasped by left, hinge teeth generally very oblique . . . . . **Bathyarca**

Subfamily Arcinae

Genus *Arca* Linné, 1758

Type species: *Arca noae* Linné, 1758 (*ICZN Opinion* 189)

Three species of *Arca* s.s. are now known from southern Africa, and are separable as follows:

- 1 Shape quadrate, with a more or less alate dorsal line; radial ribs fairly strong **navicularis**
- Shape irregular, dorsal line not alate, radial sculpture fine and weak (except posteriorly) . . . . . 2
- 2 Umbo situated just anterior to median, entire ligamental area occupied by chevron grooves . . . . . **avellana**
- Umbo situated near anterior end, ligamental chevrons occupying anterior half of area . . . . . **ventricosa**

*Arca navicularis* Bruguière, 1789. Fig. 1

*Arca navicularis* Bruguière, 1789: 99; E. A. Smith, 1903: 395; Lamy, 1907: 20 (references); Braga, 1952: 102, pl. 8, fig. 4; Barnard, 1964: 369; Boshoff, 1965: 110. Type locality: 'Saint Domingue.'

Range: Indo-West Pacific to Natal.

Regional locality data: NORTHERN MOZAMBIQUE (all NM colln.: K. Grosch): Conducia Bay (H5524), also N. W. Choca, under rock slab, little surf, *Thalassodendron* (H5462), under rock slab, 4–5 ft above LST (H5461), on coral head of reef, LST (H5458); S. E. Cabaceira Pequena, Mozambique Bay, under rock on reef, some surf, 1 ft below LST (H5459). SOUTHERN MOZAMBIQUE: sandbanks west of central Bazaruto Is., shell debris and *Thalassodendron*, dredged 10 ft (NM J2390: E. Roscoe); N. of Benguera Is., *Thalassodendron* bed, ± 40 ft (NM G4468: R.K.); ½ mi. W. of Santa Carolina Is., sand and shell debris, 3 ft at LST (NM J2392); Inhambane (Braga 1952); Inhaca Is. (NM 8097: R.K.; NM 4519: P. H. Boshoff); Bay of Maputo (Barnard 1964). ZULULAND: Sodwana Bay, 50 m (NM A5140: A. Connell, juveniles). NATAL: Durban (NM 2024: H. Burnup, rec. E. A. Smith, 1903; NM 8325: R.K.); Durban Bay Harbour beds, Holocene or Pleistocene (NM 5022: R.K.; B1657, B1634: B. J. Young).

Notes: Although the name *Arca navicularis* has been applied, without exception, to an Indo-Pacific species, the given type locality of 'Saint Domingue' raises the question of whether Bruguière did not in fact have the western Atlantic *Arca zebra* Swainson, 1832, in mind. However, his citation of Chemnitz, 1784: pl. 54, fig. 533, which illustrates an 'ostindisch' shell, provides support for the traditional view.

In most southern African specimens ligament and general form resemble Philippi's figures of *A. navicularis* (1847: pl. 3, fig. 2), but an occasional shell is more like *A. linter* Jonas, 1845, as figured by Philippi (op. cit., fig. 3). It is unlikely that more than one species is involved locally.

*Arca ventricosa* Lamarck, 1819

*Arca ventricosa* Lamarck, 1819: 38; Prashad, 1932: 33 (references and synonymy). Type locality: 'les mers d'Inde' [= Amboina, designated Iredale, 1939].  
*Navicula ventricosa*; Iredale, 1939: 294.

Known range: Indo-West Pacific to Zanzibar, here extended to southern Mozambique.

Regional locality data: NORTHERN MOZAMBIQUE: Lunga Bay, in brittle coral head on reef, current, little surf, LST (NM H5464: K. Grosch); Conducia Bay, on coral-encrusted rock, little surf, 1 ft above LST (NM H5465: K. Grosch). SOUTHERN MOZAMBIQUE: Morungulu, near Massinga (NM G8165: Mrs E. Roscoe).

*Arca avellana* Lamarck, 1819. Figs 2, 3

*Arca avellana* Lamarck, 1819: 38; Lamy, 1904: 136, pl. 5, figs 1, 2 (holotype); Prashad, 1932: 32 (references and synonymy); Barnard, 1964: 369 (references); Boshoff, 1965: 109; Kilburn & Rippey, 1982: 156, pl. 35, fig. 8, text fig. 104. Type locality: 'Nouvelle Hollande a l'île St Pierre-St François' [= 'very probably Shark's Bay, West Australia', fidé Iredale, 1939: 293].

Range: Indo-West Pacific to South Africa, as far west as Port Alfred.

Notes: This common species is represented in the NM collection by over 55 samples from Mozambique, Natal, Transkei and eastern Cape Province. Local shells agree well with specimens from Western Australia (NM J5043), the presumed type locality.



Figs 1-3. *Arca navicularis* Bruguière, 1789, and *A. avellana* Lamarck, 1819, right valves. 1, *A. navicularis*, Durban, 47 × 22,3 mm. 2-3, *A. avellana*: 2, narrow form (*acuminata* Krauss, 1848), Kosi Bay, 30,2 × 11,2 mm; 3, typical form, Umkomaas, 36,4 × 19,7 mm.

Genus *Trisidos* Röding, 1798

Type species: (o.d.) *Arca tortuosa* Linné, 1758 and Morton (1983).

The functional significance of the peculiar twisted shell of *Trisidos* has been recently discussed by Tevesz & Carter (1979) and Morton (1983).

Boshoff (1965) showed that Barnard's 1964 record of the western Pacific *T. semitorta* (Lamarck, 1819) was based on the left valve of *T. tortuosa*, as was that of Braga (1952).

*Trisidos tortuosa* (Linné, 1758)

*Arca tortuosa* Linné, 1758: 693; Hanley, 1855: 91. Type locality unknown [= Mysol, Papua, fidé Iredale, 1939].

*Arca (Trisidos) tortuosa*; Barnard, 1964: 369; Boshoff, 1965: 105.

*Trisidos tortuosa*; Iredale, 1939: 270.

*Arca semitorta* (non Lamarck, 1819); Braga, 1952: 103. pl. 9. fig. 1; Barnard, 1964: 369.

Range: Indo-West Pacific to southern Mozambique.

Regional locality data: CENTRAL MOZAMBIQUE: Beira (NM G8171: Mrs E. Roscoe). SOUTHERN MOZAMBIQUE: Maputo (NM 4608: R.K.; G6055: K. Grosch; F6749: A. C. & W. H. van Bruggen); Inhaca Is. (NM 4529: P. H. Boshoff).

Notes: *T. tortuosa* is restricted to sheltered areas of fine muddy sand and is apparently absent from the coral sands of northern Mozambique.

Oyama (1974) attempted to redefine *T. tortuosa* by designation of a 'lectotype figure'. However he has overlooked the presence of the actual holotype in the collection of the Linnean Society of London.

Genus *Barbatia* Gray, 1842

Type species: *Arca barbata* Linné, 1758 (s.d. Gray, 1857).

Subgeneric classification of the genus *Barbatia* has been the subject of much disagreement. Numerous subordinate taxa—often raised to full genera—have been proposed, based on characters (in various combinations) such as shape, sculpture, periostracal development, etc. However, it is evident that there is little likelihood of natural groupings being finalised until basic species-level taxa have been resolved for the genus as a whole. Instead of attempting to reconcile local taxa with the often artificial subgeneric categories available, a more fundamental approach is here adopted. Study of the material in the Natal Museum suggests that two natural lineages are available, one of which is readily subdivisible:

- 1 Cardinal area covered by chevrons of lamellar ligament . . . . . **Barbatia** s.s.
- Chevrons bearing lamellar ligament restricted to post-umbonal part of area . . . . . 2
- 2 Muscle scars raised; sculpture strongly cancellate; without periostracum **Acar**
- Muscle scars not raised; sculpture usually not strongly cancellate; periostracum present . . . . . 3
- 3 Left valve slightly larger than right; exterior with a depressed ray . . . **Destacar**
- Equivalve, without radial impression . . . . . **Calloarca**

Note: The posterior situation of the lamellar ligament in the *Acar-Calloarca-Destacar* complex should not be confused with the position in some *Barbatia* s.s. where the *entire* ligament may be more or less posterior. In the former case the anterior part of the cardinal area is covered only by a thin layer of fibrous ligament.

Subgenus *Barbatia* s.s.

Key to species of *Barbatia* s.s. in southern Africa and Mozambique

- 1 Ligament posterior to umbo; shell markedly oblique, narrowing anteriorly; hinge line with fine, notch-like median teeth . . . . . **obliquata**
- Ligament amphidetic; shell not strongly oblique, median hinge teeth not as above . . . . . 2
- 2 Hinge line with discrepant teeth below umbo; externally blotched with brown; periostracum conspicuously setose . . . . . **setigera**
- Hinge teeth not discrepant; uniform white to light brown, periostracum absent or with short bristles . . . . . 3
- 3 Dorsal and ventral margins nearly parallel; median radial ribs deeply bifid or paired, posterior ones very wide and flat . . . . . **bistrigata**
- Shape and sculpture not as above . . . . . 4
- 4 Sculpture coarsely tuberculose-cancellate, posterior ribs with strong nodules; periostracum feeble or absent; median hinge teeth obsolete . . . . . **revelata**
- Sculpture of smooth to granular radial riblets, posterior ones not nodose; periostracum thick and conspicuous; median hinge teeth rarely obsolete . . . . . **foliata**

*Barbatia (Barbatia) foliata* (Forsskål, 1775). Figs 4, 5

*Barbatia foliata* (Forsskål, 1775); Kilburn & Rippey, 1982: 157, 215 (synonymy), pl. 35, figs 9a, b, text-figs 105 and p. 216 (lectotype).

*Barbatia petersii* Dunker, 1870: 135, pl. 45, figs 5–7. Type locality: Quirimba Island.

*Arca petersii*; Von Martens, 1879: 741.

Range: Indo-West Pacific to Port Alfred.

Notes: A common, highly variable species, represented in the NM collection by many samples. It has previously been recorded from southern Africa under such names as *Arca helblingi* (*non* Bruguière, 1789), *A. nivea* Röding, 1798, and *A. decussata* (Sowerby, 1833). No material agreeing exactly with *Barbatia petersii* is available, but it appears to fall within the variation observed in *B. foliata*.

*Barbatia (Barbatia) revelata* (Deshayes, 1863). Fig. 6.

*Arca revelata* Deshayes, 1863: 23, pl. 3, figs 20, 21. Type locality: Réunion Island.

*Barbatia revelata*; Kilburn & Rippey, 1982: 157.

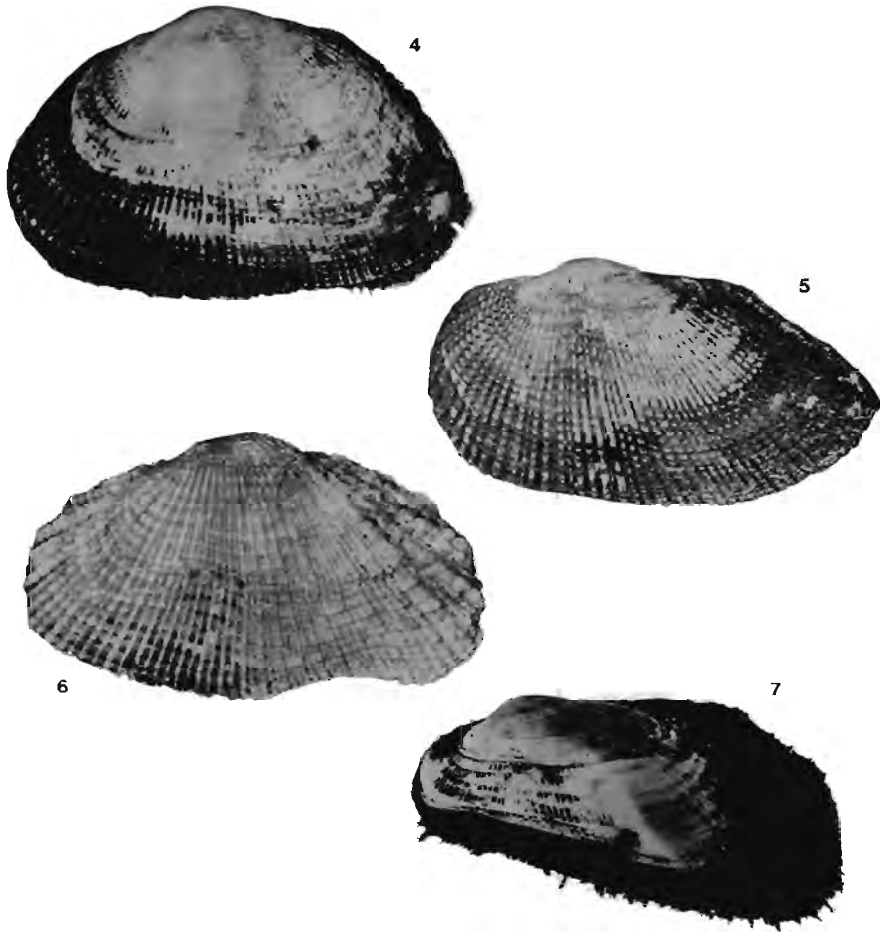
*Arca caelata* (*non* Reeve, 1844); Sowerby, 1897: 27; Lamy, 1907: 92.

*Arca plicata* (*part*); Boshoff, 1965: 111.

Known range: Mauritius and Réunion to eastern Cape border.

Regional locality data (all NM colln.): NORTHERN MOZAMBIQUE: Conducia Bay (H5455: K. Grosch); Choca, Conducia Bay, in coral growth, on reef, LST, little surf (H5453: K. Grosch); SW shore of Mozambique Is., under rock slab on

reef, LST, current, little surf (5452: K. Grosch), Lunga Bay, in depression in coral head, LST (H5454: K. Grosch). SOUTHERN MOZAMBIQUE: Inhaca Island (NM 4563: P. H. Boshoff). ZULULAND: Kosi Estuary (4610: O. Bourquin); Cape Vidal (5497: R.K.). NATAL: Durban (2040; 4564: H. C. Burnup; B1639: B. J. Young); Réunion Rocks, near Isipingo (4603: R.K.); Scottburgh (4566: H. C. Burnup); Shelley Beach (4565: R.K.); Palm Beach (5032: L. & R. Cock). TRANSKEI (single valves only): Mzamba (B907: R.K.); Mbotyi (A5215: R.K.); off Port Grosvenor, 80–84 m and 100–110 m (C597, C637, C686: MN); off Waterfall Bluff, 100 m (C540: MN) off Oora River, 196 m (NM C5173: MN); off Kei River, 222 m (NM C4079: MN). EASTERN CAPE PROVINCE: Kei River mouth (H. Jefferies colln.).



Figs 4–7. *Barbatia (Barbatia) foliata* (Forsskål, 1775), *B. (B.) revelata* (Deshayes, 1863) and *B. (B.) obliquata* (Wood, 1828), left valves. 4–5, *B. foliata*: 4, typical form, Isipingo, 69,3 × 63,4 mm; 5, granulate form, Durban, 60,8 × 33,2 mm. 6, *B. revelata*, Réunion Rocks, Natal, 55,2 × 31,5 mm. 7, *B. obliquata*, Banyana River, Transkei, 41,8 × 20,7 mm.

Notes: This species was recorded from South Africa by Sowerby (1897) as *Arca caelata*, but overlooked by subsequent authors. Local material agrees closely with the type figures of *A. revelata* and with a specimen from Mauritius (NM G3762). Jacobson & Usticke (1966: 10) showed that *caelata* was a Caribbean form of *Barbatia candida* (Helbling, 1779), but erroneously treated *revelata* as a 'clean well-sculptured example of *B. decussata* (Sowerby)' *Byssosarca decussata* Sowerby, 1833, as shown by three syntypes (BM(NH) 1969232), falls within the range of variation of the protean *Barbatia foliata* (Forsskål, 1775) (see Kilburn & Rippey, 1982: 215). Differences between *B. revelata* and *B. foliata* are given in the preceding key; there is no sign of intergrading.

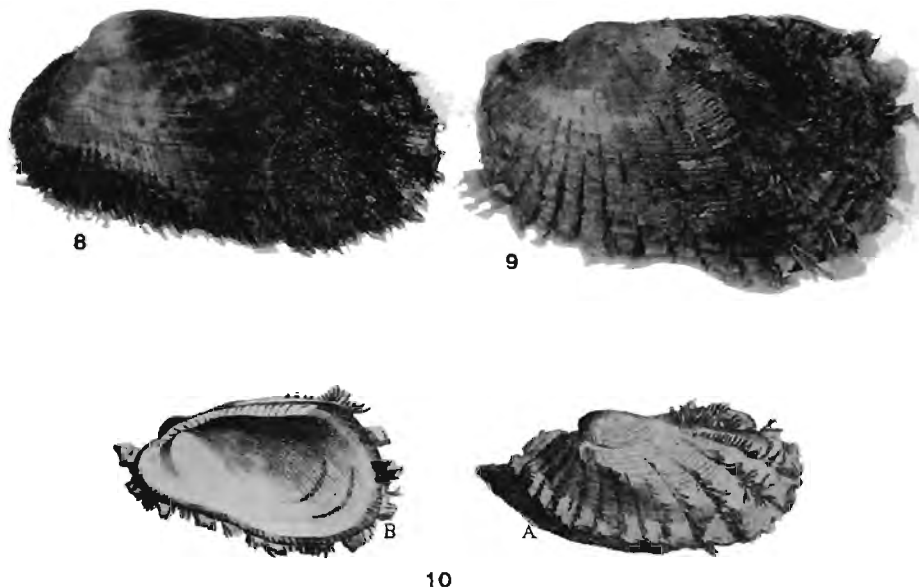
The periostracum in *B. revelata* forms only a thin film, but under magnification is seen to form inconspicuous interstitial lappets where not abraded away.

*Barbatia (Barbatia) setigera* (Reeve, 1844) **stat. rev.** Figs 8, 12

*Arca setigera* Reeve, 1844: pl. 14, fig. 94; Kobelt, 1891: 153, pl. 39, figs 1, 2. Type locality: Zanzibar. *Arca (Barbatia) fusca* (non Bruguière, 1789); Boshoff, 1965: 104, pl. 1, figs 1, 4.

Known range: Red Sea to Tanzania, here extended to eastern Transkei.

Regional locality data: NORTHERN MOZAMBIQUE: Conducia Bay (NM H5452: K. Grosch), N.W. Choca, after cyclone (NM H5450: K. Grosch). SOUTHERN MOZAMBIQUE: Bazaruto Is. (NM J2388: E. Roscoe); Santa Carolina Is. (NM G4114: R.K.); Baia dos Cocos, near Jangamo (NM F9109: A. Jenner); Mossongulo, near Massinga (NM G3831: B. R. Stuckenberg); Inhaca Is.



Figs 8-10. *Barbatia (Barbatia) setigera* (Reeve, 1844) and *B. (B.) lacerata* (Bruguière, 1789). 8, *B. setigera*, Conducia Bay, Mozambique, 64.3 × 36.1 mm, left valve. 9-10, *B. lacerata*: 9, Zamboanga, Philippines, NM F8832, 76.7 × 47.2 mm, left valve; 10, type figures, after Linné, 1753: pl. 6, figs 1A, B.

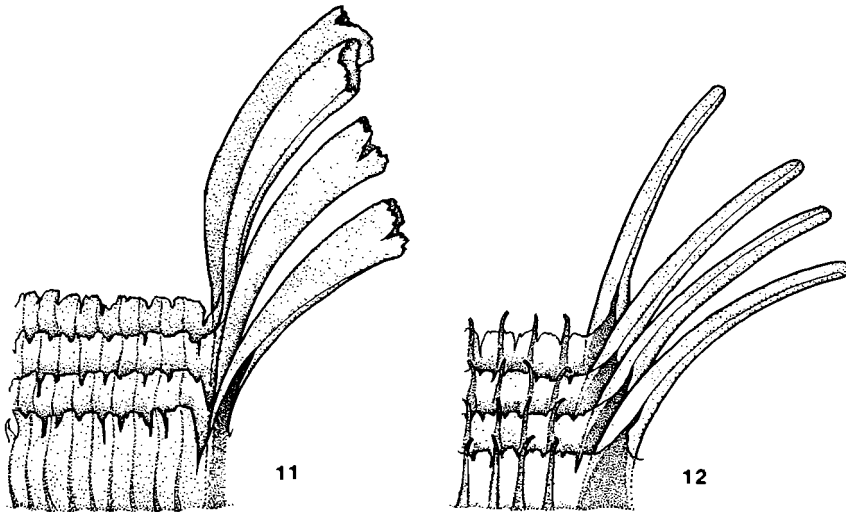


(NM 4562: P. H. Boshoff); Cabo de Santa Maria, Bay of Maputo (NM 8060: R.K.). ZULULAND: Kosi Bay (NM A4570: S. Blaber). NATAL: Umkomaas (NM B5744: H. C. Burnup); Park Rynie (NM 4607: R.K.); Melvill (NM 4602: R.K.); Ifafa (NM 4560: W. Falcon). EASTERN TRANSKEI: Mzamba (NM 5280); off Port Grosvenor, 120–128 m, coarse sand, some mud (NM C1198: *MN*); Lwandile/Mdumbi (NM C56: R.K.).

Notes: Previous authors have treated *Arca setigera* as a synonym of *Arca lacerata* Bruguière, 1789 (Figs 9, 10). Although the two species are undeniably similar, they are readily distinguishable by periostracal characters (Figs 11, 12). In both species the periostracum consists of radial rows of long processes, separated by intervals of small, lamellate, imbricate lobes. In *B. setigera*, however, the long processes are simple bristles, while the minor lamellae are fringed with setae; anteriorly the periostracum presents a bristly appearance. In *B. lacerata*, on the other hand, the long processes are broad, blade-like to spatulate and rendered relatively inconspicuous by the dense covering of non-setose minor lamellae. Hinge teeth in *B. setigera* are coarser, these numbering 8–10 anteriorly, where *B. lacerata* shows at least 17.

Syntypes of *B. setigera* (BM(NH) 1969187) were compared with local material and found to agree exactly. In validating the name *Arca lacerata*, Bruguière (1789: 101) cited several figure-references, of which those in Linné's non-binomial *Museum Tessinianum* of 1753 (pl. 6, figs 1A and B) can be regarded as equivalent to modern type figures. Although somewhat crude, these figures (Fig. 10) show flattened periostracal processes and non-setose intermediary lobes, as in *lacerata* auct.

*Arca fusca* Bruguière, 1789 (*non* Lightfoot, 1786) is a synonym of *Barbatia amygdalumtostum* (Röding, 1798). This species differs from *B. setigera* in its more regularly elliptical shape, beaded ribs, finely setose periostracum and much finer



Figs 11–12. Diagrams of periostracal structure in 11, *Barbatia lacerata*, and 12, *B. setigera*.

hinge teeth. It occurs in Tanzania, and may prove to range into northern Mozambique; Von Marten's record (1879: 741) of '*Arca fusca*' from Quirimba island should be re-examined in this regard. *Arca fusca* Lightfoot, 1786, was regarded by Rehder (1967: 10) as a *nomen dubium*.

*Barbatia lacerata*, *amygdalumtostum* and allies have been referred to the genus/subgenus *Ustularca* Iredale, 1939 (type species (o.d.) *U. cruciata renuta* Iredale, 1939). This group is supposedly characterised by its dark coloration and 'medially dislocated' tooth line, both of which are actually features also found in some NM examples of the Mediterranean *B. barbatia* (Linné, 1758), type species of *Barbatia*.

*Barbatia (Barbatia) obliquata* (Wood, 1828). Fig. 7

*Arca obliquata* Wood, 1828: 6, pl. 2, fig. 4. Type locality unknown, here designated as Algoa Bay.  
*Arca (Barbatia) obliquata*; Barnard, 1964: 373 (references), fig. 2c (prodissoconch); Boshoff, 1965: 112.

*Barbatia obliquata*; Kilburn & Rippey, 1982: 157, pl. 35, fig. 11, text fig. 106.  
*Arca alfredensis* Bartsch, 1915: 182, pl. 46, figs 9, 10. Type locality: Port Alfred.

Range: False Bay to Bay of Maputo; tropical Indian Ocean ?

Notes: The NM collection contains numerous samples from various localities between Cape Agulhas and Inhaca Island. However, no sign of the species has been seen elsewhere in Mozambique, which implies that *B. obliquata* may prove to be a warm-temperate southern African endemic. This conflicts with literature records from Sri Lanka, Red Sea and elsewhere in the northern Indian Ocean. Local material agrees with the holotype (BM(NH) 1969190), which from the date of description was probably taken back by a transport ship returning from the newly-founded (1820) settlement at Algoa Bay.

The subgeneric name *Savignyarca* Jousseaume, 1921 (type species (o.d.) *S. savignyarca* Jousseaume, 1921) is available for the *obliquata* group, should this prove to be a natural one. The oblique shape, in itself, is of doubtful value, as parallel development is found in unrelated species such as *B. setigera*. However, the feeble median hinge teeth occur in allied species such as *B. virescens* (Reeve, 1844) and *B. scazon* (Iredale, 1939), and may prove to be a useful synapomorphy.

*Barbatia (Barbatia) bistrigata* (Dunker, 1866)

*Arca bistrigata* Dunker, 1866: 87, pl. 30, figs 4-6; Kobelt, 1891: 164, pl. 41, figs 7, 8; Braga, 1952: 105, pl. 8, fig. 6. Type locality: Bombay and China.

*Arca (Barbatia) bistrigata*; Barnard, 1964: 373; Boshoff, 1965: 105.

*Nipponarca bistrigata*; Habe, 1964: 164, pl. 49, fig. 11; idem, 1981: 34 (references).

Range: Indo-Pacific to southern Mozambique.

Regional locality data: SOUTHERN MOZAMBIQUE: Maputo (NM 5031: R.K.; also Braga (1952) and Barnard (1964)); Inhaca Island (NM 4559: P. W. Boshoff). CENTRAL MOZAMBIQUE: Beira, harbour dredgings (NM G8157: Mrs E. Roscoe).

Notes: Only single, mostly worn valves have been seen. Like *Trisidos tortuosa*, *B. bistrigata* seems to prefer muddy areas, and is absent from the coral coast of northern Mozambique.

Subgenus *Calloarca* Gray, 1857

Type species: (o. d.) *Byssosarca alternata* Sowerby, 1883.

The type species of *Calloarca* is a somewhat aberrant *Barbatia* from tropical west America with very strong posterior ribbing which is invariably cited as the main characteristic of the group. However, such sculptural details are unlikely to be of great phyletic significance, and attention is drawn rather to the bipartite ligament, in which the lamellar component is restricted to a few posterior chevrons as in *Acar*. Indeed, such a synapomorphy may prove useful grounds for uniting the two as a full genus; *Acar* would become the nominate taxon (first revisor Lamy, 1907). Probably synonyms of *Calloarca* are *Barbarca* Dall, Bartsch & Rehder, 1938, *Hawaiarca* Dall, Bartsch & Rehder, 1938, and *Opularca* Iredale, 1939.

Key to species of *Calloarca* in southern Africa and Mozambique

- 1 Cardinal area (valves together) somewhat arrowhead-shaped (i.e. widening strongly anterior to umbo) ..... 2
  - Cardinal area lanceolate ..... 3
- 2 Radial ribs uniform in strength; hinge with a toothless median gap; adult exceeding 20 mm in length; littoral ..... **tenella**
  - Radial ribs markedly stronger posteriorly than elsewhere; tooth line not interrupted; maximum length barely exceeding 10 mm; outer continental shelf ..... **cibotina**
- 3 Posterior ribs coarse, granules usually flat and square; posterior hinge teeth more oblique than elsewhere; total depth/length 0,41–0,47; attains 30 mm; littoral ..... **sculpturata**
  - Posterior ribbing fine; granules rounded, hinge not as above, total depth/length 0,46–0,55; attains 14 mm; outer continental shelf ..... **tetraquetra**

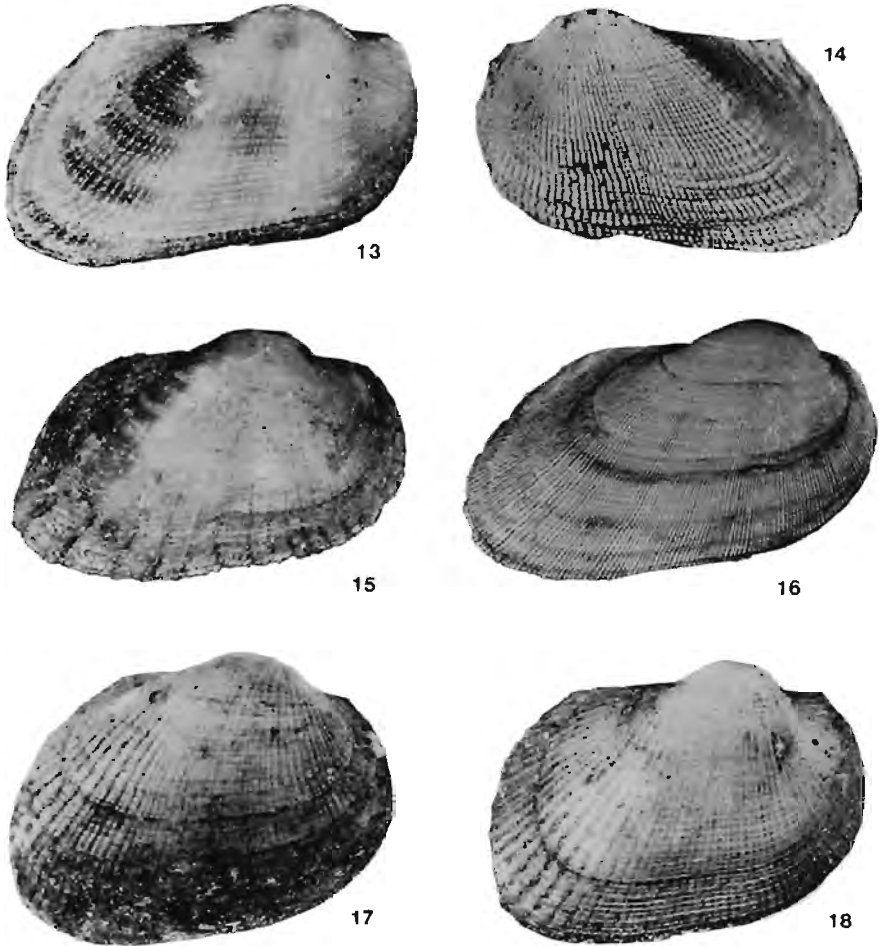
***Barbatia (Calloarca) tetraquetra* sp. n.** Figs 13, 14, 19

Diagnosis: Shell trapeziform, dorsal line straight, forming a distinct angle postero-dorsally, umbonal ridge rounded; about 70 fine radial riblets bearing inconspicuous granules where crossed by weaker concentric threads; cardinal area as in subgenus; hinge with 5–9 anterior teeth, 11–16 posteriorly, separated by a toothless gap; off-white, suffused or blotched posteriorly with brownish-orange. Maximum length about 10 mm.

Description: Shell trapeziform, height/length 0,54–0,58, slightly wider posteriorly than anteriorly; umbones low, situated about 0,33–0,46 of length of hinge from anterior end; dorsal line straight, forming a distinct angle posterodorsally, posterior end declivous, anterior end strongly rounded, forming a slight angle at posterodorsal end; ventral margin with a slight median concavity and narrow byssal gape. Valves deep (depth 0,46–0,55 of length), externally with a rounded umbonal ridge. Sculptured by approximately 70 fine, rather flattened radial riblets, cut by weaker or subequal concentric threads into inconspicuous granules, becoming somewhat squamiform on posterior face, where riblets are slightly

coarser than elsewhere; interstices narrow; riblets divided into groups by shallow radial furrows.

Ligamental area narrowly lanceolate, divided into two segments; anterior part covered by a translucent fibrous film, marked with faint transverse and longitudinal striae; posterior half with about 4, closely-packed oblique lamellae forming a chevron pattern in opposed valves. Hinge line gently curved, most concave at about 0,25 length from anterior end, where the two tooth series diverge; anterior series of 5-9 teeth, posterior one of 11-16, separated by a distinct smooth gap;



Figs 13-18. *Barbaia (Calloarca) tetraquetra* sp. n., *B. (C.) sculpturata* (Turton, 1932), *B. (C.) tenella* (Reeve, 1844) and *B. (C.) cibotina* (Melvill, 1906). 13-14, *B. tetraquetra*: 13, holotype, 9.1 × 5.4 mm, right valve; 14, paratype, B3766, off Park Rynie, 100 m, 10.2 × 5.9 mm, left valve, whitened with ammonium chloride. 15, *B. sculpturata*, Banyana River mouth, Transkei, 15.1 × 9.3 mm, right valve. 16, *B. tenella*, Cape Vidal, Zululand, 23.4 × 12.8 mm, right valve. 17-18, *B. cibotina*: 17, with periostracum, off Park Rynie, 120 m, 9.0 × 6.7 mm; 18, cleaned, same locality, 8.6 × 5.8 mm; both right valves.

individual teeth rather peg-like. Inner ventral margin almost smooth. Anterior adductor scar more clearly-defined, but subequal to posterior one in size.

Pinkish-white, inside and out, suffused posteriorly with brownish-orange. Periostracum thin, with radial rows of short setae towards ventral margin; usually worn away or obscured by marine-growths.

Prodissoconch flatly domed, ill-defined.

Pallial eye-spots fine and numerous, becoming few and large posteriorly.

Dimensions: 9,1 × 5,4 mm (both valves together) × 4,7 mm (holotype); 14,5 × 8,3 × 7,3 mm; 5,8 × 5,3 mm; 7,6 × 4,3 × 3,5 mm (paratypes).

Range: Continental shelf and upper slope from off Natal south coast to western Transkei, in 45–140 metres.

Type material (all NM colln. *R/V Meiring Naudé*): NATAL: Holotype, off Park Rynie, 140 m, sponge-rubble (B4532/T2497). Paratypes, same data (B3860/T2498), 17; same locality 110–130 m, eroded shell-conglomerate (B3584/T2502), 1; same locality, 120 m, rubble and solitary corals (B3777/T2501), 20; same locality, 100 m, sponge-rubble and sand (B3766/T2500), 4½; off Scottburgh, 100 m (B3497/T2508), 2; off Port Shepstone, 125 m, sponge-rubble (B3977/T2499), 1. TRANSKEI: off Mtamvuna River, 100 m, rubble (C459/T2504), 3; same locality, 102–110 m (C790/T2803), 1; same locality, 115 m, sponge-rubble (C448/T2505), 1; same locality, 140 m, sponge-rubble (C890/T2507), 1; same locality, 143 m, sponge-rubble (C904/T2506), 4; off Mbotyi, 45–50 m (C392/T2532), lv.; off Port St Johns, 30 m, worm-tubes, organic debris (C988/T2509, C1545/T2511), 2; off Whale Rock, 90 m, sponge-rubble, small pebbles (C1824/T2533), 1; off Mncwasa Point, 74 m, sand and rubble (C1856/T2531), 4; off Mendu Point, 92–100 m, rocks, hydroids, broken coral (C4754/T2712), 3; of Nqabara Point, 95 m, sponge, sand (C4179/T2713), 6; off Qora River, 100 m, coarse sand, some sponge-rubble (A4859/T2714), 2; do, 87 m, coarse sand (C4286/T2715), 4; off Sandy Point, 94 m, sponges, gorgonians (C4041/T2717), 7; do, 90 m, calcareous debris, coarse sand (C4528/T2718), 24; off Qolora River, 114 m, sponge rubble (C3937/T2719), 5; do, 96 m, gorgonians, sponges (C4655/T2720), 3.

Notes: This common species may be the same as *Arca elegans* Viader, 1951 (*non* Perry, 1811) from Mauritius, apparently differing only in being less oblong, with deeper valves and more numerous hinge teeth. The Japanese *Barbatia yamamotoi* (Habe & Sakurai, 1961), and *B. stearnsi* (Pilsbry, 1895) are also comparable; the former has fewer, coarser ribs, a conspicuously setose periostracum, more numerous hinge teeth and slightly unequal valves; the latter has a more hirsute periostracum, a less trapeziform outline and browner coloration. *B. parva* (Sowerby, 1833) of the tropical Indo-Pacific, differs in shape and colour. Of local species, the Cape *Barbatia sculpturata* (Turton, 1932) is very similar to *B. tetraquetra* but differs in its posterior hinge teeth being more strongly inclined to the horizontal, (see Figs 19, 19a), in the ribs being cut into flat, squared granules rather than rounded ones, in its less tumid valves (0,41–0,47 against 0,46–0,55 depth/length) and larger adult size than *tetraquetra*, in its coarser posterior ribbing, pinker colour and generally longer, less square-set anterior end. *B. tetraquetra* replaces

*B. sculpturata* in offshore waters and in Natal, the latter species being a warm-temperate littoral taxon, the only specimens so far dredged being essentially a few single valves from 20–25 and 40–45 metres, and two live ones from 32–35 m.

One large (10,2 mm) example of *B. tetraquetra* was found to be harbouring several hundred yellow ova (each approximately 0,25 mm in diameter) between the demibranchs on both sides. The advantages of incubation in a community dominated by filter-feeding sponges is obvious. I am unable to trace any other record of the incubatory habit in the family Arcidae.

*Barbatia (Calloarca) sculpturata* (Turton, 1932). Figs 15, 19a

*Barbatia sculpturata* W. H. Turton, 1932; Kilburn, 1972: 430 (references), fig. 15; Kilburn & Rippey, 1982: 157, pl. 35, fig. 10.

Range: Saldanha Bay to eastern Transkei.

Type material: Holotype & paratypes in Oxford University Museum. Two opposing paratype valves in NM colln (B5974/T2711: ex. Albany Museum colln, don. Turton 1930).

Additional locality records (see Kilburn, 1972): EASTERN CAPE: Jeffreys Bay (NM A4290: F. Graeve); Port Elizabeth (NM A4291: F. Graeve); Port Alfred (NM B635: E. K. Jordan). TRANSKEI: Kei River mouth (NM C3501: R.K.); Qolora River mouth (NM C3324: R.K.); Sandy Point (NM C3636: R.K.); Banyana River area (NM B1284, B1338: R. & J.K.); Nthlonyane (NM B1450: R. & J.K.); Lwandile/Mdumbi area (NM C169: R.K., R. Fregona); Mbotyi (M A4796: R.K., J. McKay).

Also: off Whale Rock, Transkei, 20–25 m, two valves (NM C3251: MN) and off Ubombo, Transkei, 40–45 m, one valve (NM C1843: MN); off Mncwasa Point, Transkei, 32–35 m, marine growths, some sand, two living (NM C3079: MN). These single valves may have been derived from littoral populations.

*Barbatia (Calloarca) tenella* (Reeve, 1844). Fig. 16

*Arca tenella* Reeve, 1844: pl. 14, sp. 91; Lamy, 1907: 93 (references); Stevenson, 1972: 201. Type locality: Burias Island, Philippines.

*Barbatia (Barbarca) tenella*; Kilburn, 1972: 432.

Range: Indo-West Pacific to Zululand.

Regional locality records: NORTHERN MOZAMBIQUE: between 11°00' and 13°00'S. (NM G3992: A. Jenner); Conducia Bay (NM H5444: K. Grosch). SOUTHERN MOZAMBIQUE: Two Mile Reef, Benguera Is. (NM G1294: Mrs E. Roscoe). ZULULAND: Cape Vidal, under rock in pool (Kilburn, 1972).

Notes: *Barbatia tenella* has been referred to the genus/subgenus *Barbarca* Dall, Bartsch & Rehder, 1938, proposed as a subgenus of *Calloarca*; the type species (o.d.) of *Barbarca*, *C.(B.) hua* Dall, Bartsch & Rehder, 1938, is a synonym of *tenella* (Kay, 1979). *Opularca* Iredale, 1938, type species (o.d.) *O. tenella egenora* Iredale, 1939, is consequently a synonym of *Barbarca*. However, the mere absence of strong posterior ribs is, in my opinion, scarcely significant enough to warrant recognition of *Barbarca* as a subgenus.

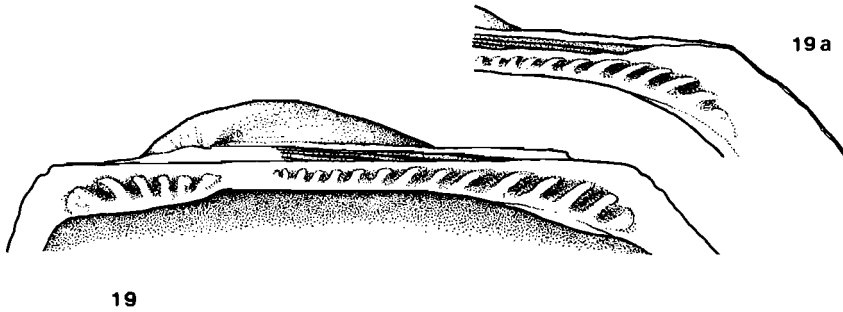


Fig. 19. Right hinge of *Barbatia tetraquetra*, with (19a) posterior end of hinge of *B. sculpturata* inset for comparison.

*Barbatia (Calloarca) cibotina* (Melvill, 1906). Figs 17, 18, 20

*Arca (Scapharca) cibotina* Melvill, in Melvill & Standen, 1906: 795, pl. 54, fig. 4. Type locality: Gulf of Oman, 156 fathoms.

*Samacar cibotina*; Stevenson, 1972: 196.

*Arca lienardi* Viader, 1951: 129, pl. 2, figs 7, 8. n. syn. Type locality: Port Louis, Mauritius.

*Striarca (Spinearca) soyoae* Habe, 1958: 255, pl. 11, figs 28, 29. n. syn. Type locality: Sagami Bay, Honshu, Japan.

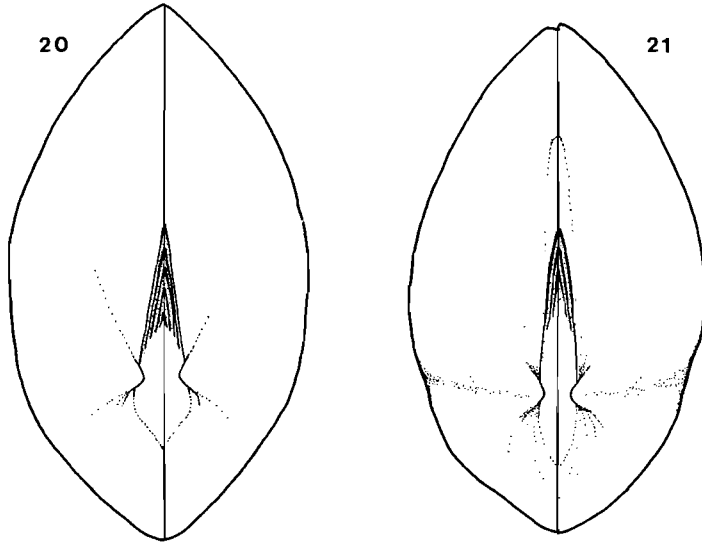
Known range: Arabian Gulf, here extended to Japan and to Transkei.

Regional locality records (all NM: *R/V Meiring Naudé*): NATAL: Off Park Rynie, 100 m, sponge-rubble and sand (B3771), 110–130 m, eroded shell and conglomerate (B3583), 120 m, rubble and solitary corals (B3778), 136 m, sponge-rubble (B3915), 140 m, sponge-rubble (B3859); off Port Shepstone, 70 m, eroded shell and sponge-rubble (B3702), 175 m, sponge and coarse rubble (B3976). TRANSKEI: off Mtamvuna River, 80 m, rocks (C465); 115 m, sponge, rocks (C487); 120–140 m, sponge-rubble (C444); off Port Grosvenor, 97–199 m, sandstone, gorgonians (C982), 100–115 m (C1390); off Whale Rock, 150–165 m, coarse sand (NM C2342); off Mncwasa Point, 90 m, coarse sand (NM C2776); off Mbashe River, 100 m, sponges (NM C1962).

Notes: *Barbatia cibotina* is one of the commonest Arcidae found on the Natal continental shelf. Syntypes (NMW) have been compared with local specimens and found to agree well, apart from being smaller in size. *Arca lienardi*, judging by the figures and description, is a synonym, as is *Striarca soyoae*; I am indebted to Mr Akihiko Matsukuma for sending a detailed drawing of the cardinal area of *soyoae*. A very similar species is *B. (C) alia* (Dall, Bartsch & Rehder, 1938) from Hawaii, which, however, has only about half as many ribs.

*B. cibotina* is sympatric with *B. tetraquetra*, from which it differs in shape, non-setose periostracum, lack of colour and by the arrowhead-shaped cardinal area. Both live singly or in small groups, byssally attached to siliceous sponges.

The following descriptive notes are based on local material: Breadth/length 0,60–0,75, depth/length 0,53–0,59; no byssal gape; internal margin coarsely crenulated about posteroventral corner, weakly so elsewhere. Adductor muscle scars sometimes chalky, but not situated on myophores. Cardinal area arrowhead-shaped, widest in front of umbones, steeply margined posteriorly, but not anter-



Figs 20-21. Dorsal view of 20, *Barbatia cibotina* (Melvill, 1906) and 21, *B. colpodes* sp. n.

iorly, where it is circumscribed by a faint groove; posterior third to half of area covered by four chevron-shaped ligament lamellae, remainder with an almost smooth fibrous covering. Hinge line gently curved, with a slightly dislocated but continuous tooth line; posterior teeth 14-19, becoming weaker towards midline; anterior teeth 9-13, rather irregular, one proximal tooth normally conspicuous. Exterior without a distinct umbonal ridge; sculptured by 70-90 fine radial riblets, cut into small, flattened, quadrangular granules by concentric threads; about seven ribs flanking umbonal angle are markedly stronger and more widely-set than elsewhere. Prodissoconch cap-shaped, length 0,35 mm. White inside and out; periostracum moderate to dark yellowish-brown, thin and film-like, except towards ventral margin where somewhat fibrous.

Dimensions: 8,8 × 5,9 × 5,0 mm (both valves together), 9,3 × 5,2 × 5,1 mm; 10,5 × 6,8 mm.

Pallial margin with a single relatively large eye-spot anteriorly on each side.

#### Subgenus *Destacar* Iredale, 1936

Type species: (o.d.) *Arca metella* Hedley, 1917.

This weak subgenus is identical to *Calloarca* (as here interpreted) except for the left valve being slightly larger than the right. The two species so far known are small, with fine sculpture and a sunken antemedian ray; a third member of the group is probably *B. yamamotoi* (Habe & Sakurai, 1961) of Japan.

#### ***Barbatia (Destacar) colpodes* sp. n. Figs 21-24.**

Diagnosis: Ovate-trapeziform, inequivalve with a depressed ray about 0,3 in length from anterior end; radial riblets fine, dense, about 90, bearing small gran-



ules; hinge with 6–7 anterior teeth, 12–14 posterior, separated by slight gap; white, periostracum finely setose, with longer setae posteriorly, maximum length about 7,0 mm.

Description: Shell ovate-trapeziform (height/length 0,63–0,73) with a rather straight dorsal line, angled at each end, and a tumid umbo; anterior end evenly curved, posterior end wider, with obtusely rounded posteroventral corner; a distinct depressed ray divides valves from umbo to about 0,3 length from anterior end. Valves deep, total length 0,53–0,54 length, left valve slightly larger than right; central margin slightly sinuous, but without byssal gape. Sculpture of fine, dense radial riblets, about 90 in total, bearing small granules where crossed by concentric threads; radial sculpture becoming weak towards posterodorsal margin.

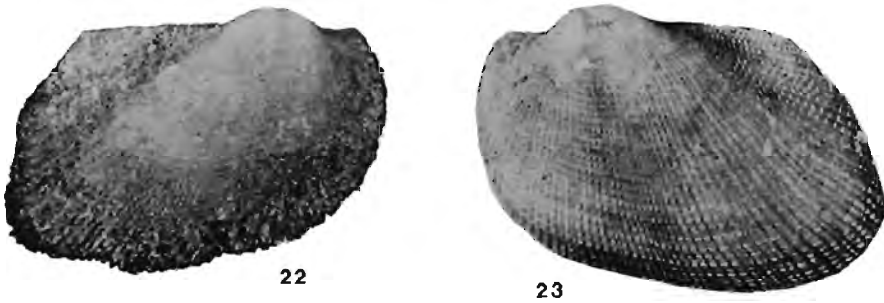
Cardinal area lanceolate, anteriorly poorly demarcated, covered by a thin film of fibrous ligament, except for the extreme posterior end where there are 2–3 chevrons of lamellar ligament. Hinge plate with two series of teeth, slightly discordant and separated by a narrow gap; 6–7 large anterior teeth, 12–14 posterior ones, becoming smaller and less oblique towards middle. Inner ventral margin finely crenulate.

Prodissoconch a simple dome, about 0,18 mm in length.

White; periostracum yellowish, finely setose, with several rays of longer hairs posteriorly.

Dimensions: 5,9 × 3,7 mm, depth (valves together) 3,2 mm (holotype); 6,2 × 4,1 × 3,3 mm, 6,9 × 5,0 × (single valve) 2,2 mm (paratypes).

Range: Outer continental shelf of northern Zululand.



Figs 22–23. *Barbatia (Destacar) colpodes* sp. n.: 22, holotype, 5,9 × 3,7 mm, right valve; 23, paratype A5788, without periostracum, off Sodwana Bay, 100 m, 5,2 × 3,2 mm; left valve.

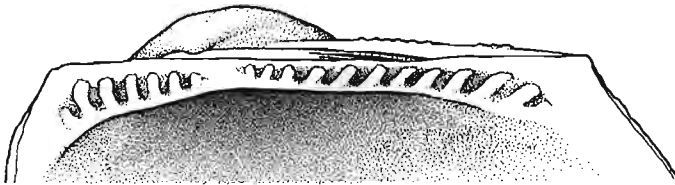


Fig. 24. Hinge of *Barbatia colpodes*, right valve.

Type material: Holotype, Ledsman Shoal, Zululand, 100 m (NM B5754/T2635: C.S.I.R. Water Res.). Paratopotypes (NM B4003/T2634), one complete, one left, one right valve. Paratype 4, off Kosi Bay, 100 m (NM B821/T2633: C.S.I.R. Water Res.), one left valve; paratypes 5–15, off Sodwana Bay, 100 m (NM A5788/T662: C.S.I.R. Water Res.).

Notes: Closely allied to *B. (D.) metella* (Hedley, 1917) of New South Wales, which is larger with a more obliquely trapeziform outline and coarser radial ridges (about 70, instead of about 90). Curiously, six valves from off Scottburgh in 100 m (NM B4580: C.S.I.R.) appear to agree well with *B. metella* and may indicate the presence of that species in local waters. However, better material is required.

#### Subgenus *Acar* Gray, 1857

Type species: *Arca gradata* Broderip & Sowerby, 1829 (s.d. Woodring, 1925).

This well-defined group contains species with raised adductor muscle scars, a cardinal area which shows chevrons of lamellar ligament posteriorly only, cancellate sculpture and little or no periostracum. Three species appear to be present in southern Africa.

- 1 Prodissoconch domed, without raised margin; tropical . . . . . **plicata**
- Prodissoconch peaked with a raised collar; warm-temperate endemics . . . . . 2
- 2 Hinge plate evenly curved, tooth row continuous; scales simple . . . . . **agulhasensis**
- Hinge plate sinuous, tooth row interrupted by a smooth gap; scales vesicular . . . . . **petasion**

#### *Barbatia (Acar) plicata* (Dillwyn, 1817). Figs 25, 26, 30

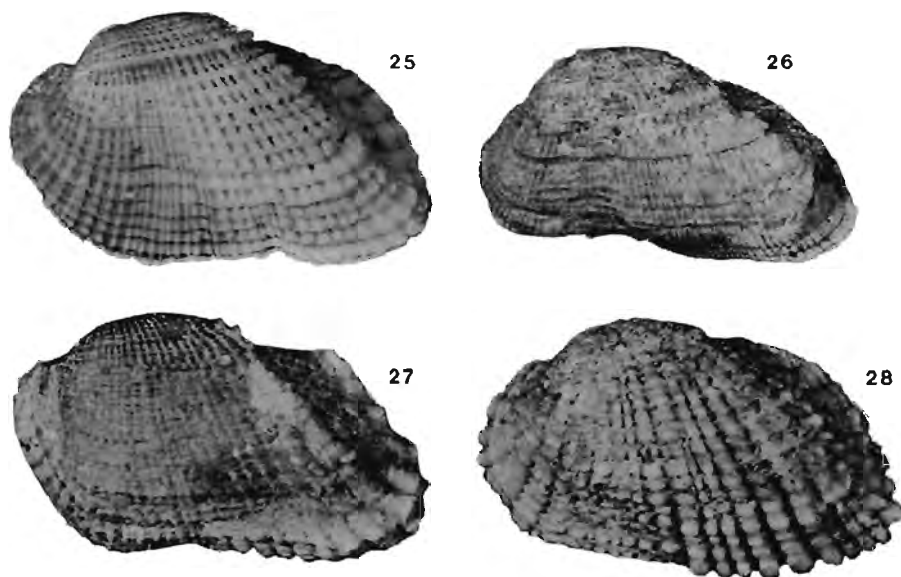
*Arca plicata* Dillwyn, 1817: 227 (based on Chemnitz, 1795: 244, pl. 204, fig. 2008); Prashad, 1932: 50 (references and synonymy); [partim] Barnard, 1964: 372; Boshoff, 1965: 111. Type locality: Red Sea.

*Arca donaciformis* Reeve, 1844: pl. 16, fig. 104. Type locality: 'Mozambique Channel (found embedded in madrepora)'.

Range: Indo-West Pacific to eastern Transkei.

Regional locality data: SOUTHERN MOZAMBIQUE: Santa Carolina Is. (NM G852, G7025, J2286, J2288: Mrs E. Roscoe); Bazaruto Is., 23 fathoms, attached to base of coral (NM J2287: Mrs E. Roscoe); Inhaca Is. (NM 4567: P. H. Boshoff). ZULULAND: off Richards Bay, 50 m, juvenile (NM A6090: A. Connell); off Sodwana Bay, 50 m, juvenile (NM A5133: A. Connell). NATAL: Durban Bay (NM B4594, B1666: B. J. Young); off Durban, 50 m (NM B4098: A. Connell); Isipingo (NM 4004: R.K.); Umkomaas (NM 2044, 2858, 44568: H. C. Burnup); Scottburgh (NM 4570: H. C. Burnup); Port Shepstone (NM 4569: H. C. Burnup). TRANSKEI: between Lwandile and Mdumbi (NM C60: R. K. & R. Fregona); off Mendu Point, 66 m, coarse sand and rubble (NM C4819: MN).

Notes: Barnard (1964) erroneously treated *Arca agulhasensis* Thiele, 1931, as a synonym of *B. plicata*, and cited many offshore locality records for the latter. It is clear that he confused three distinct species. The prodissoconch figured and described by him as that of *plicata*, actually belongs to *B. agulhasensis* or to the new species here described. *B. plicata* is a tropical littoral and inshore (50 metres or less) species, represented in the NM collection from numerous Indo-Pacific



Figs 25–28. *Barbatia (Acar)* spp, left valves. 25–26, *B. (A.) plicata* (Dillwyn, 1817): 25, Scottburgh, 19,2 × 11,3 mm; 26, Santa Carolina Island, Mozambique, 23,9 × 13,5 mm. 27, *B. (A.) agulhasensis* (Thiele, 1931), off Waterfall Bluff, Transkei, 90–100 m, 13,6 × 8 mm. 28, *B. (A.) petasion* sp. n., holotype, 9,4 × 5,7 mm.

localities, including that of the type. Its prodissoconch consists of a smooth, simple dome, approximately 0,18 mm in length, without any trace of a bordering collar. One slightly deformed specimen (NM G7025) from Santa Carolina Island could almost have served as a model for Reeve's figure of his *Arca donaciformis*.

As observed by Barnard, Thiele's 1931 identification of worn Agulhas Bank material as the Australian *Barbatia (Acar) aceraea* Melville & Standen, 1899, is unacceptable. Study of a syntype of *aceraea* (BM(NH) 1899.2.23.23) shows it to have the small, diamond-shaped ligament of an *Arcopsis*. Possibly Thiele's material will prove to be *B. (Calloarca) tetraquetra*.

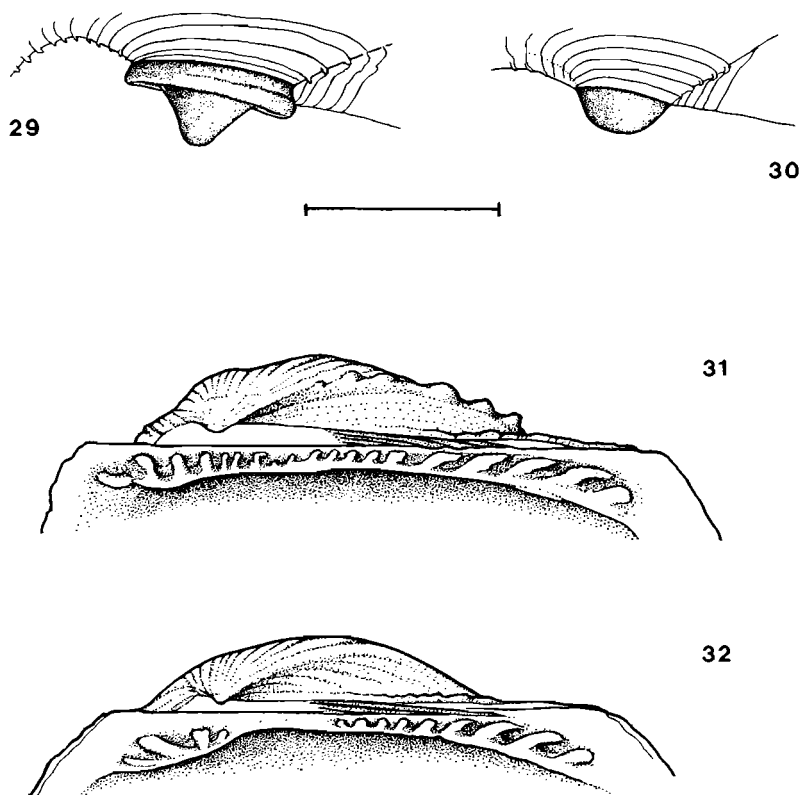
*Barbatia (Acar) agulhasensis* (Thiele, 1931). Figs 27, 31

*Arca (Acar) agulhasensis* Thiele, in Thiele & Jaekel, 1931: 177, pl. 1, fig. 12. Type locality (unrestricted) Agulhas Bank, 80–155 m.

Known range: Agulhas Bank, here extended to eastern Transkei.

Locality records: CAPE PROVINCE: Off Cape Agulhas (34°51'S, 19°37'8''E), 80 m, and off Tsitsikamma coast (35°16'S, 22°26'7''E), 155 m (Thiele, 1931). EASTERN TRANSKEI: off Waterfall Bluff, 90–100 m, eroded sandstone, some coral (NM C531: MN).

Notes: *Barbatia agulhasensis* differs from *B. plicata* in its collared prodissoconch, and in sculptural details, the divaricating posterior ribs being more radially disposed (instead of curving sharply dorsally), the interstices overall being less conspicuously foveolated, and the sculpture generally finer. From *B. petasion*,



Figs 29–32. *Barbatia* (Acar) spp: 29–30. prodissoconchs of *B. (A.) petasion* and *B. (A.) plicata* respectively, scale line = 0,5 mm. 31–32. right hinges of *B. (A.) agulhasensis* and *B. (A.) petasion* respectively.

*B. agulhasensis* differs mainly in its evenly-curved hinge plate, continuous tooth line and non-vesicular scales. The prodissoconch is worn in the only specimen available, but was fortunately figured by Thiele.

***Barbatia* (Acar) *petasion* sp. n.** Figs 28, 29, 32

*Arca plicata* [partim]; Barnard, 1964: 372, ?fig. 2a

**Diagnosis:** An *Acar* with relatively dense radial ribs and lamellate concentric ridges with vesicle-like scales at intersections; posterior face with 7–9 coarse ribs diverging towards posterodorsal margin; hinge plate sinuously curved; tooth line divided into two discrepant series by a wide, smooth gap, anterior series of 3–4 teeth, posterior one 9–13. Prodissoconch with an apical tubercle and raised margin. Maximum length about 13 mm.

**Description:** Shell quadrate (height/length 0,61–0,67) and inflated (depth/length 0,52–0,67); posterodorsal end slopingly truncate, anterior end strongly rounded, ventral margin slightly concave medially; umbonal ridge strong; occasionally keeled, posterior face strongly concave, medium face very slightly so. Sculpture consisting of somewhat lamellate concentric ridges crossed by subequal radials,

their intersections with conspicuous scales usually so strongly vaulted as to form vesicles; radial ribs 24–32, increasing rapidly by bifurcation and interpolation to 40–50; posterior face with an additional 7–9 ribs, which diverge at a slight angle to posterodorsal margin; scales finest just anterior to midline.

Cardinal area narrowly arrowhead-shaped, circumscribed by a groove and expanded just anterior to beaks; surface with growth lines and transverse striation, posterior third of area covered by 2–5 chevrons. Hinge plate sinuously curved, point of greatest concavity just posterior to beaks, widening anteriorly. Tooth line strongly discrepant, separated into two series by a wide, smooth gap; anterior series with 3–4 unequal teeth, sometimes with small accessory denticles; teeth of posterior series 9–13, rather irregular, obliquely inclined distally. Adductor muscle scars raised; ventral margin strongly crenulated all round.

Dirty white; periostracum obsolete. Prodissoconch with a sharply-pointed tubercle-like apex and raised marginal collar; length about 0,48 mm. Pallial eye-spots small and numerous, as in other *Acar* spp. (Rost 1955).

Dimensions: 9,4 × 5,7 mm, depth (valves together) 4,9 mm (holotype); 10,3 × 6,7 mm, depth 6,5 mm, 12,9 × 8,8 mm (single valve) (paratypes).

Range: Natal continental shelf to eastern Cape littoral, as far west as Cape Agulhas; intertidal to 130 m.

Type material: Holotype: off Mtentu River, Transkei (30°05,2 S, 31°16,0 E), 60 metres, dredged on sponge-rubble (NM C1547/T2518). Paratypes: NATAL (all NM colln.: *R/V Meiring Naudé*): off Park Rynie, 110–130 m, eroded shell and conglomerate (B3587/T2520), 4 v.; off Port Shepstone, 70 m (B3703/T2519), 4 v. TRANSKEI (NM colln.: *R/V Meiring Naudé*): off Mtentu River, 60 m, sponge-rubble (C785/T2530), 2; off Port Grosvenor, 80–84 m, worn calcareous nodules (C646/T2523, 2, C698/T2663, 3), 95–100 m, sand and gorgonians (C983/T2521), 1; 100–115 m (C1388/T2525), 5 v.; off Rame Head, 100 m, shell-conglomerate (NM C1827/T2665), 1; off Ubombo, 60–62 m (NM C3277/T2666), 1 v.; off Mncwasa Point, 74 m, sand and rubble (C1857/T2664), 1; off Mendu Point, 48 m (C4775/T2721), 1 v; off Nqabara Point, 95 m, sponge, sand (C4180/T2722), 2; off Qora River, 75 m (C3910/T2712), 3 v; do, 100 m (C4860/T2724), 2 v; do, 150–168 m, stones, sponges (C5098/T2725), 1; off Stony Point, 192 m, rocks (C4377/T2726), 1; off Sandy Point, 90 m, calcareous debris (C4529/T2727), 2 + 1 v; off Kei River, 138 m (C5133/T2728), 3 v. EASTERN CAPE (littoral): Gouubie, living (NM A4663/T2526: Mrs C. M. Connolly), 2½; Port Alfred, all single valves (B4593/T2513: J. Hutt, 27 v.; A2125/T2529: R.K., 4 v.; 3759/T2527: E. K. Jordan, 20 v.); Port Elizabeth, single valves (NM A9896/T2528: F. Graeve), 4 v. AGULHAS AREA: Arniston, Cape Agulhas; living juveniles (NM A1811/T2522: C. M. Connolly), 5.

Notes: In the present state of chaos surrounding the *Acar* species-complex, the description of another new species might well be viewed as a particularly wilful act of perversity. Yet, *B. petasion* is a common, well-characterised taxon which does not appear to conform to any species yet described. As mentioned, Barnard (1964) confused it with *B. plicata* (Dillwyn, 1817) and *B. agulhasensis* (Thiele, 1931), from which it differs in its somewhat vesicular nodules, sinuous hinge-line

and reduced anterior tooth number, and by the tooth series being interrupted by a smooth gap instead of being continuous. The collared prodissoconch further distinguishes *petasion* from *plicata*. A similar prodissoconch occurs in *B. agulhasensis*, but apart from the aforesaid differences, the oblique shape shown in the type figures of that species does not appear to occur in *petasion*.

The frequent occurrence of *B. petasion* in eastern Cape waters indicates it to be a warm-temperate endemic rather than a tropical Indo-Pacific element. Compared with species such as *Barbatia iota* (Iredale, 1939) and *B. botanica* (Hedley, 1916) of Australia, and *B. divaricata* (Sowerby, 1833) and *B. dubia* (Baird, 1873) of the tropical Pacific, *B. petasion* differs in details of sculpture and hinge-structure. The prodissoconch in *B. botanica* resembles that of *B. plicata* (paratypes loaned by A.M.) but is unknown in the others.

In the Cape Province *B. petasion* appears to inhabit shallower water than in Transkei and Natal, and may even occur living at extreme low-tide level. This was probably the species recorded by Turton (1932: 216) from Port Alfred as the West American *B. gradata* (Broderip & Sowerby, 1829), the West Atlantic *B. dominicensis* (Lamarck, 1819) and the Mediterranean *B. scabra* (Poli, 1795).

#### Genus *Samacar* Iredale, 1936

Type species; (o.d.) *Arca strabo* Hedley, 1915.

Two subgenera are here recognised:

- 1 One or more anterior hinge teeth weakly bifurcate, forming a short series ..... **Samacar** s.s.
- Anterior hinge teeth forming a D-shaped complex of ramifying, interrupted teeth ..... **Deltaodon**

#### *Samacar (Samacar) strabo* (Hedley, 1915). Figs 33, 34

*Arca strabo* Hedley, 1915: 697, pl. 78, figs 19, 20. Type locality: off Port Macquarie, New South Wales, 100 fathoms.

Known range: New South Wales, here extended to Natal and Transkei.

Regional locality data (all NM colln.: *R/V Meiring Naudé*): NATAL: off Scottburgh, 100 m (B4581); off Park Rynie, 136 metres, alive on sponges (B3901). TRANSKEI: off Port Grosvenor, 105 m (C621) and 120–128 m (C1194); off Umgazi, 100 m (C1853); off Bulungula River mouth, 250–270 m (C2130); off Whale Rock, 150–165 m (C2351).

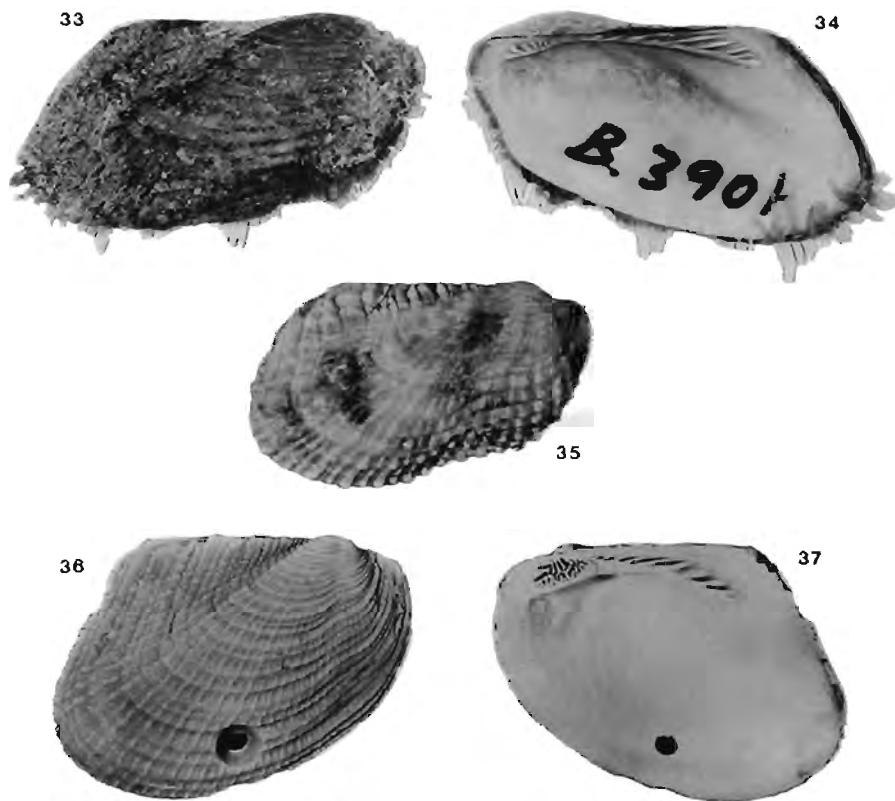
Notes: Hedley's excellent figures leave no doubt as to the identity of local material. To his description it might be added that the shell is tinged with moderate brown, the concentric ridges being sometimes paler than the intervals. The anterior hinge teeth are not as distinctly forked as in Hedley's figures.

*S. pacifica* (Nomura & Zinbo, 1934) of Japan scarcely seems separable.

#### Subgenus *Deltaodon* Barnard, 1962

Type species: (o.d.) *D. tugelae*.

This taxon was omitted by Newell (1969), but appears to be valid. It is closely allied to *Samacar*, and differs chiefly in the highly-developed deltoid complex of



Figs 33–37. *Samacar (Samacar) strabo* (Hedley, 1915) and *S. (Deltaodon) tugelae* (Barnard, 1962): 33–34, *S. strabo*, off Park Rynie, Natal, 136 m, 16,4 × 9,1 mm, hinge retouched. 35–37, *S. tugelae*: 35, juvenile, off Sodwana Bay, 100 m, 4,1 × 2,5 mm; 36–37, paralectotype, NM 4001/T1013, 'Natal', 20,7 × 16 mm, whitened with ammonium chloride.

anterior teeth. It is here treated as a subgenus of that taxon. Barnard's statement that the type species is eivalve requires confirmation, as only loose valves are known.

*Samacar (Deltaodon) tugelae* (Barnard, 1962). Figs 35–37

*Deltaodon tugelae* Barnard, 1962: 249, fig. 2; Kilburn, 1973: 699. Type locality 'Natal'.

Known range: Zambesi Delta to Natal.

Locality records: MOZAMBIQUE: Zambesi Delta, shallow water (Kilburn, 1973). ZULULAND: off Kosi Bay, 100 m (NM B465: A. Connell); off Ledsman Shoal, 100 m (NM B3553: A. Connell); Sodwana Bay, 100 m (NM A5767: A. Connell). NATAL: off Port Shepstone, 70 m (B3701: MN).

Notes: Fresh adults are still unknown. Juveniles (Fig. 35) are white, lightly to heavily suffused or blotched with orange to orange-brown, and similar blotches are just visible in an adult paratype.

Genus *Anadara* Gray, 1847

Type species: (o.d.) *Arca antiquata* Linné, 1758

The large, mud-dwelling 'bloody cockles' of the genus *Anadara* are poorly represented in the waters of south-eastern Africa, and only seven living species are here recorded. An eighth is represented by an extinct population dating back perhaps 100 000 years; although doubtfully 'Recent' it is included for completeness.

Subgeneric divisions of the genus vary from author to author. The system used here basically follows that of Lim (1968), with the addition of *Mabellarca*. Although I am hesitantly accepting *Scapharca* as a (dubious) subgenus (some workers even accord it full generic status), a gradual transformation sequence certainly exists between the inequivalve and equivalve states, as pointed out long ago by Lamy (1907: 7). Two local species, *A. erythraeonensis* and *A. mosambicana*, are just such intermediate cases. Even the name *Anadara* itself is doubtfully valid, for Yoloye (1974) has shown that significant differences do not exist between this and the earlier *Senilia* Gray, 1842 (type species (s. d. Gray, 1857) *Arca senilis* Linné, 1758).

Key to subgenera of *Anadara* in southern Africa and Mozambique

- |   |   |                     |
|---|---|---------------------|
| 1 | Lamellar ligament amphidetic .....  | 2                   |
| – | Lamellar ligament opisthodetic save for a few anterior ligamental grooves .....                 |                     |
|   |   | <b>Mabellarca</b>   |
| 2 | Inequivalve .....   | <b>Scapharca</b>    |
| – | Equivalve .....   | 3                   |
| 3 | Periostracum thick, velvety or bristly; ribs smooth or granular; byssus present or absent ..... | <b>Anadara s.s.</b> |
|   | Periostracum smooth or concentrically striated; ribs nodular; byssus absent .....               | <b>Tegillarca</b>   |

Subgenus *Anadara* s.s.

Although many examples of the type species, *Anadara antiquata*, totally lack ligamental chevrons, large or gerontic individuals develop a few incomplete, usually interrupted, ligamental grooves at each end of the cardinal area. Attempts at separating a group with smooth ligament ('*Anadara* s.s.') from one with ligamental chevrons (*Diluvarva* Woodring, 1925) are thus untenable.

The two locally-known species may be separated thus

- |   |  |                      |
|---|--|----------------------|
| 1 | Umbo 0,27–0,32 from anterior end, early ribs without punctae, periostracum bristly .....                           | <b>antiquata</b>     |
| – | Umbo 0,35–0,39 from anterior end; ribs in young with transverse rows of minute punctae; periostracum velvety ..... | <b>uropigimelana</b> |

*Anadara (Anadara) uropigimelana* (Bory de St Vincent, 1824). Fig. 40

*Arca uropigimelana* Bory de St Vincent, 1824: 156, pl. 307, fig. 2; Lamy, 1907: 207 (references and synonymy); Barnard, 1964: 370. Type locality unknown.

*Arca uropygmelana* Kobelt, 1891: 85, pl. 23, figs 5, 6; von Martens, 1879: 74 (*nom. null.*).

*Arca holoserica* Reeve, 1843: pl. 2, fig. 11; Boshoff, 1965: 107, pl. 14, fig. 1. Type locality: Samar, Philippines.

Range: Western Pacific to Red Sea and southern Mozambique.



Regional locality data: NORTHERN MOZAMBIQUE: Quirimba Island (von Martens). CENTRAL MOZAMBIQUE: Chinde and Beira (Barnard). SOUTHERN MOZAMBIQUE: Inhaca Is. (Boshoff, 1965; NM 4510, 9892: P. H. Boshoff; J2314: R.K.).

*Anadara (Anadara) antiquata* (Linné, 1758) Figs 38, 39, 45

*Arca antiquata* Linné, 1758: 694; Hanley, 1855: 93, pl. 4, fig. 3 (holotype). Type locality "O. Americano" [erroneous, = Amboina, fidé Rumphius, 1705].

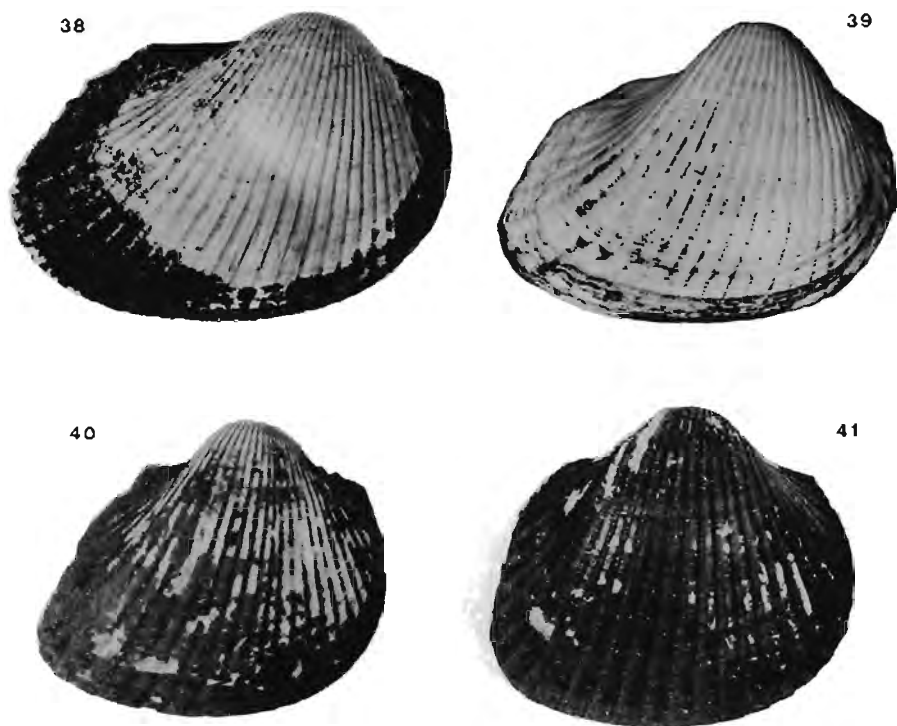
*Anadara antiquata*; Habe, 1965: 81, pl. 2, fig. 11; Vokes, 1969: 3, pl. 1, figs 1-7.

*Arca hankeyana* Reeve, 1844: pl. 10, fig. 68. Type locality: 'Harbour of Mozambique' [i.e. Mozambique Island].

*Arca antiquata* var. *hankeyana*; Boshoff, 1965: 106, pl. 2, figs 2, 4; pl. 14, fig. 2.

Range: Indo-West Pacific to Natal.

Regional locality data: NORTHERN MOZAMBIQUE: between 11°00' and 13°00'S (NM G3977: A. Jenner); Port Amelia (NM J2334: Mrs E. Roscoe); Murebue Beach, 20 km S. of Port Amelia (NM F6049, ex Tvl. Mus.); Mozambique Island, muddy grassflats (NM G3566: RK); off Cabaceira, N.E. Mozambique Bay, muddy sand and *Thalassodendron*, 1 ft above LST, little surf (NM H5473:



Figs 38-41. *Anadara* spp, right valves. 38, *A. (A.) antiquata* (Linné, 1758), Durban, 79,7 × 53,2 mm. 39, *A. (A.) ? antiquata*, Santa Carolina Island, Mozambique, 78,8 × 59,0 mm. 40, *A. (A.) uropigimelana* (Bory de St Vincent, 1824), Inhaca Island, 54 × 45,6 mm. 41, *A. (Scapharca) natalensis* (Krauss, 1848), Durban, 61 × 53,4 mm.

K. Grosch); Conducia Bay, sandy mud with *Thalassodendron* and gravel, inshore, 4 ft above LST (H5474: K. Grosch). SOUTHERN MOZAMBIQUE: Benguera Is., Bazaruto Archipelago (NM G1295: Mrs E. Roscoe); Santa Carolina Is. (NM 4515: P. Boshoff; NM 8058: R.K.). NATAL: Durban (NM 4514: R.K.; 4513, 2048–50: H. C. Burnup).

Notes: A single massive specimen (Fig. 39) from Santa Carolina Island (NM G4102: Mrs N. Cumming) may represent a distinct species. Although resembling *A. antiquata* in most respects, it has a much higher umbo and none of the ribs are bifid. There is a superficial resemblance to figures of *Anadara ehrenbergi* (Dunker, 1868) from the Red Sea, and in all probability such a shell was the basis for Braga's record (1952: 106) of *ehrenbergi* from Inhambane. The true *ehrenbergi*, however, is more oblong and has deeply incised sculpture. The entire *Anadara antiquata* complex needs careful study using modern methods. Although several workers have attempted to differentiate *Arca hankeyana* (in which each rib bears three fine secondary grooves) from *A. antiquata* (with bifid ribs), these appear to be merely sculptural variants that can occur in a single population.

#### Subgenus *Scapharca* Gray, 1847

Type species: (o.d.) *Arca inaequalis* Bruguière, 1789.

As mentioned in the introduction, the inequivalve state of *Scapharca* is connected to the equivalve one of *Anadara* by transitional stages. The group, moreover, is probably polyphyletic.

#### Key to *Scapharca* species of southern Africa and Mozambique

- 1 Left valve only slightly overlapping right one, with a narrow byssal gape; height/width 0,55–0,71, umbo distinctly anterior to dorsal midline; ribs bifid, much wider than intervals. . . . . 2
- Left valve markedly larger than right, no byssal gape; height/width 0,79–0,94, umbo near middle of dorsal line; ribs not bifid, subequal to intervals  
**natalensis**
- 2 Chevron grooves on cardinal area 2–4; height/length 0,55–0,63, depth/length 0,44–0,53 . . . . . **erythraeonensis**
- Chevron grooves 4–8; height/length 0,65–0,71, depth/length 0,60–0,62  
**mosambicana**

#### *Anadara (Scapharca) natalensis* (Krauss, 1848). Figs 41, 42

*Arca natalensis* Krauss, 1848: 17, pl. 1, fig. 12; Barnard, 1964: 371 (references); Barash & Danin, 1972: 330, fig. 15. Type locality: 'Prope Natalpoint' [i.e. Durban Bluff].

*Arca (Anadara) uropigimelana* (non Bory de St Vincent); Boshoff, 1965: 105.

Known range: Red Sea and Madagascar to Durban, here extended to Transkei.

Regional locality records: NORTHERN MOZAMBIQUE: Conducia Bay (NM H5478: K. Grosch), soft sand above *Thalassodendron*, 2 ft above LST (NM H5476: K. Grosch), muddy sandflat, *Thalassodendron* and gravel, 3 ft above LST (H5475: K. Grosch), washed up after cyclone (H5477: K. Grosch). SOUTHERN MOZAMBIQUE: Inhassoro (NM G8156: Mrs E. Roscoe); Bay of Maputo (NM3441: H. W. Bell-Marley); Inhaca Is. (NM 4505: P. H. Boshoff). ZULU-

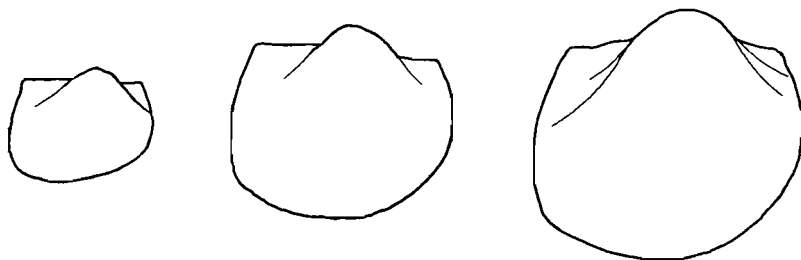


Fig. 42. *Anadara natalensis*, diagram showing change in shape with growth; length of shell 16,4 mm, 27,4 mm and 33,8 mm respectively.

LAND: Richards Bay (Barnard, 1964);  $\pm 6$  mi. off Tugela River, 20 fathoms (NM 9972, 9924, 9486: G. Scott); Tugela Bank, 34–41 metres and 33 metres, fine mud (NM A7142, 9854: H. Champion); Tugela–Amatikulu Bank, 17–22 fath. (NM 9884: H. Champion); off Tugela River, 24 fath. (Barnard, 1964). NATAL: Durban Bay (NM 2046–7, B4604, 4506–7, 3279: H. Burnup; 2045: F. Quekett; B2500, B2502: B. J. Young; 5290: R.K.); 29°53'S, 31°06'E, 71 metres (Barnard). TRANSKEI: off Port St Johns, 30–35 m, soft black mud with worm-tubes, living (NM C108: MN).

Notes: This tropical east coast species is characteristic of the muddy silt of sheltered bays and offshore mudbanks, down to a depth of about 50 metres. The 'Cape St Blaize' record cited by Barnard is highly improbable; other cases of *Pieter Faure* material from Zululand being mislabelled 'Cape St Blaize' were noted by Kilburn (1981: 383). According to Barash & Danin (1972) *A. natalensis* has now traversed the Suez Canal into the Mediterranean.

No trace of the Burnup specimen recorded by E. A. Smith (1903) as *Arca inaequivalvis* (Bruguière, 1789) has been found in either the NM or BM(NH) collections. However, there can be little doubt that this was a misidentification of *Anadara natalensis*.

*Anadara natalensis* agrees well with the subgenus *Cunearca* Dall, 1898 (type species *Arca incongrua* Say, 1822, s.d. Lamy, 1907), save that sculpture is not discrepant between the two valves. Single valves of *natalensis* and the equivalve *uropigimelana* have been confused; in the latter, the radial ribs are separated by narrow gaps (instead of wide intervals) and the periostracum is more velvety. Juvenile *natalensis* (30 mm or less) are rather oblique with a high posterior auricle (Fig. 42) and look deceptively different to the adult.

Two specimens from Mozambique Island (NM J4497: R.K.) may prove to represent *Anadara inaequivalvis*, but are unfortunately immature. Lazzari & Leonard (1981) have illustrated the enormous variability of Mediterranean specimens of this Indo-Pacific species. On the other hand, these Mozambique shells agree well with the type figures of *Arca amygdalum* Philippi, 1845 (*non* Link, 1807), yet another Indo-Pacific taxon now reported from the eastern Mediterranean. This has been recently renamed *Scapharca demiri* Piani, 1981, although Habe (1981: 36) synonymizes it with *Anadara subcrenata* (Lischke, 1869). Clearly much work remains to be done on the Indo-Pacific anadarids.

*Anadara (Scapharca) erythraeonensis* (Jonas in Philippi, 1851). Figs 43, 46

*Arca erythraeonensis* Jonas in Philippi, 1851: 51. Type locality: 'Mare Erythraeum'.

*Barbatia erythraeensis* Dunker, 1869: 123, pl. 40, figs 6-8 (*nom. null.*).

*Arca erythraeensis*; Lamy, 1907: 227; E. A. Smith, 1903: 395; Barnard, 1964: 370.

*Arca erythraeensis* Braga, 1952: 105, pl. 9, fig. 3 (*nom. null.*).

*Arca (Anadara) erythraeensis* Boshoff, 1965: 108 (*partim, nom. null.*).

Range: Red Sea to Durban Bay.

Regional locality records: SOUTHERN MOZAMBIQUE: Bartholomeu Dias estuary (NM J2313: Mrs E. Roscoe); Inhaca Is. (NM J2315: P. Boshoff); Delagoa Bay [= Bay of Maputo] (Barnard (1964), Braga (1952)). NATAL: Durban (NM 2051: H. Burnup; 4511: W. Falcon).



Figs 43-44. *Anadara (Scapharca) erythraeonensis* (Jonas in Philippi, 1851) and *A. (S.) mosambicana* (Bianconi, 1856); right valves. 43, *A. erythraeonensis*, Durban, 85,4 × 56,0 mm. 44, *A. mosambicana*, Inhaca Is., 70,6 × 48,4 mm.

HOLOCENE/PLEISTOCENE BAY DEPOSITS: Richards Bay, Zululand, deep in mud (NM B2484: B. J. Young; A4257: C. Hanneman); Durban Bay, harbour beds (NM A2220: B. J. Young; Barnard (1964)).

Notes: In this species (and in *Anadara mosambicana*) the left valve only slightly overlaps the right one at the posteroventral margin; anterior to this the ventral margins gape rather widely. The largest example seen, a single valve from Durban, measures 100 × 61,6 mm.

*Anadara (Scapharca) mosambicana* (Bianconi, 1856). Figs 44, 47

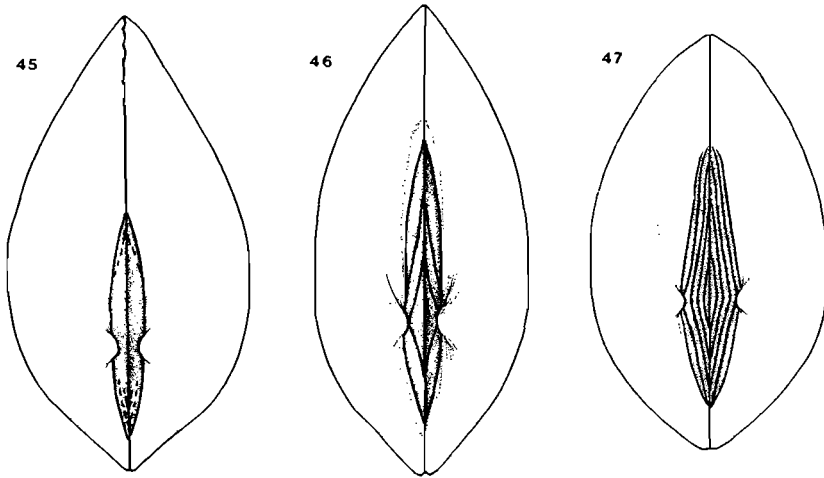
*Arca mosambicana* Bianconi, 1856: 403, pl. 306, figs 1a, b; Lamy, 1907: 228. Type locality: 'Mosambico' [here restricted to Inhambane, where Fornasini is known to have collected].

*Arca scapha* var. *mosambicana* von Martens, 1879: 741 (*nom. null.*).

*Arca (Anadara) erythraeensis* (*partim, non erythraeonensis* Philippi, 1851); Boshoff, 1965: 108, pl. 2, figs 1, 3, pl. 14, fig. 3.

Known range: Northern to southern Mozambique.

Locality records: NORTHERN MOZAMBIQUE: Quirimba and Mozambique Islands (Von Martens). SOUTHERN MOZAMBIQUE: Inhaca Island, western littoral (NM 4512: P. H. Boshoff, 1½ individuals).



Figs 45-47. Dorsal views of 45, *Anadara antiquata*, 46, *A. erythraeonensis* and 47, *A. mosambicana*, showing cardinal area.

Notes: Too few examples of this rare and poorly-known taxon are available for its validity to be accepted without question. Although sometimes confused with *Anadara antiquata*, it differs in possessing well-developed ligamental chevrons. There is far greater resemblance to *A. erythraeonensis*, from which it differs chiefly in its slightly shorter, deeper valves and more numerous ligamental chevrons (see Key). However, both available individuals of *A. mosambicana* show signs of boring-activity and consequent growth-interruption, as do the type figures. To what extent this has affected shape-parameters is unknown. However, rib number in *mosambicana* (39-45) is slightly higher than in *erythraeonensis* (37-40), and periostracal characters may differ, although only one example of each retaining this has been seen. In an old *erythraeonensis* from the Burnup collection the periostracum is deep brown, becoming darker brown posteriorly, while in a more recently collected *mosambicana* it is deep yellowish-brown overall and somewhat more fibrous.

The larger of the two NM specimens of *A. mosambicana* measures  $80,6 \times 52,7$  mm.

#### Subgenus *Mabellarca* Iredale, 1939

*Mabellarca* Iredale, 1939: 264. Type species: (o.d.) *Arca dauzenbergi* Lamy, 1907.

*Caloosarca* Olsson, 1961: 98 *syn n.* Type species: (o.d.) *Arca rustica* Tuomey & Holmes, 1857.

Vokes (1969) has redefined *Caloosarca* and utilised it for a group of upper Miocene to Recent western Atlantic species. However its characteristics, notably the peculiar ligament, as well as shape and sculpture, apply equally to the supposed Indo-Pacific taxon *Mabellarca*. In this group the lamellar ligament lies predominantly posterior to the umbo, although a few grooves generally develop anteriorly in adults, sometimes forming complete chevrons. Valves are equal in size, with nodular ribs. Many species, including *A. africana*, seems to show a small underlying swelling at the anterior end of the hinge plate. Whether *Mabellarca* is in turn

a synonym of *Lunarca* Gray, 1857, as claimed by Newell (1969), is for a future revisor to decide.

*Anadara (Mabellarca) africana* (Sowerby, 1904). Figs 50, 51

*Arca (Scapharca) africana* Sowerby, 1904: 4, pl. 6, fig. 4; (part) Barnard, 1964: 371; Stevenson, 1972: 195. Type locality: 18 miles N.W. of mouth of Tugela River, 46–55 fath.

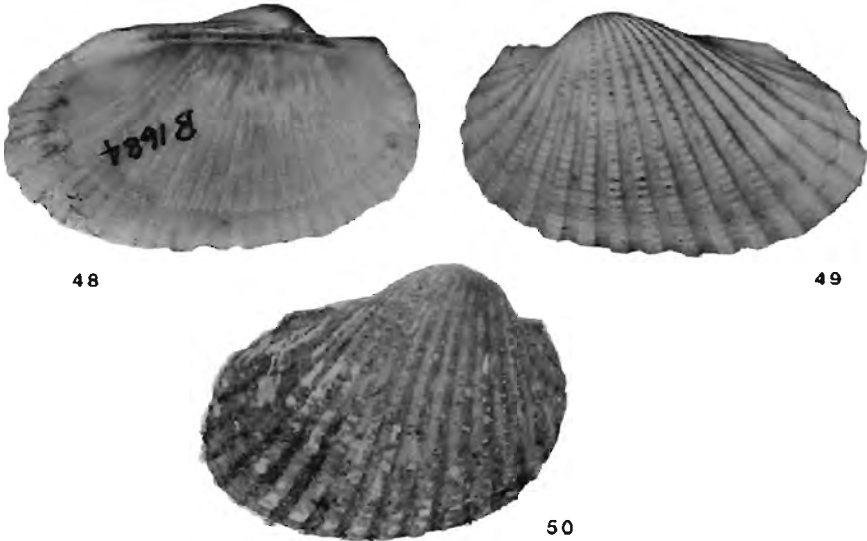
Type material: Lectotype BM(NH) 1904.12.23.171, here designated (Stevenson (1972), as 'Holotype'). Two paralectotypes in SAM (Barnard (1964) as 'cotypes') and one in NMW (Oliver (1981) as 'paratype').

Known range: Zululand to Natal, here extended to Transkei.

Locality records: ZULULAND: off Richards Bay, 50 m, juveniles (NM 6059: A. Connell); Tugela bank, 34–41 m (NM A7144: H. Champion). NATAL: 29°53'S, 31°06'E, 71 m (Barnard, 1964). TRANSKEI: off N'tafufa River, 50 m, mud and sand (NM C1033: MN); off Port St Johns, 30–50 m, mud, worm-tubes (NM C1077: MN); off Mgazi River, 48 m, mud (NM C3267: MN); off Nthlonyane River, 51 m, sandy mud (NM C2881: MN); Kei River mouth, worn valve, littoral (NM C3515: R.K.).

Notes: This small arcid is characteristic of soft muddy grounds, particularly off the larger river systems, at depths of 50 m or less. With the exception of the worn valve mentioned above there are no records of littoral examples.

*Anadara africana* was synonymised with the Western Pacific *A. ferruginea* (Reeve, 1844) by Stevenson (1972). The two are certainly very similar, but compared with Pacific material and with three possible syntypes of *ferruginea* (B.M.(N.H.) 1969178), *A. africana* is shorter anteriorly, the tooth line shows a more marked dislocation, and the sculpture is more discrepant on the two valves.



Figs 48–50. *Anadara (Mabellarca)* spp. 48–49, *A. (M.) dautzenbergi* (Lamy, 1907), left valve, Durban harbour beds, 33,5 × 19,7 mm. 50, *A. (M.) africana* (Sowerby, 1904), right valve, off N'tafufu River, Transkei, 50 m, 23,2 × 17,0 mm.

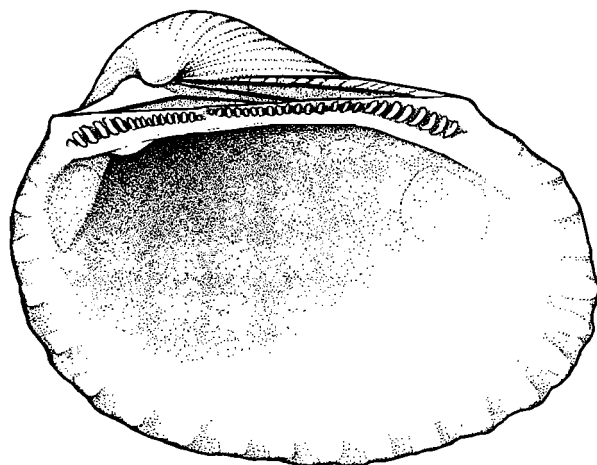


Fig. 51. *Anadara (Mabellarca) africana*, interior of right valve.

Radial ribs number 24–28 in *A. ferruginea*, 20–23 in *A. africana*. Consequently *A. africana* is here regarded as a valid taxon.

*Anadara (Mabellarca) dautzenbergi* (Lamy, 1907). Figs 48, 49

*Arca dautzenbergi* Lamy, 1907: 232, pl. 3, figs 9, 10, 11; Prashad, 1932: 39; Iredale, 1939: 265, pl. 2, figs 13, 13a. Type locality: l'Île Nou, New Caledonia.

*Arca (Scapharca) africana* (part); Barnard, 1964: 371.

Known range: New Caledonia to Indonesia, with an extinct population here reported from Durban Bay.

Regional locality data: NATAL: Durban Bay, harbour beds (NM 5030: R.K.; 4509: H. Puzey; B1684: B. J. Young).

Notes: Durban harbour dredgings have yielded valves of a (locally) extinct arcid that agree well with figures and descriptions of the western Pacific *Anadara dautzenbergi*, save that the ribs are slightly fewer (20–21 instead of 23) and appear less distinctly bifid. They are not referable to the only known western Indian Ocean *Mabellarca*, *A. dichotoma* (Deshayes, 1863) from Réunion Island, which has much finer ribbing.

Dating of such derived shells is somewhat conjectural but this material evidently represents a tropical fauna that was established during the last interglacial or perhaps a subsequent interstadial (R. Ward pers comm.).

#### Subgenus *Tegillarca* Iredale, 1939

Type species: (o. d.) *Arca granosa* Linné, 1758.

#### *Anadara (Tegillarca) granosa* (Linné, 1758)

*Arca granosa* Linné, 1758: 694. Type locality: 'O. Europae meridionalis'.

*Anadara (Anadara) granosa*; Schenck & Reinhart, 1938: 42, pl. 2, fig. 9, pl. 4, fig. 1 (lectotype).

*Arca (Anadara) granosa*; Boshoff, 1965: 106.

*Tegillarca granosa*; Habe, 1965: 73 (synonymy), pl. 2, fig. 8, pl. 3, fig. 4.

Range: Indo-West Pacific to southern Mozambique.

Regional locality data: SOUTHERN MOZAMBIQUE: Inhaca Is. (NM 4508: P. H. Boshoff; also Boshoff, 1965).

Notes: The only Mozambique shells examined are two immature right valves. These, however, agree well with NM material from Japan, Philippines, Western Australia, etc. It is curious that no further examples of this conspicuous species have come to hand.

#### Genus *Bathyarca* Kobelt, 1881

Type species: (o.d.) *Arca pectunculoides* Scacchi, 1833.

Several species may be represented in southern Africa. However, at present too little material is available for a decision, particularly in view of the considerable variation in shell form claimed for the type species, *Bathyarca pectunculoides* of the North Atlantic.

#### *Bathyarca orientalis* (Thiele, 1931). Figs 52, 53

*Arca (Bathyarca) orientalis* Thiele in Thiele & Jaeckel, 1931: 179, pl. 6(1), fig. 14; Barnard, 1964: 376, fig. 2d, e, f. Type locality: 35°16'S, 22°26'E (designated Barnard, 1964).

A typical example, together with a shell tentatively regarded as an extreme morphotype, is here figured.



Figs 52–53. *Bathyarca* sp. 52, *B. orientalis* (Thiele, 1931), off Port Grosvenor, 100–115 m, 2,8 × 2,3 mm, right valve. 53, *B. ? orientalis*, off Bulungula River, Transkei, 250–270 m, 7,5 × 5,5 mm, left valve.

#### Subfamily Noetiinae

#### Genus *Sheldonella* Maury, 1917

Type species: (o.d.) *Noetia maoica* Maury, 1917.

Although the name *Barbatiella* Jousseume in Lamy, 1917, predates *Sheldonella* by several months, it was introduced in the m/s combination '*Barbatiella barbatiella* Jous.', which was not only rejected by Lamy as a synonym of *Arca lateralis* Reeve, 1844, but referred to the 'sous-genre' *Noetia* Gray, 1857. *Barbatiella* is thus a name first published in synonymy, and under ICZN article 11d, invalid.



*Sheldonella lateralis* (Reeve, 1844). Figs 54, 55

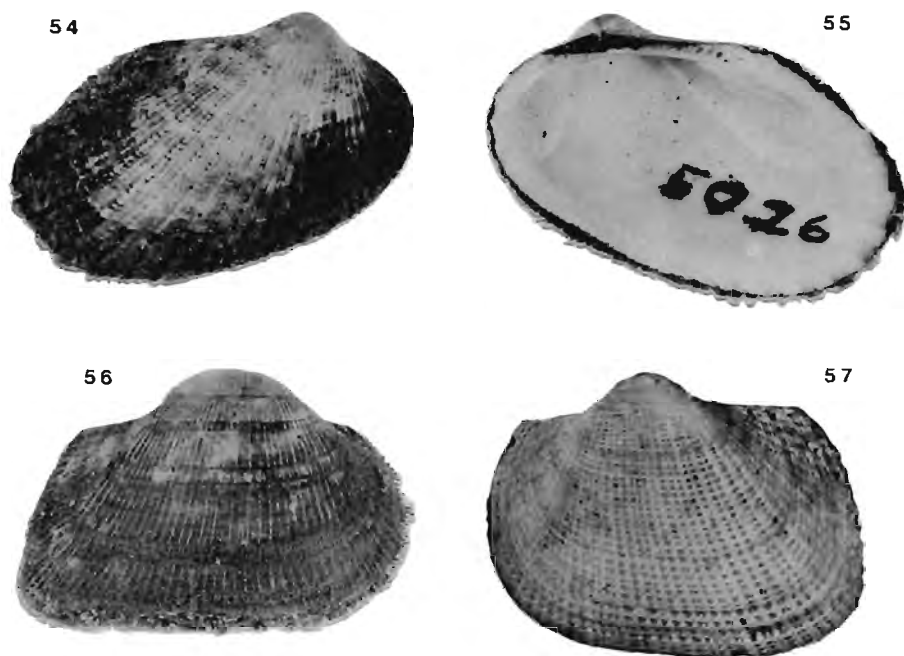
*Arca lateralis* Reeve, 1844: pl. 17, fig. 115. Type locality: Philippine Islands.

*Noetia (Barbatiella) lateralis*; Kilburn, 1972: 432 (references).

*Sheldonella lateralis*; Kilburn & Rippey, 1982: 158, pl. 35, fig. 14, text fig. 109.

Range: Indo-West Pacific to Jeffreys Bay.

Notes: Local material was compared with two syntypes of *Arca lateralis* (B.M.(N.H.) 1969244) and found to agree exactly, confirming my 1972 action in synonymising *Arca cafria* Bartsch, 1915, with *lateralis*.



Figs 54–57. *Sheldonella* and *Arcopsis* spp. 54–55, *S. lateralis* (Reeve, 1844), Jeffreys Bay, 18,2 × 13,3 mm, right valve. 56, *A. symmetrica* (Reeve, 1844), Qolora River mouth, Transkei, 17,1 × 11,5 mm, right valve. 57, *A. ornata* (Viader, 1951), off Sodwana Bay, 100 m, 5,7 × 4,2 mm, left valve.

There are numerous samples in the NM collection from various littoral localities between Beira and Jeffreys Bay; single valves have been dredged as deep as 50 metres. Shells from the Bay of Maputo are much thicker and deeper than those from further south, but are rather worn.

Genus *Arcopsis* von Koenen, 1885

*Arcopsis* von Koenen, 1885: 86. Type species: (s.d. Reinhart, 1935) *Arca limopsis* von Koenen, 1885.

*Ribriarca* Noda, 1980: 75. syn. n. Type species: (o.d.) *R. okinawaensis* Noda, 1980 [= *Pectunculus ornatus* Viader, 1951].

Two species of *Arcopsis* are known from southern Africa:

- 1 Ligament diamond-shaped in opposed valves; sculpture of fine radial riblets, crossed by concentric threads; periostracum dense, brown; attaining 18 mm  
***symmetrica***

- Ligament a narrow transverse strip; sculpture delicately beaded-clathrate; periostracum absent; not exceeding 7 mm in length . . . . . **ornata**

*Arcopsis ornata* (Viader, 1951) **comb. n.** Figs 57–59

*Pectunculus ornatus* Viader, 1951: 130, pl. 3, figs 8, 9. Type locality: off Port Louis, Mauritius.

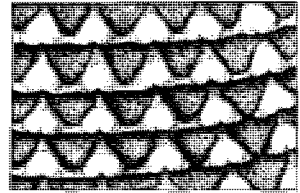
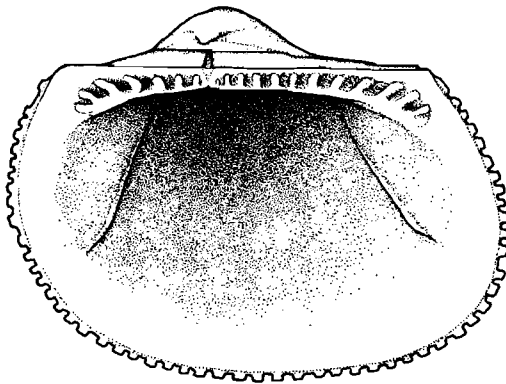
*Ribriarca okinawaensis* Noda, 1980: 75, pl. 12, figs 10a–c. **Syn n.** Type locality: Shimajirigun, Okinawa, Shinzato Formation (Pliocene).

*Arcopsis minabensis* Habe, 1981: 38, pl. 2, fig. 1. **Syn. n.** Type locality: off Minabe, Honshu, Japan, 20–30 m.

Known range: Japan to Mauritius, here extended to Zululand.

Regional locality records: ZULULAND: Ledsman Shoal, 100 m (NM B4060: CSIR Water Res.); off Sodwana Bay, 100 m (NM A5786: CSIR Water Res.).

Notes: Although described as a member of the genus *Pectunculus* Lamarck, 1799 [= *Glycymeris* da Costa, 1778], this species is undoubtedly an arcid. The narrowly transverse ligament is unique, but resembles most closely that of the genus *Arcopsis*. The delicate beaded-clathrate sculpture is superficial and easily abraded away, leaving a surface that appears smooth except for growth striae, some of which form concentric furrows. Such a worn specimen has misled Noda (1980) into creating a new genus *Ribriarca* for his *okinawaensis*; although the distinctive ligament was not mentioned in the text, its groove is evident in his fig. 10b, and is also just visible in the type photograph of *P. ornatus*.



Figs 58–59. *Arcopsis ornata*, interior of right valve, with detail of sculpture.

Some variation is evident in proportions, similar to that found in other species of *Arcopsis*. Height/length ratios for recorded specimens may be summarised thus:

<i>A. minabensis</i> :	0,67–0,71
NM shells:	0,72–0,75
<i>P. ornata</i> (holotype):	0,79
<i>R. okinawaensis</i> :	0,80

The holotype of *ornata* measured  $6,3 \times 5$  mm, the Pliocene *okinawaensis*  $13,3 \times 10,6$  mm, and the largest *minabensis* only  $6,5 \times 4,5$  mm. Zululand material approaches the holotype in size (see below).

An earlier name for *Arcopsis ornata* may prove to be *Arca (Fossularca) polycymoides* Thiele (1925: 174, pl. 1, fig. 8) from Mauritius; the figure, however, seems to lack the straight dorsal line of *ornata*.

The following notes (based on Zululand specimens) may be added to Viader's description: Cardinal area concave, elliptical, with growth lines only; ligament in a narrow transverse groove at the level of the beaks. Hinge plate gently curved with a shallow notch marking a slight discontinuity in the tooth line; anterior teeth 6–7, posterior ones 11, separated by a very narrow gap. No byssal gape; adductor muscle scars on slightly raised flanges. Sculpture of concentric threads fimbriated by 50–60 radial riblets, combining to form a finely beaded-clathrate pattern, with deeply foveolate interstices; this sculpture is easily rubbed off, leaving an apparently smooth shell with deep, distant growth lines. Uniform white. Dimensions  $5,4 \times 4,0$  m, depth (valves together) 3,7 mm;  $6,1 \times 4,4$  mm, depth 3,5 mm. Height/length 0,72–0,75, depth/length 0,57–0,69. Evidently no periostracum.

*Arcopsis symmetrica* (Reeve, 1844). Fig. 56

*Arca symmetrica* Reeve, 1844: pl. 17, fig. 120 (not '117'); Lamy, 1907: 104 (references). Type localities: 'bay of Manila, Singapore'.

*Arca (Barbatia) symmetrica*; E. A. Smith, 1883: 111; Kobelt, 1889: 94, pl. 25, figs 7, 8.

*Arca (Fossularca) symmetrica*; Habe, 1953: 209, pl. 30, figs 12, 13; Habe, 1964: 163, pl. 49, fig. 1.

*Striarca symmetrica*; Noda, 1966: 73 (references), table 34.

*Arca lactea* (non Linné, 1758); Krauss, 1848: 15.

*Arca lactea* var. *gibba* Krauss, 1848: 16. **Syn n.** Type locality: 'auf den Felsen-Terrassen der Natalküste'.

*Arca (Arcopsis) gibba*; Barnard, 1964: 375 (references); Boshoff, 1965: 110.

*Arcopsis gibba*; Kilburn & Rippey, 1982: 158, pl. 35, fig. 13, text fig. 108.

*Arca (Fossularca) afra* (non Gmelin, 1791); Thiele, 1931: 174.

Range: Western Pacific to eastern Cape Province.

Regional locality records (selected, all NM): NORTHERN MOZAMBIQUE: Conducia Bay (H5445, H5460: K. Grosch). SOUTHERN MOZAMBIQUE: Inhaca Is. (4535: P. Boshoff). ZULULAND: off Richards Bay, 50 m (A1698: CSIR). NATAL: Mvoti River mouth (9345: R.K.); Chaka's Rock, Umhlali (5021: R.K.); Durban, many; Umkomaas (2041: H. C. Burnup); Scottburgh (4540: Burnup); Mtwalumi (9468: R.K.); Port Shepstone (4539: Burnup). TRANSKEI: Mbotyi (A5276: R.K., J. McKay); Msikaba (B4961: R.K.); Hluleka (C1408: R.K.); Lwandile/Mdumbi (C66: R.K.); Banyana River (B1302: R.K.); off Whale Rock, 20–26 m, living (C3250: MN); off Mendu Point, 48 m (C4774: MN); Sandy Point (C3741: R.K.); Quolora (C330: R.K.): EASTERN CAPE, East London: living (A4251/5020, B469: R.K., Mrs C. Connolly); Port Alfred, dead (B674: E. K. Jordan); Port Elizabeth, living (4537: R.K.); Jeffreys Bay, right valve (9627: R.K.).

Notes: Much confusion surrounds the species of the genus *Arcopsis*, but it appears that the name *gibba* can no longer be maintained. Comparison between local material and three 'probable syntypes' of *Arca symmetrica* (B.M.(N.H.) 1969250) reveals no difference at all; published illustrations of *symmetrica* simi-

larly agree. Smith (1884) pointed out that the figures 120 and 117 had been interchanged on Reeve's plate, the latter figure actually showing *Arcopsis zebuensis* (Reeve, 1844). *A. zebuensis* has a more inequilateral shell and a narrower, less equilateral ligament than *symmetrica*. One would wish, however, for a detailed comparison with *Arca pisolina* Lamarck, 1819; as figured by Lamy (1904: pl. 5, figs 6-7), there is some similarity. However, Lamy (1907) maintained *symmetrica* and *pisolina* as separate species, regarding the latter as a synonym of *Arca afra* Gmelin (1791: 3308). Stevenson (1972: 201), on the other hand, regards the possible syntypes of *A. symmetrica* as also referable to *afra*, and Thiele & Jaeckel (1931) also synonymised *gibba* with the latter. However, *Arcopsis afra* (Gmelin, 1791) was based on Adanson's 'Le Jabet' from Senegal, and is unlikely to be applicable to an Indo-Pacific taxon. Good series from Dakar (NM F931) and Sao Thome (NM H6842) show *A. afra* to differ from *A. symmetrica* in its somewhat *Acar*-like sculpture and in the presence of a conspicuous notch in the hinge plate at the level of the ligament.

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