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Pectinoidea (Bivalvia: Propeamussiidae and Cyclochlamydidae) from the southwestern Indian Ocean

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ABSTRACT

Twenty-five species of Pectinoidea (24 Propeamussiidae, 1 Cyclochlamydidae) are herein listed from the Mozambique Channel, northwestern and southern Madagascar, and northeastern South Africa.

New species: *Propeamussium rosadoi*, *Parvamussium catillus*, *Parvamussium kilburni*, *Parvamussium puillandrei*, *Parvamussium strongae*, *Cyclopecten cassiculus*, *Cyclopecten kantori*, *Cyclochlamys bacachorda*.

New synonym: *Amussium sewelli* Knudsen, 1967 = *Propeamussium watsoni* (E.A. Smith, 1885).

New records for the Mozambique Channel and northwestern Madagascar: *Propeamussium andamanicum*, *Propeamussium arabicum*, *Propeamussium caducum*, *Propeamussium jeffreysii*, *Propeamussium sibogai*, *Propeamussium watsoni*, *Parvamussium formosum*, *Parvamussium scitulum*, *Parvamussium torresi*, *Parvamussium vesiculatum*, *Cyclopecten kapalae*, *Similipecten eous*.

New records for southern Madagascar: *Propeamussium jeffreysii*, *Propeamussium sibogai*, *Propeamussium watsoni*, *Parvamussium formosum*, *Parvamussium scitulum*, *Parvamussium thyrideum*, *Parvamussium vesiculatum*, *Parvamussium vidalense*, *Cyclopecten kapalae*, *Similipecten eous*.

New record for South Africa: *Propeamussium jeffreysii*, *Parvamussium formosum*, *Parvamussium scitulum*, *Cyclopecten horridus*, *Similipecten eous*.

KEY WORDS: Mollusca, Pectinoidea, Propeamussiidae, Cyclochlamydidae, SW Indian Ocean, new taxa, new synonym, new records.

INTRODUCTION

This paper deals with bathyal living glass- and micro-scallops (Pectinoidea: Propeamussiidae and Cyclochlamydidae) sampled by French deep-sea campaigns and expeditions to the Mozambique Channel (Benthedi 1977, Mainbaza 2009), northwestern Madagascar (Crevettière 1975, Miriky 2009), southern Madagascar (Atimo Vatae 2010) and Inhaca Island, Mozambique (Inhaca 2011). In addition benthic pectinoid material from off KwaZulu-Natal and Transkei, South Africa, mainly sampled by the Natal Museum Dredging Programme (NMDP) (Dijkstra & Kilburn 2001), is also recorded herein.

The families Propeamussiidae and Cyclochlamydidae are poorly known from the present regions. Only three Propeamussiidae species, i.e. *Parvamussium texturatum* (Dautzenberg & Bavay, 1912), *Cyclopecten incubans* Barnard, 1964 and *Cyclopecten vidalensis* Barnard, 1964 are previously recorded from South Africa (Barnard 1964). Twenty-five species of Pectinoidea (24 Propeamussiidae, 1 Cyclochlamydidae) are herein listed from the Mozambique Channel, northwestern and southern Madagascar, and northeastern South Africa. Most species (52%) have an Indo-Pacific distribution, or are morphologically close to southwest Pacific species (48%). Six species are endemic to the Mozambique Channel (*Propeamussium rosadoi*, *Parvamussium catillus*, *Parvamussium puillandrei*, *Parvamussium strongae*, *Cyclopecten cassiculus* and *Cyclopecten kantori*), and one species to South Africa (*Cyclochlamys bacachorda*).

All studied material is deposited in the Muséum national d'Histoire naturelle (MNHN) in Paris and the KwaZulu-Natal Museum (NMSA) in Pietermaritzburg, with some voucher material in the reference collection of the senior author.

MATERIAL AND METHODS

Institutional abbreviations

AMS	Australian Museum, Sydney, Australia;
NHM	The Natural History Museum, London, UK;
KBIN	Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, Belgium;
MBUR	FB Biologie, Meeresbiologie, Universität Rostock, Rostock, Germany;
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, USA;
MNHN	Muséum national d'Histoire naturelle, Paris, France;
NHMW	Naturhistorisches Museum Wien, Vienna, Austria;
NMSA	KwaZulu-Natal Museum, South Africa;
NMW	National Museum of Wales, Cardiff, UK;
NSMT	National Science Museum, Tokyo, Japan;
RMNH	Rijksmuseum van Natuurlijke Historie (now Naturalis Biodiversity Center, Leiden), the Netherlands;
SMF	Senckenberg Museum, Frankfurt am Main, Germany;
USNM	National Museum of Natural History, Washington, DC, USA;
ZMA	Zoölogisch Museum, Amsterdam (now part of Naturalis Biodiversity Center, Leiden), the Netherlands;
ZSI	Zoological Survey of India, New Alipore, Calcutta, India.

Abbreviations: station data: CC: chalut à crevettes (shrimp trawl), CP: chalut à perche (beam trawl), DW: drague Warén (Warén dredge); *other abbreviations:* D: convexity, H: height (dorsal–ventral), W: width (anterior–posterior), lv: left valve(s), rv: right valve(s), pr: live taken specimen, v: valve(s), stn: station; *regions:* MC/R: Mozambique Channel/new record, NMDP: Natal Museum Dredging Programme; NWM/R: Northwestern Madagascar/new record, SA/R: South Africa/new record, SM/R: Southern Madagascar/new record, SWP: Southwestern Pacific.

TAXONOMY

Superfamily Pectinoidea Rafinesque, 1815

Family Propeamussiidae Abbott, 1954

Key to genera of Propeamussiidae in the southwestern Indian Ocean

- 1 Shell with auricles equal in size, lacking byssal notch, internal ribs commencing early, and external sculpture weak **Propeamussium** de Gregorio, 1884
- Shell with unequal auricles, and with byssal notch and internal ribs.....2
- 2 Shell prominently commarginally sculptured on rv, internally with ribs commencing after early growth stage **Parvamussium** Sacco, 1897
- Shell of most specimens lacking internal ribs3
- 3 Shell prominently radially and/or commarginally sculptured externally, with vesicles on many specimens; internal ribs lacking from most specimens, rudimentary on a few **Cyclopecten** Verrill, 1897

- Shell lacking commarginal sculpture on rv.....4
- 4 Shell with raised anterior auricle and broad hinge dentition.....
..... *Similipecten* Winckworth, 1932

Genus *Propeamussium* de Gregorio, 1884

Propeamussium de Gregorio, 1884: 119 (Proposed as a subgenus of *Pecten*). Type species (OD): *Pecten* (*Propeamussium*) *ceciliae* de Gregorio, 1884; Miocene, Sicily, Italy.

Remarks: For description of the family Propeamussiidae see Mikkelsen and Bieler (2008: 148) and for synonymy, diagnosis, distribution and discussion of the genus *Propeamussium* see Dijkstra (1995: 12).

Key to species of *Propeamussium* in the southwestern Indian Ocean

- Shell large, slightly oblong, weakly commarginally sculptured 1
- 1 Shell 58 mm high, hyaline, lv with fine commarginal lirae, prominent commarginal sculpture near ventral margin, 9–11 variable in length, delicate internal ribs
..... *P. andamanicum* (E.A. Smith, 1894)
- Shell small, circular, flattened, weakly sculptured 2
- 2 Shell 15 mm high, hyaline, lv creamy or reddish, rv whitish, 7 prominent internal ribs
..... *P. arabicum* Dijkstra & Janssen, 2013
- Shell oblong, auricles somewhat raised 3
- 3 Shell 29 mm high, hyaline, brownish, lv smooth and glossy, 10 internal ribs slightly nodulose at distal ends
..... *P. caducum* (E.A. Smith, 1885)
- Shell almost circular, flattened, weakly latticed sculptured 4
- 4 Shell 28 mm high, semi-transparent, lv orange-brownish, rv whitish, 10 internal ribs
..... *P. jeffreysii* (E.A. Smith, 1885)
- Shell almost circular, flattened, early ontogeny smooth and glossy 5
- 5 Shell 25 mm high, semi-transparent or opaque, orange-brownish tinted, 9 internal ribs
..... *P. rosadoi* sp. n.
- Shell large, circular, lv with delicate commarginal growth lines 6
- 6 Shell *c.* 55 mm high, hyaline, creamy or brownish, lv almost smooth, 8 strong, broad internal ribs
..... *P. sibogai* (Dautzenberg & Bavay, 1904)
- Shell large, circular, rather solid, lv radially sculptured 7
- 7 Shell *c.* 60 mm high, opaque, whitish, lv with delicate radial sculpture in early growth stage, commarginal lamellae near ventral margin, 10 internal ribs
..... *P. watsoni* (E.A. Smith, 1885)

Propeamussium andamanicum (E.A. Smith, 1894)

Fig. 1C, D

Amussium andamanicum Smith, 1894: 172, pl. 5, figs 13–14; Knudsen, 1967: 273, pl. 1, fig. 22, text-fig. 15. Type locality: Andaman Sea (12°59'N 93°23'10"E), -1249 m, live, blue mud, 13.xi.1890 (*Investigator*, stn 113).

Propeamussium andamanicum: Dijkstra 1995: 15, figs 5–8, 138–142; 2001: 74; Dijkstra & Maestrati 2008: 79; 2012: 391.

Description: Shell fragile, up to 58 mm high (most specimens smaller, up to 40–50 mm), hyaline, elongate, inequivalve, almost inequilateral, left valve slightly more inflated than

right valve, auricles small and almost similar sized, umbonal angle 105° – 110° , left valve transparent white, right valve creamy. Interior riblets commencing directly below umbo, variable in length and number (most specimens 9–11), all gradually enlarging, lateral ones more prominent, extending to central shell disc. Prodissoconch $250\ \mu\text{m}$ high. Byssal notch lacking. Left valve covered with fine commarginal lirae commencing on central shell disc, extending to ventral margin. Auricles rather small, equally sized and smooth, hinge line straight. Right valve with fine commarginal lirae, interstitial granulated (prismatic calcite layer). Auricles with delicate commarginal striae, anterior and posterior margin somewhat raised. No ctenolium. Resilifer rather triangularly elongate.

Type material examined: Lectotype (pr) ZSI 7418/9, designated by Dijkstra (1995: 15).

Other material examined: NW MADAGASCAR: ($13^{\circ}46'S\ 47^{\circ}33'E$), -1490–1600 m, live, campaign Crevettière 1975, stn CH131, trawled, leg. A. Crosnier, 20.i.1975 (NMSA J1599). MOZAMBIQUE CHANNEL: ($17^{\circ}50'S\ 43^{\circ}07'E$), -1475–1530 m, live, campaign Crevettière 1975, stn CH 126, trawled, leg. A. Crosnier, 16.i.1975 (MNHN); ($18^{\circ}00'S\ 43^{\circ}00'E$), -1715–1750 m, live, campaign Crevettière 1975, stn CH 127, trawled, leg. A. Crosnier, 16.i.1975 (MNHN).

Distribution and habitat: *Propeamussium andamanicum* is recorded from the Andaman Sea, Laccadive Sea and Arabian Sea (Smith 1895, 1904), Gulf of Aden and Zanzibar area (Knudsen 1967), New Caledonia (Dijkstra 1995), Vanuatu, Wallis and Futuna (Dijkstra 2001), Fiji (Dijkstra & Maestrati 2008). Now also from northwestern Madagascar and the Mozambique Channel (new record). *Propeamussium andamanicum* is living on soft substrata of mud or muddy sand at bathyal and upper abyssal depths of -281–2000 m (Dijkstra & Maestrati 2012). Present material live at -1490–1750 m.

Remarks: The present specimens resemble in all morphological characters the type material, although the commarginal lirae on the left valve are slightly weaker. Descriptions of the soft parts and diet are given by Knudsen (1967: 274).

Propeamussium arabicum Dijkstra & Janssen, 2013

Fig. 1A, B

Propeamussium arabicum Dijkstra & Janssen, 2013: 184, figs 1–2, 7–9. Type locality: Gulf of Aden ($12^{\circ}21.5'N\ 44^{\circ}33.0'E$), -506 m, dead, grey-greenish sandy mud, 04.iii.1995 (*Meteor* 31, stn 105.4).

Description: Shell small, up to 15 mm in height, fragile, transparent, almost circular, somewhat higher than wide, inequivalve, equilateral, left valve slightly more inflated than right valve, auricles slightly unequal, umbonal angle 110° – 115° , colour of left valve creamy or reddish, right valve whitish. Prodissoconch $200\ \mu\text{m}$ high. Left valve sculptured with numerous delicate, regularly spaced, antimarginal lirae, crossed by irregularly arranged, minutely undulated growth lines, commencing 1 mm below umbo and extending to above central part of disc, central part and periphery smooth. Anterior auricle somewhat larger than posterior with fine commarginal lirae, weaker on posterior. Dorsal margin weakly lamellated near anterior margin. Right valve sculptured with fine, regularly close-set commarginal lirae, more widely spaced near ventral margin. Auricles smooth, unequal in form and size. No byssal fasciole or byssal notch. Ctenolium absent. Hinge line straight. Interior ribs of both valves prominent (7 with 2 auricular) commencing in early growth stage and extending to the submarginal area. No rudimentary interstitial riblets.

Type material examined: Holotype (lv) SMF 341743, 108 paratypes (lv & rv) MBUR (14 v), RMNH (40 v), SMF (341744–47, 341748–50). The additional valves of the type and other stations are not belonging to the type series (Dijkstra & Janssen 2013: 184).

Other material examined: NW MADAGASCAR: Between Majunga and Cap Saint-André (15°34'S 45°44'E), -287–450 m, live, campaign Miriky, stn CP3263, 10.vii.2009 (MNHN); in front of the Narendry Bay (14°29'S 47°26'E), -332–379 m, live, campaign Miriky, stn CP3289, 14.vii.2009 (MNHN); in front of the Narendry Bay (14°29'S 47°26'E), -409–425 m, live, campaign Miriky, stn CP3290, 14.vii.2009 (MNHN); in front of the Narendry Bay (14°27'S 47°25'E), -347–408 m, live, campaign Miriky, stn CP3291, 14.vii.2009 (MNHN); in front of the Narendry Bay (14°30'S 47°26'E), -268–408 m, live, campaign Miriky, stn CP3293, 14.vii.2009 (MNHN); in front of the Narendry Bay (14°29'S 47°27'E), -263–331 m, live, campaign Miriky, stn CP3294, 14.vii.2009 (MNHN). MOZAMBIQUE CHANNEL: Zambeze transect (19°34'S 36°45'E), -825–827 m, live, campaign Mainbaza, stn CC3155, 13.iv.2009 (MNHN). SOUTH AFRICA: Zululand: Off Matigulu River mouth (29°22.3'S 31°57.7'E), -400 m, dead, mud, NMDP stn ZR12, dredged RV *Meiring Naudé*, 16.vi.1989 (NMSA E8820).

Distribution and habitat: Gulf of Aden, dead at -321–917 m. Now also extended southwards to northwestern Madagascar and the Mozambique Channel (new record). Present specimens are on soft substrata of mud and sand at a bathyal range of -331–825 m (minimum depth range).

Remarks: The most closely resembling species is *Propeamussium siratama* (Oyama, 1951) recorded from Japan (-100–300 m) (Hayami 2000: 913), which differs from the present species in being smaller (typically up to 10 mm, present specimens up to 15 mm in height), in having a weaker latticed sculpture on the left valve, in having more internal ribs (typically 8 with sometimes a few rudimentary interstitial riblets in late growth stage near the ventral margin, present specimens 7 without rudimentary riblets), and in colour (typically left valve whitish opaque or transparent, present specimens reddish or sporadical whitish transparent). Another resembling species is *Propeamussium andamanense* (Bavay, 1905) from the Andaman Sea. This species is somewhat smaller in size (up to 9 mm in height), also almost circular of shape and having also 7 internal ribs, but is different in sculpture of the left valve (throughout the disc a fine latticed sculpture of numerous closely spaced radial riblets and weak interstitial commarginal lirae), whereas *P. arabicum* has a more delicate latticed sculpture in early growth stage to the central part of the disc. Moreover, *P. andamanense* is more solid, opaque white (*P. arabicum* transparent reddish or sporadical whitish). A rather resembling species is *Propeamussium malpelsonium* (Dall, 1908), recorded from the tropical eastern Pacific. *Propeamussium malpelsonium* differs in having a more prominent sculpture on the entire disc of the left valve and in having 11 internal ribs. This species is only recorded from abyssal depths, 2690–4505 m (Grau 1959: 14). *Propeamussium steindachneri* (Sturany, 1901) recorded from the Red Sea, Gulf of Aden, Arabian Sea and Gulf of Oman (-439–457 m) (Knudsen 1967: 280; Oliver 1992: 73; Dijkstra & Janssen 2013: 191) differs from *P. arabicum* in having a more oblique shape, smooth left and right valves, fewer internal ribs (usually 6), smaller auricles, and creamy and white dots on the left valve.

Propeamussium caducum (E.A. Smith, 1885)

Fig. 1E, F

Amussium caducum E.A. Smith, 1885: 309, pl. 23, figs 1–1c; Knudsen 1967: 274, pl. 1, fig. 17, text-fig. 16. Type locality: Philippines, West of Luzon (12°21'N 122°15'E), -1280 m, live, blue mud, 16.i.1875 (*Challenger*, stn 207).

Amussium weberi Dautzenberg & Bavay, 1912: 32, pl. 28, figs 9–13. Type locality: Indonesia, Bali Sea (7°19.4'S 116°49.5'E), -538 m, live, fine dark brown sandy mud, 19.ii.1900 (*Siboga*, stn 316).

Propeamussium nakazawai Kuroda, [1929–35] 1932: 87, figs 101–102 (ICZN Art. 11, *nomen nudum*). Synonymy established by Oyama (1951), and subsequently followed by Habe (1958, 1977) and Knudsen (1967).

Propeamussium caducum: Dijkstra 1991: 6, figs 1–2; 1995: 15, figs 9–10, 129–132; 2013: 10, pl. 1, figs 1a–d, pl. 4, fig. 1; Dijkstra & Maestrati 2008: 82; 2012: 391; Dijkstra & Janssen 2013: 187, figs 10–12.

Description: Shell up to 29 mm in height, fragile, slightly higher than wide to circular, slightly inequivalve, almost equilateral, semi-transparent to opaque, glossy, creamy, left valve slightly more inflated than right valve, umbonal angle about 90°. Prodissoconch 200 µm high. Left valve smooth, with commarginal growth lines, no radial striations. Auricles small, without sculpture, somewhat raised near margins. Right valve with widely spaced commarginal lirae, commencing at 3 mm shell height and extending to submarginal area, with interstitial microscopic scratches. Auricles with fine commarginal striae, strong scales on the marginal areas of hinge. Hinge line straight near umbo, gradually raised to the anterior and posterior margins. Interior radial lirae generally 10, sometimes 9 or 11, slightly nodulose at distal ends, more prominent on right valve. No byssal notch, ctenolium lacking, lateral gape present.

Type material examined: *Amussium caducum*: Lectotype (pr) NHMUK (1887.2.9.3310), designated by Dijkstra (1995: 17), 4 paralectotypes NHMUK (1887.2.9.331/1–4). *Amussium weberi*: Lectotype ZMA (Moll. 3.12.013), designated by Dijkstra (1995: 17), paralectotypes in KBIN, MCZ and RMNH.

Other material examined: NW MADAGASCAR: Off Mahajamba Bay (14°48'S 46°60'E), -620–637 m, live, campaign Miriky, stn CP3249, 07.vii.2009 (MNHN); Off Majunga (15°25'S 45°57'E), -609–800 m, live, campaign Miriky, stn CP3251, 08.vii.2009 (MNHN); Off Majunga (15°22'S 45°58'E), -850–900 m, live, campaign Miriky, stn CP3252, 08.vii.2009 (MNHN); Off Majunga (15°25'S 45°55'E), -243–950 m, live, campaign Miriky, stn CP3253, 08.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°31'S 45°45'E), -640–800 m, live, campaign Miriky, stn CP3268, 11.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°31'S 45°46'E), -760–1000 m, live, campaign Miriky, stn CP3269, 11.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°24'S 45°56'E), -750–780 m, live, campaign Miriky, stn CP3278, 12.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°22'S 45°57'E), -780–1020 m, live, campaign Miriky, stn CP3279, 12.vii.2009 (MNHN); in front of Narendry Bay (14°27'S 47°25'E), -347–408 m, live, campaign Miriky, stn CP3291, 14.vii.2009 (MNHN).

Distribution and habitat: *Propeamussium caducum* has a large distribution throughout the Indo-West Pacific from southern Japan (Okutani 2000), southwards to the East China Sea and South China Sea (Xu & Zhang 2008), the Philippine Archipelago (Knudsen 1967; Dijkstra 2013), the Indonesian Archipelago (Dijkstra & Kastoro 1997), and eastwards to the Solomon Islands (Dijkstra & Maestrati 2008), the Vanuatu Archipelago and New Caledonia (Dijkstra 1995, 2001; Dijkstra & Maestrati 2012), westwards to the Bay of Bengal, the Arabian Sea and Gulf of Aden, and southwards to Zanzibar area (Dijkstra 1995; Dijkstra & Janssen 2013). Now also extended more southwards to the northwestern area of Madagascar (new record). This species is living on soft substrata of mud or muddy sand at a bathyal range of -90–1500 m (Dijkstra 2013). Present material live at -243–1020 m.

Remarks: The present specimens from northwestern Madagascar are almost morphologically completely similar to the type material from the Philippines. Only the present shells are slightly more circular in outline and the commarginal sculpture of the right valve is somewhat more prominent than that of the type specimens. Other characters are identical, i.e. smooth surface of left valve, weak commarginal sculpture on the right valve and in late growth stage on the left valve, number of internal ribs, and coloration and transparency of disc surface.

Shell crystallography is given by Hayami (1988), and Knudsen (1967) reported on the soft parts, diet and reproduction.

Propeamussium caducum is the type species of *Flavamussium* Oyama, 1951, proposed as a subgenus of *Parvamussium* Verrill, 1897 (Dijkstra 1995: 12). However, *P. caducum* is a typical *Propeamussium*.

Propeamussium jeffreysii (E.A. Smith, 1885)

Fig. 1G, H

Amussium jeffreysii E.A. Smith, 1885: 310, pl. 23, figs 2–2c; Knudsen 1967: 276, pl. 1, fig. 19. Type locality: Philippine Islands, E of Panay (9°26'N 123°45'E), -686 m, live, blue mud, 25.i.1875 (*Challenger*, stn 210).

Propeamussium jeffreysii: Dijkstra 2001: 76, figs 5–12; 2013: 13, pl. 1, figs 2a–d, pl. 4, figs 2a–b; Dijkstra & Maestrati 2008: 83; 2012: 391.

Description: Shell fragile, up to 28 mm in height, more commonly 20–23 mm, slightly higher than wide, equilateral, inequivalve, weakly inflated, left valve somewhat more than right, auricles equal, umbonal angle 100°–110°. Colour of left valve an orange-brown tint and semi-transparent, right whitish. Prodissoconch 200 µm high. Left valve has a delicate regular latticed sculpture in early growth stage, distinct near the umbo, but tends to be obsolete near the ventral margin. Anterior and posterior auricles are relatively small, equal in size, with fine radial riblets, weaker on right valve. Right valve sculptured with fine regularly spaced commarginal lirae. Internal riblets 10 with 2 auricular riblets, and a few (2–4) interstitial rudimentary riblets in late growth stage. Hinge line straight. Resilifer triangular. No byssal fasciole, byssal notch, or ctenolium.

Type material examined: Lectotype (pr) NHMUK 1887.2.9.3313, designated by Dijkstra (2001: 76), 2 paralectotypes NHMUK 1887.2.9.3314–15. The marginal apron (prismatic calcite outer layer) of the right valves of the type material is damaged or broken off, due to its fragility.

Other material examined: NW MADAGASCAR: Between Nosy-Bé and Banc du Leven (12°38'S 48°14'E), -420–436 m, live, campaign Miriky, stn CP3183, 26.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°40'S 48°12'E), -492–524 m, live, campaign Miriky, stn CP3184, 26.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°38'S 48°10'E), -560–576 m, live, campaign Miriky, stn CP3185, 26.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°30'S 48°08'E), -691–695 m, live, campaign Miriky, stn CP3187, 26.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°26'S 48°13'E), -578–580 m, live, campaign Miriky, stn CP3192, 27.vi.2009 (MNHN); West of Cap d'Ambre (12°08'S 48°53'E), -496–501 m, dead, campaign Miriky, stn DW3195, 28.vi.2009 (MNHN); West of Cap d'Ambre (12°06'S 48°54'E), -560–653 m, live, campaign Miriky, stn DW3200, 28.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°44'S 48°12'E), -442–491 m, live, campaign Miriky, stn CP3210, 29.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°23'S 47°56'E), -391–438 m, live, campaign Miriky, stn DW3217, 30.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°46'S 48°11'E), -430–488 m, dead, campaign Miriky, stn CP3223, 02.vii.2009 (MNHN); West of Nosy-Bé (13°24'S 47°57'E), -435–600 m, live, campaign Miriky, stn DW3231, 03.vii.2009 (MNHN); Mahajamba Bay (14°50'S 46°57'E), -340–446 m, live, campaign Miriky, stn CP3248, 07.vii.2009 (MNHN); Majunga (15°22'S 46°00'E), -493–750 m, live, campaign Miriky, stn CP3250, 08.vii.2009 (MNHN); Majunga (15°22'S 45°58'E), -850–900 m, live, campaign Miriky, stn CP3252, 08.vii.2009 (MNHN); Mahajamba Bay (14°47'S 46°58'E), -512–680 m, live, campaign Miriky, stn CP3285, 13.vii.2009 (MNHN); in front of Narendry Bay (12°26'S 48°13'E), -578–580 m, live, campaign Miriky, stn CP3292, 14.vii.2009 (MNHN). MOZAMBIQUE CHANNEL: NE region, Mayotte (12°46'S 44°58'E), -475–510 m, dead, campaign Benthedi 1977, stn 61 (MNHN); Mayotte (12°46.5'S 44°57.6'E), -530–535 m, dead, campaign Benthedi 1977, stn DS 62, Sanders epibenthic sledge, RV *Suroit*, 29.iii.1977 (MNHN); Mayotte, E Bandele reef (12°53.8'S 45°16.2'E), -520–830 m, dead, campaign Benthedi 1977, stn 37 (MNHN); Maputo transect (25°13'S 35°18'E), -480–503 m, dead, campaign Mainbaza, stn CP3135, RV *Vizconde de Eza*, 10.iv.2009 (MNHN); Maputo transect (23°31'S 35°50'E), -446–475 m, dead, campaign Mainbaza, stn CP3142, RV *Vizconde de Eza*, 11.iv.2009 (MNHN); Zambeze transect (19°34'S 36°45'E), -352–357 m, live, campaign Mainbaza, stn CC3151, RV *Vizconde de Eza*, 13.iv.2009 (MNHN); Zambeze transect (19°34'S 36°45'E), -443–445 m, dead, campaign Mainbaza, stn CC3152, RV *Vizconde de Eza*, 13.iv.2009 (MNHN); Zambeze transect (19°35'S 36°46'E), -518–524 m, live, campaign Mainbaza, stn CC3153, RV *Vizconde de Eza*, 13.iv.2009 (MNHN); Maputo transect (25°34'S 34°11'E), -155–165 m, dead, campaign Mainbaza, stn CC3175, RV *Vizconde de Eza*, 17.iv.2009 (MNHN). MOZAMBIQUE: S region: Off Zavora, -235–400 m, live, trawled, don. J. Rosado, 30.iii.1998 (NMSA L4655). S MADAGASCAR: Manantenina (24°24'S 47°34'E), -502–504 m, live, expedition Atimo Vatae, stn DW3526, RV *Nosy Bé II*, 01.v.2010 (MNHN); Fort-Dauphin (25°19.8'S 47°00.9'E), -77 m, dead, expedition Atimo Vatae, stn DW3536, RV *Nosy Bé II*, 02.v.2010 (MNHN); Fort-Dauphin (25°28'S 47°02'E), -607–633 m, dead, expedition Atimo Vatae, stn CP3542, RV *Nosy Bé II*, 03.v.2010 (MNHN); E of Faux Cap (25°37'S 46°20'E), -433–456 m, live, expedition Atimo Vatae, stn DW3564, RV *Nosy Bé II*, 06.v.2010 (MNHN); Fort-Dauphin (25°05.5'S

47°05.5'E), -69–70 m, live, expedition Atimo Vatae, stn CP3569, RV *Nosy Bé II*, 08.v.2010 (MNHN); S Pointe Barrow (25°31'S 44°16'E), -296–302 m, dead, expedition Atimo Vatae, stn CP3583, 10.v.2010 (MNHN); S Pointe Barrow (25°35'S 44°15'E), -821–910 m, dead, expedition ATIMO VATAE, stn CP3595, RV *Nosy Bé II*, 12.v.2010 (MNHN). SOUTH AFRICA: *Zululand*: Off Matigulu River mouth (29°22.3'S 31°57.7'E), -400 m, dead, mud, NMDP stn ZR12, dredged RV *Meiring Naudé*, 16.vi.1989 (NMSA E8820). *Transkei*: Off Mbashe River (32°22.8'S 29°00.8'E), -450–500 m, dead, coarse sand, some mud, dredged NMDP, RV *Meiring Naudé*, stn Q14, 06.vii.1985 (NMSA C9023).

Distribution and habitat: *Propeamussium jeffreysii* is recorded throughout the Indo-West Pacific from southern Japan, Taiwan, East China Sea, South China Sea, and the Philippines (Bernard, Cai & Morton 1993: 53; Hayami 2000: 913; Xu & Zhang 2008: 77; Dijkstra 2013: 13), eastwards to Wallis and Futuna, Vanuatu (Dijkstra 2001: 78; Dijkstra & Maestrati 2012: 391) and Fiji (Dijkstra & Maestrati 2008: 83), and westwards to the Maldive Islands, Gulf of Aden and southeastern Africa (Knudsen 1967: 276). Now also recorded from the Mozambique Channel, northwestern and southern Madagascar, and South Africa (new record). *Propeamussium jeffreysii* is living on soft-bottom assembles of mud or muddy sand at a bathymetric range of -80–797 m (Dijkstra 2013: 13). Present material live at -70–900 m.

Remarks: Almost all morphological characters of the present material are identical to the type specimens from the Philippines. The colour of the type specimens is orange-brownish and of the present material somewhat paler. However, this coloration is also observed in material from the southwestern Pacific (MNHN). The commarginal sculpture on the left valve is somewhat more prominent on the type specimens than of the present material. However, the radial and latticed sculpture of the left valve is variable in prominence or even lacking in a few eroded specimens. The internal ribs are generally 10–11 in number (6–7 main ribs and additional short ribs laterally). The interstitial rudimentary riblets vary strongly (1–4) or are sometimes lacking. Soft parts, reproduction and diet are described by Knudsen (1967: 277).

In the original description of *Amussium jeffreysii* the right valve is the upper valve and the left valve the lower, in contrast to present descriptions.

Propeamussium rosadoi sp. n.

Fig. 1M–S

Etymology: After Mr José Rosado, an advanced amateur shell collector from Mozambique, who sampled and supplied much of the shell material for this investigation and participated in the three French campaigns herein mentioned.

Description: Shell up to 25 mm in height, fragile, most specimens transparent and some opaque, almost circular, inequivalve, slightly equilateral, left valve somewhat more inflated than right. Valves gapping laterally. Auricles relatively small and unequal in size (anterior: posterior ratio is 1.25: 1) and shape (anterior larger than posterior). Umbonal angle about 90°. Colour of left valve orange-brownish tinted, right valve paler, translucent whitish internal radial riblets. Prodissoconch 170 µm long. Left valve in early ontogeny smooth and glossy (c. 3 mm), then sculptured towards the central part of the disc with weak closely spaced radial riblets, in late growth stage smooth with a few delicate commarginal growth lines near the periphery, one or two delicate radial plicae near the posterior margin. Anterior auricle smooth and dull, posterior with microsculpture of very closely spaced radial scratches. Right valve sculptured with regularly spaced (c.

5 per mm) fine commarginal lirae. Anterior auricle laterally with very fine commarginal growth lines, posterior smooth with a narrow groove near the suture of the disc. Interior ribs 9, commencing in early ontogeny and extending submarginally, with one auricular on each side, ribs of right valve broader than of left valve. Resilifer triangular, elongate. Outer ligament rather broad. Hinge line straight. Small byssal notch, no ctenolium.

Dimensions: Holotype: Height 25.0 mm, width 24.9 mm, convexity 5.0 mm.

Type material: Holotype (pr) (MNHN IM-2000-30115), paratypes (MNHN IM-2000-30117, 16 pr, 5 lv, 2 rv; NMSA L9513/T3917, 2 pr; RMNH.5003911, 2 pr). Type locality: NW MADAGASCAR: In front of Mahajamba Bay (14°50'S 46°57'E), -340–446 m, live, campaign Miriky, stn CP3248, 07.vii.2009.

Other material examined: MADAGASCAR: Northwest region: between Nosy-Bé and Banc du Leven (12°43'S 48°14'E), -291–353 m, live, campaign Miriky, stn CP3209, 29.vi.2009 (MNHN, 1 pr); between Nosy-Bé and Banc du Leven (12°51'S 48°12'E), -341–345 m, dead, campaign Miriky, stn DW3226, 02.vii.2009 (MNHN, 1 lv); West of Nosy-Bé (13°27'S 47°55'E), -187–247 m, live, campaign Miriky, stn DW3234, 03.vii.2009 (MNHN, 3 pr, 2 rv); in front of Mahajamba Bay (14°50'S 47°00'E), -349–442 m, live, campaign Miriky, stn CP3247, 07.vii.2009 (MNHN, 3 pr, 2 lv); in front of Mahajamba Bay (14°48'S 46°60'E), -620–637 m, live, campaign Miriky, stn CP3249, 07.vii.2009 (MNHN, 1 pr). SOUTH MADAGASCAR: Between Lokaro and Sainte Luce (24°53'S 47°28'E), -184–203 m, dead, expedition Atimo Vatae, stn DW3515, RV *Nosy Bé II*, 30.iv.2010 (MNHN, 1 lv); Manantenina (24°23'S 47°32'E), -395–407 m, dead, expedition Atimo Vatae, stn DW3525, RV *Nosy Bé II*, 01.v.2010 (MNHN, 5 rv); Manantenina (24°24'S 47°34'E), -502–504 m, dead, expedition Atimo Vatae, stn DW3526, RV *Nosy Bé II*, 01.v.2010 (MNHN, 1 lv); Manantenina (24°23'S 47°32'E), -305–313 m, dead, expedition Atimo Vatae, stn CP3527, RV *Nosy Bé II*, 01.v.2010 (MNHN, 1 rv); Manantenina (24°24'S 47°33'E), -424–438 m, dead, expedition Atimo Vatae, stn DW3528, RV *Nosy Bé II*, 01.v.2010 (MNHN, 1 lv); Manantenina (24°24'S 47°33'E), -402–407 m, dead, expedition Atimo Vatae, stn DW3529, RV *Nosy Bé II*, 01.v.2010 (MNHN, 1 lv, 2 rv); Sainte Luce (24°43'S 47°32'E), -296–307 m, live, expedition Atimo Vatae, stn DW3534, RV *Nosy Bé II*, 02.v.2010 (MNHN); S Pointe Barrow (25°31'S 44°16'E), -296–302 m, live, expedition Atimo Vatae, stn CP3583, RV *Nosy Bé II*, 10.v.2010 (MNHN, 1 pr).

Distribution and habitat: Northwestern and southern Madagascar. Living bathyally on soft substrata of mud or muddy sand at a maximum depth range of -187–637 m, minimum depth range -247–620 m.

Remarks: The most closely resembling species is *Propeamussium rubrotinctum* (Oyama, 1951) recorded from southern Japan, South China Sea, Solomon Islands, Vanuatu Archipelago, New Caledonia, Fiji, Wallis and Futuna, and Tonga, live at -210–869 m (Dijkstra & Maestrati 2012: 392), which differs morphologically from *P. rosadoi* in having a smaller size (20 mm in height, *P. rosadoi* 25 mm), in having a throughout smooth shell disc of the left valve (*P. rosadoi* partially with a radial sculpture) and a very weak commarginal sculpture on the right valve (*P. rosadoi* with a more prominent commarginal sculpture), in having 10 and sometimes several rudimentary internal ribs (*P. rosadoi* 9 without rudimentary riblets), and in having a different colour (orange or whitish patches or dots, *P. rosadoi* uniform orange-brownish).

Another resembling species is *Propeamussium steindachneri* (Sturany, 1901) recorded from the Red Sea, Gulf of Aden, Arabian Sea, and Gulf of Aden, live at -363–479 m (Dijkstra & Janssen 2013), which differs from *P. rosadoi* in having a smaller size (up to c. 15 mm in height, *P. rosadoi* c. 25 mm), in having a smooth left and right shell disc (*P. rosadoi* radially (lv) and commarginally (rv) sculptured), and in having fewer and weaker internal ribs (*P. steindachneri* 6, *P. rosadoi* 9).

Similar sized specimens of *P. jeffreysii* from the same stations as *P. rosadoi* could be easily mixed with *P. rosadoi*, but the former species could be differentiated from the latter species by the following characters, i.e. closer spaced with rudimentary interstitial internal ribs (*P. rosadoi* wider spaced and lacking rudimentary interstitial internal ribs),

a latticed sculpture on the left valve (*P. rosadoi* a radial sculpture), a darker orange-brownish coloured left valve, and narrower internal ribs on the right valve (*P. rosadoi* broader and more prominent).

Propeamussium sibogai (Dautzenberg & Bavay, 1904)

Fig. 11, J

Amussium sibogai Dautzenberg & Bavay, 1904: 207, figs 1–4; Dautzenberg & Bavay 1912: 31, pl. 28, figs 1–4. Type locality: Indonesia, Bali Sea (7°15'S 115°15'E), -289 m, live, mud and broken shells, 14.iii.1899 (*Siboga*, stn 12).

Propeamussium sibogai: Knudsen 1967: 272, pl. 1, figs 23–24; Dijkstra 1995: 23, figs 19–22; 2001: 81; 2013: 14, pl. 1, figs 4a–d, pl. 4, fig. 4; Dijkstra & Kastoro 1997: 253, figs 24–29.; Dijkstra & Marshall 1997: 79, pl. 3, figs 1–3.; 2008: 5, figs 1, 3H–J; Wang 2002: 151, pl. 5, fig. 7; Dijkstra & Maestrati 2008: 84; 2013: 470.

Amussium cf. *sibogai*: Barnard 1969: 655, pl. 1, figs a–d.

Description: Shell fragile, up to 65 mm in height (most specimens smaller up to 40–50 mm), hyaline, almost circular, inequivalve, somewhat inequilateral, slightly oblique, left valve more inflated than right valve, laterally gaping rather strongly, auricles small and equal in size, umbonal angle 120°–125°. Left valve creamy brown, right valve creamy. Prodissoconch 220 µm high. Left valve covered with a few delicate commarginal growth lines; a few minute commarginal lamellae present near ventral margin of some specimens. Delicate radial lirae developed near posterior margin. Auricles smooth, somewhat raised on lateral margins. Right valve with widely spaced commarginal lirae, weaker at periphery, and microscopic interstitial granules. Marginal apron lacking from most specimens due to the very thin layer of prismatic calcite (Hayami 1988: fig. 4). Auricles smooth. Hinge line straight. Internal costae 7 in most specimens, deep brown on left valve, white and broader on right valve. Marginal costae with 4 or 5 small nodules, visible through lateral gape. Resilifer triangular, elongate. No byssal notch.

Type material examined: Holotype (pr) ZMA Moll. 304001.

Other material examined: NW MADAGASCAR: Between Nosy-Bé and Banc du Leven (12°38'S 48°14'E), -420–436 m, live, campaign Miriky, stn CP3183, 26.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°40'S 48°12'E), -492–524 m, live, campaign Miriky, stn CP3184, 26.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°30'S 48°18'E), -346–376 m, dead, campaign Miriky, stn CP3189, 27.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°31'S 48°15'E), -415–416 m, dead, campaign Miriky, stn CP3190, 27.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°44'S 48°12'E), -442–491 m, live, campaign Miriky, stn CP3210, 29.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°33'S 47°56'E), -391–438 m, live, campaign Miriky, stn DW3217, 30.vi.2009 (MNHN); Northwest region, between Nosy-Bé and Banc du Leven (12°46'S 48°11'E), -430–488 m, live, campaign Miriky, stn CP3223, 02.vii.2009 (MNHN); Mahajamba Bay (14°50'S 46°57'E), -340–446 m, live, campaign Miriky, stn CP3248, 07.vii.2009 (MNHN); Majunga (15°22'S 46°00'E), -493–750 m, live, campaign Miriky, stn CP3250, 08.vii.2009 (MNHN); in front of Narendry Bay (14°29'S 47°26'E), -409–425 m, live, campaign Miriky, stn CP3290, 14.vii.2009 (MNHN). S MADAGASCAR: Between Lokaro and Sainte Luce (24°53'S 47°28'E), -184–203 m, dead, expedition Atimo Vatae, stn DW3515, 30.iv.2010 (MNHN). MOZAMBIQUE CHANNEL: Maputo transect (25°12'S 35°17'E), -503–505 m, dead, campaign Mainbaza, stn CP3136, 10.iv.2009 (MNHN); Maputo transect (23°31'S 35°50'E), -446–475 m, live, campaign Mainbaza, stn CP3142, 11.iv.2009 (MNHN). MOZAMBIQUE: E of Inhaca Island, -457 m, live, don. Mrs K. Eastwood (NMSA 5294, 1 pr); Bazaruto Island, -549 m, live, ex colln K. Eastwood (NMSA J5095). SOUTH AFRICA: Zululand: Off Matigulu River mouth (29°22.3'S 31°57.7'E), -400 m, dead, mud, NMDP stn ZR12, dredged RV *Meiring Naudé*, 16.vi.1989 (NMSA E8820). *KwaZulu-Natal*: Off Durban (29°55.8'S 31°13.0'E), -337–346 m, live, stn B3.1, trawled ORI, 20.ii.2006 (NMSA W8601); Off Durban, -366 m, live, don. R. Kilburn, 01.ix.1969 (NMSA 4492).

Distribution and habitat: *Propeamussium sibogai* is recorded throughout the tropical Indo-West Pacific from southern Japan (Hayami 2000), southwards to the Philippines

and Indonesia (Dautzenberg & Bavay 1912; Knudsen 1967; Dijkstra & Kastoro 1997; Dijkstra 2013), eastwards to the Solomon Islands, Vanuatu Archipelago, Loyalty Islands, New Caledonia, Wallis and Futuna Islands, Fiji, Tonga, and Kermadec Islands (Dijkstra 1995; 2001; Dijkstra & Maestrati 2008; 2013; Dijkstra & Marshall 2008), and westwards only recorded from off Durban, South Africa (Knudsen 1967). Now also from the Mozambique Channel and northwestern and southern Madagascar (new record). *Propeamussium sibogai* is living on soft substrata of mud or muddy sand at a bathyal depth of -90–750 m (Dijkstra 2013; present records). Present material live at -340–750 m.

Remarks: All morphological characters of the present material are identical to the holotype from the Bali Sea, Indonesia. These characters are rather constant and can slightly vary in number of the internal ribs. Occasionally on one or both sides the lateral rib is divided into two separated ribs. The southwestern Indian Ocean morph does not have divided lateral ribs and thus only 6 internal ribs (typically 7).

Propeamussium sibogai is the type species of *Luteamussium* Oyama, 1951: 82, which was treated by Hertlein (1969: N350) as a junior synonym of *Propeamussium*, subsequently followed in literature by most authors (see references). Descriptions of the soft parts, reproduction and diet are given by Knudsen (1967: 272).

Propeamussium watsoni (E.A. Smith, 1885)

Fig. 1K, L

Amussium watsoni E.A. Smith, 1885: 309, pl. 22, figs 8–8c. Type locality: NE of New Guinea (2°23'S 144°04'E), -1957 m, live, blue mud, 10.iii.1875 (*Challenger*, stn 218).

Propeamussium watsoni bayonnaisense Okutani, 1962: 15, pl. 2, figs 1–2. Type locality: Japan, 24 miles off Bayonnaise Rocks (32°00'N 140°21.4'E), -2140–2160 m, live, 05.vii.1960 (*Soyo-Naru*, stn B4).

Amussium sewelli Knudsen, 1967: 279, pl. 2, figs 1–2, text-figs 18A, B. Type locality: Zanzibar area (4°05'54"S 41°10'12"E), -1789 m, live, globigerina ooze, Agassiz trawl, 17.i.1934 (*John Murray*, stn 118) **syn. n.**

Propeamussium watsoni: Dijkstra 1995: 24, figs 27–30, 123–124; Dijkstra & Maestrati 2010: 334; 2013a: 362; 2013b: 470.

Description: Shell up to 52 mm high (most specimens smaller up to 40–45 mm), inequivalve, almost circular, slightly higher than wide, somewhat inequilateral, umbonal angle 120°–125°. Opaque, left valve milky-white, right valve cream. Prodissoconch 240 µm high. Left valve more convex than right valve, with delicate radial lirae that commence at *c.* 3 mm shell length and extend to central part of disc, crossed by commarginal lamellae in central part and extend to the ventral margin, lamellae variable in prominence or even lacking. Auricles relatively small, equal, commarginal lamellae prominent on anterior, finer and more closely spaced on posterior. Most specimens with 10 internal ribs and a small auricular riblet on each side, commencing just below resilifer and extending to pallial line. Right valve with fine regular commarginal lirae and granulate interstitial microsculpture (prismatic calcite layer). Auricles with commarginal lirae, anterior auricle with a few radial lines near suture, absent from posterior auricle. Prominent scales on anterior and posterior dorsal margins of auricles. Resilifer triangular, erect. No byssal notch.

Type material examined: *Amussium watsoni*: Lectotype (pr) NHMUK 1887.2.9.3307, designated by Dijkstra (1995: 24), 2 paralectotypes (pr) NHMUK 1887.2.9.3308/1–2. *Propeamussium watsoni bayonnaisense*: Holotype (pr) NSMT Mo.62759, 5 paratypes (pr) NSMT Mo.62760. *Amussium sewelli*: Holotype (pr) NHMUK 196641, paratype (pr) NHMUK 196642.

Other material examined: NW MADAGASCAR: In front of Majunga (15°25'S 45°55'E), -243–950 m, live, campaign Miriky, stn CP3253, 08.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°31'S 45°42'E), -777–800 m, dead, campaign Miriky, stn CP3270, 11.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°31'S 45°45'E), -780–800 m, dead, campaign Miriky, stn CP3271, 12.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°24'S 45°56'E), -750–780 m, live, campaign Miriky, stn CP3278, 12.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°22'S 45°57'E), -780–1020 m, live, campaign Miriky, stn CP3279, 12.vii.2009 (MNHN). S MADAGASCAR: S Pointe Barrow (25°35'S 44°15'E), -821–910 m, live, expedition Atimo Vatae, stn CP3595, 12.v.2010 (MNHN).

Distribution and habitat: Northern Indian Ocean, southern Japan, Papua New Guinea, New Caledonia, Vanuatu, Society Islands, Tuamotu Archipelago, and Austral Islands (Dijkstra & Maestrati 2010: 335; 2013a: 362). Now also northwestern and southern Madagascar (new record). Living bathyally on soft substrata of mud or muddy sand at a depth range of -650–2160 m. Present material live at -243–1020 m (maximum bathyal range), minimum range -780–821 m.

Remarks: The present material from northwestern and southern Madagascar is almost similar to the type material, although the commarginal lamellae of the left valve are almost lacking (only a few near the ventral margin in some of the largest specimens) and the commarginal lamellae of the right valve are somewhat more widely spaced than the typical specimens. However, both features are variable in examined material from other localities in the southwestern Pacific (MNHN).

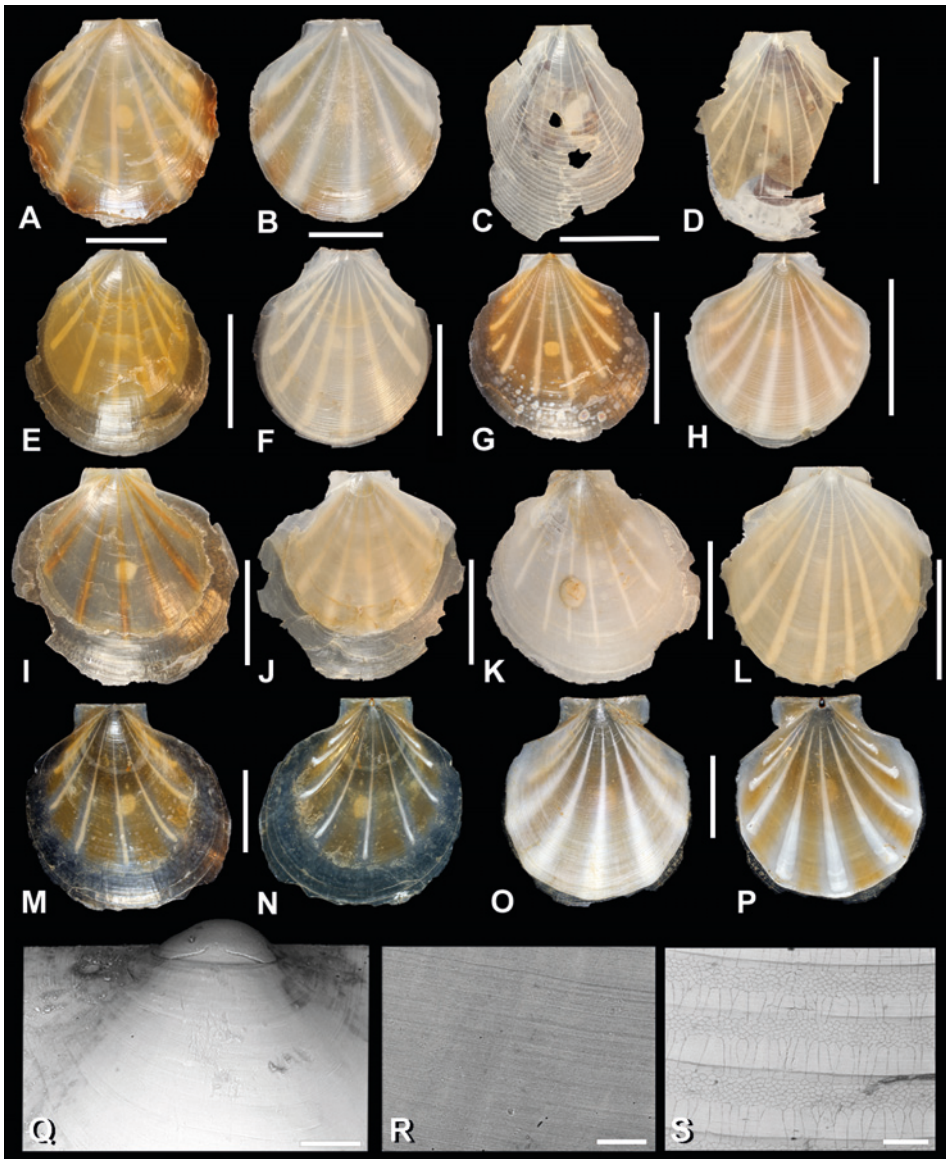
There are no basic morphological differences between the Japanese morph *P. watsoni bayonnaisense* and *P. watsoni* (Dijkstra 1995: 25).

According to Knudsen (1967: 280) *P. sewelli* from the Zanzibar region differs from *P. watsoni* in having a different shape of the auricles and a different reflection of the posterior margin of the posterior auricle. In addition he also observed differences in the “arrangement of the tentacles of the mantle edge” (Knudsen 1967: fig. 18b, c). However, these three characters of *P. sewelli* are also observed in specimens of *P. watsoni* from other localities of the southwestern Pacific (MNHN) and are interspecific variations of *P. watsoni*. Therefore, *P. sewelli* is treated herein as a junior synonym of *P. watsoni*.

Knudsen (1967: 281) also treated *Propeamussium alcocki* (E.A. Smith, 1894) as a junior synonym of *P. watsoni*, whereas Dijkstra (1995: 13) considered both as valid

Fig. 1. *Propeamussium* spp.: (A–B) *P. arabicum* Dijkstra & Janssen, 2013: campaign Miriky, stn CP3289, (A) external view of the left valve, H 14.1 mm, scale bar = 5 mm; (B) external view of the right valve, H 13.7 mm, scale bar = 5 mm (MNHN). (C–D) *P. andamanicum* (E.A. Smith, 1894): campaign Crevettière 1975, stn CH131, (C) external view of the left valve, H 44.1 mm, scale bar = 2 cm; (D) external view of the right valve, H 33 mm, scale bar = 2 cm (NMSA J1599). (E–F) *P. caducum* (E.A. Smith, 1885): campaign Miriky, stn CP3269, (E) external view of the left valve, H 21.7 mm, scale bar = 1 cm; (F) external view of the right valve, H 17.7 mm, scale bar = 1 cm (MNHN). (G–H) *P. jeffreysii* (E.A. Smith, 1885): campaign Mainbaza, stn CC3151, (G) external view of the left valve, H 17.5 mm, scale bar = 1 cm; (H) external view of the right valve, H 14.2 mm, scale bar = 1 cm (MNHN). (I–J) *P. sibogai* (Dautzenberg & Bavay, 1904): campaign Miriky, stn CP3248, (I) external view of the left valve, H 42.1 mm, scale bar = 2 cm; (J) external view of the right valve, H 41.5 mm, scale bar = 2 cm (MNHN 38099). (K–L) *P. watsoni* (E.A. Smith, 1885): campaign Miriky, stn CP3253, (K) external view of the left valve, H 44.2 mm, scale bar = 2 cm; (L) external view of the right valve, H 36.2 mm, scale bar = 2 cm (MNHN). (M–S) *P. rosadoi* sp. n., holotype: campaign Miriky, stn CP3248, (M) external view of the left valve, H 25.2 mm, scale bar = 1 cm; (N) internal view of the left valve, H 25.2 mm, scale bar = 1 cm; (O) external view of the right valve, H 20.6 mm, scale bar = 1 cm; (P) internal view of the right valve, H 20.6 mm, scale bar = 1 cm; (Q) prodissoconch of the left valve, H 25.2 mm, scale bar = 0.1 mm; (R) details of the left valve, H 25.2 mm, scale bar = 0.2 mm; (S) details of the right valve, H 20.6 mm, scale bar = 0.2 mm (MNHN IM-2000-30115).

species. *Propeamussium alcocki* could be distinguished from *P. watsoni* by having a semi-transparent thin shell (*P. watsoni* is opaque and more solid), by having a more oval shape (*P. watsoni* is almost circular), by having a smooth left valve and sometimes some commarginal lamellae in late ontogeny (*P. watsoni* has a radial sculpture in early growth stage and more prominent commarginal lamellae in later growth stage), and by having thin internal radial ribs (*P. watsoni* has more solid and broader ribs, especially on the right valve).



Genus *Parvamussium* Sacco, 1897

Parvamussium Sacco, 1897a: 102 (Proposed as a subgenus of *Amussium* Herrmannsen, 1846, an unjustified emendation of *Amusium* Röding, 1798); no diagnosis given, but type species designated; Sacco 1897b: 48 (diagnosis). Type species (OD): *Pecten (Pleuronectes) duodecimlamellatus* Bronn, 1832; Pliocene, northern Italy (Waller 2011: 25).

Remarks: For synonymy, diagnosis, distribution and discussion see Dijkstra (1995: 25).

Key to species of *Parvamussium* in the southwestern Indian Ocean

- Shell small, circular, semi-transparent, auricles nearly equal, byssal notch moderately deep, 13 internal ribs and one rudimentary 1
- 1 Shell 7.2 mm high, left valve smooth, umbonal part glossy, inequivalve, equilateral, auricles dissimilar in shape, colour whitish *P. catillus* sp. n.
- Shell small, subcircular, opaque, whitish, auricles unequal, byssal notch moderately deep, 10 internal ribs, adults also with rudimentary (1–7) 2
- 2 Shell 10 mm high, left valve slightly more convex than right valve, inequivalve, almost equilateral, auricles dissimilar in shape, lv with weak radial sculpture, rv with regularly spaced commarginal lirae *P. formosum* (Melvill in Melvill & Standen, 1907)
- Shell small, almost circular, semi-transparent, auricles unequal, lv creamy and reddish mottled, rv whitish, 10–11 prominent internal ribs, 1–5 rudimentary 3
- 3 Shell 12 mm high, lv smooth, near periphery weak commarginal sculpture, byssal notch moderately deep *P. kilburni* sp. n.
- Shell small, subcircular, opaque, whitish, auricles almost equal in size, 9–10 internal ribs 4
- 4 Shell 13 mm high, both valves flattened, lv slightly more convex than rv, inequivalve, inequilateral, lv with commarginal and radial sculpture, rv with regularly spaced slightly undulated commarginal lirae *P. puillandrei* sp. n.
- Shell small, almost circular, lv flattened, delicately radially sculptured, 9–10 internal ribs 5
- 5 Shell c. 10 mm high, lv stained and opaque, weakly radially and commarginally sculptured, rv almost smooth, whitish, 9–10 internal ribs, with a few rudimentary in some specimens *P. scitulum* (E.A. Smith, 1885)
- Shell small, subcircular, stained and opaque, lv slightly more flattened than rv, auricles unequal, internal ribs 7–10 6
- 6 Shell 9 mm high, lv with prominent radial and weak commarginal sculpture, rv with regularly spaced commarginal lamellae *P. siebenrocki* (Sturany, 1901)
- Shell small, subcircular, hyaline, glossy, white and orange stained, lv slightly more convex than rv, auricles unequal, rudimentary internal riblets laterally 7
- 7 Shell 27 mm high, lv glossy and smooth, rv with faint commarginal closely spaced growth lines, near periphery prominent *P. strongae* sp. n.
- Shell small, almost circular, opaque, whitish or creamy stained, valves almost equally convex, flattened, auricles unequal, 10 internal ribs with 1–6 rudimentary 8
- 8 Shell 8 mm high, lv with prominent commarginal sculpture in early ontogeny, radial and commarginal sculpture in late growth stage with squamae on the intersection *P. texturatum* (Dautzenberg & Bavay, 1921)

- Shell small, almost circular, lv prominent reticulate sculpture, rudimentary internal riblets.....9
- 9 Shell 5 mm high, opaque or semi-transparent, lv with 13–17 radial costae and widely spaced weaker commarginal sculpture, fine scales on intersections, auricles with prominent commarginal lamellae.....
.....*P. thyrideum* (Melvill in Melvill & Standen, 1907)
- Shell small, almost circular, lv smooth and glossy, 10 internal ribs10
- 10 Shell 10 mm high, lv opaque and whitish, lv only sculptured with delicate commarginal lamellae near ventral margin, 10 internal ribs, with a few rudimentary in some specimens.....*P. torresi* (E.A. Smith, 1885)
- Shell small, almost circular, lv coarsely sculptured with vesicles, few rudimentary internal ribs.....11
- 11 Shell 10 mm high, lv with commarginal lirae and radially arranged vesicles, few rudimentary internal ribs anteriorly and posteriorly
.....*P. vesiculatum* Dijkstra, 1995
- Shell small, almost circular, lv with latticed sculpture in late growth stage, short internal ribs.....12
- 12 Shell 7.5 mm high, opaque and whitish, lv in early growth stage with commarginal sculpture, rudimentary or short internal ribs*P. vidalense* (Barnard, 1964)

Parvamussium catillus sp. n.

Fig. 2A–G

Etymology: From the Latin *catillus* (m.) (small dish), after the smooth circular shell that resembles a small dish.

Description: Shell up to 7.2 mm in height, fragile, semi-transparent, circular, inequivalve, left valve slightly more inflated than right valve, equilateral, auricles almost equal in size, umbonal angle 110°–115°, colour whitish. Prodissoconch 100 µm long. Left valve smooth and dead throughout shell disc, umbonal part glossy and transparent. Anterior auricle with very weak and delicate widely spaced commarginal lamellae, more prominent near shell disc, posterior auricle almost smooth with traces of very closely spaced commarginal lirae laterally. Right valve with weak, regularly spaced, commarginal lirae (c. 8 per mm). Anterior auricle with weak and very fine commarginal lirae and a noduliferous ridge along the byssal fasciole, posterior auricle continuous with disc, smooth with very close-set commarginal lirae laterally. Byssal notch moderately deep, byssal fasciole rather small, no ctenolium. Hinge line straight. Resilifer triangular. Internal ribs 13 commence in early growth stage and are exposed almost to the periphery, one interstitial rudimentary riblet antero-ventrally, and one riblet on both auricles.

Dimensions (holotype): Height 7.2 mm, width 7.2 mm, convexity 2.5 mm.

Type material: Holotype (pr) (MNHN IM-2007-41966), paratype (pr) (MNHN IM-2007-41964). Type locality: MOZAMBIQUE CHANNEL: Inhambane transect (23°35'S 36°06'E), -1092–1195 m, live, campaign Mainbaza, stn CP3139, RV *Vizconde de Eza*, leg. P. Bouchet, J. Rosado & E. Strong, 11.iv.2009.

Distribution and habitat: See type locality.

Remarks: The closest resembling species is *Parvamussium multiliratum* Dijkstra, 1995, recorded from New Caledonia, Vanuatu, Fiji, Tonga, Wallis and Futuna (Dijkstra & Maestrati 2012: 392). *Parvamussium catillus* morphologically differs from *P. mul-*

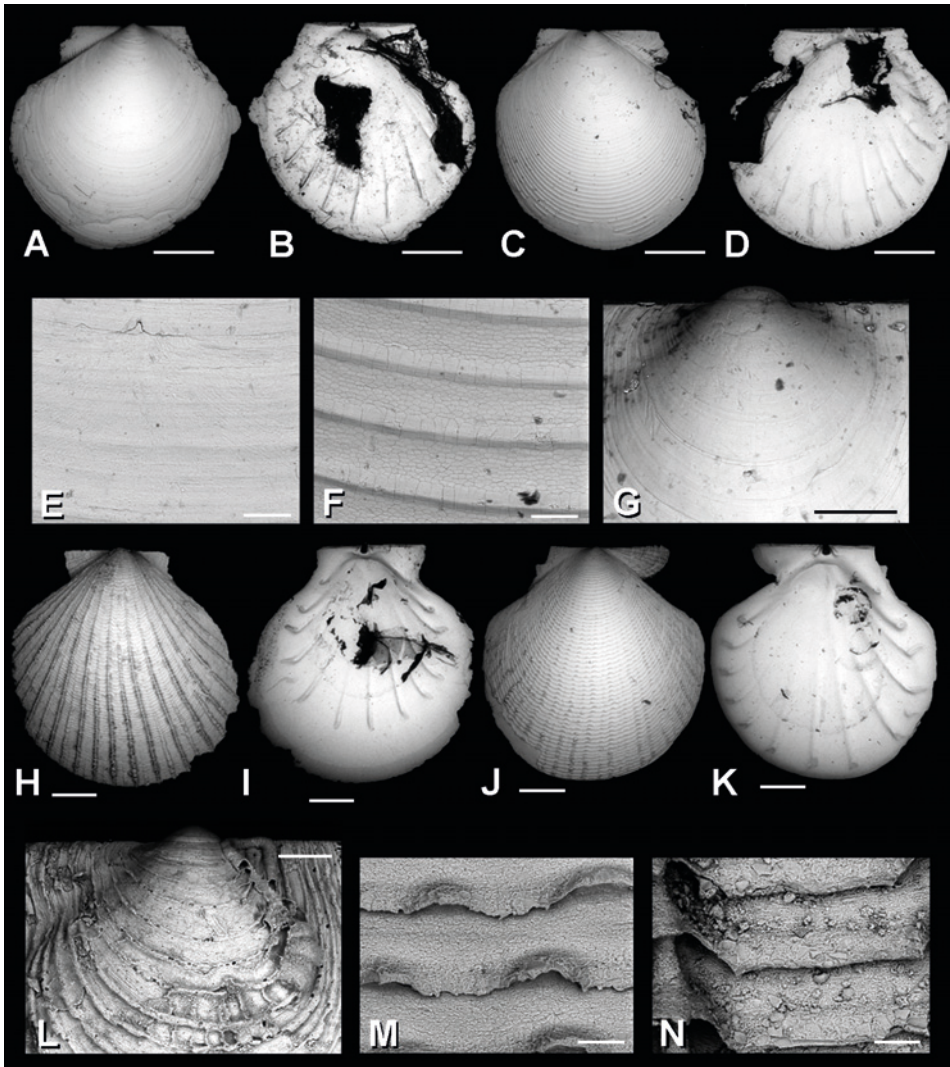


Fig. 2. *Parvamussium* spp.: (A–G) *P. catillus* sp. n., holotype: campaign Mainbaza, stn CP3139, (A) external view of the left valve, H = 7.2 mm, scale bar = 2 mm; (B) internal view of the left valve, H = 7.2 mm, scale bar = 2 mm; (C) external view of the right valve, H = 7.2 mm, scale bar = 2 mm; (D) internal view of the right valve, H = 7.2 mm, scale bar = 2 mm; (E) details of the left valve, H = 7.2 mm, scale bar = 0.1 mm; (F) details of the right valve, H = 7.2 mm, scale bar = 0.1 mm; (G) prodissoconch of the left valve, H = 7.2 mm, scale bar = 0.2 mm (MNHN 41966). (H–N) *P. puillandrei* sp. n., holotype: campaign Miriky, stn DW3200, (H) external view of the left valve, H = 12.4 mm, scale bar = 0.2 mm; (I) internal view of the left valve, H = 12.4 mm, scale bar = 0.2 mm; (J) external view of the right valve, H = 10 mm, scale bar = 0.2 mm; (K) internal view of the right valve, H = 10 mm, scale bar = 0.2 mm; (L) prodissoconch of the left valve, H = 12.4 mm, scale bar = 0.2 mm; (M) details of the right valve, H = 10 mm, scale bar = 0.1 mm; (N) details of the left valve, H = 10 mm, scale bar = 0.1 mm (MNHN 39021).

tiliratum by a smooth shell disc of the left valve (*P. multiliratum* with prominent commarginal lamellae and weak radial sculpture postero-laterally), by having fewer interior ribs (*P. multiliratum* 14 and two rudimentary).

Another somewhat resembling species is *Propeamusium arabicum* Dijkstra & Janssen, 2013, recorded from the Gulf of Aden and herein also from northwestern Madagascar and the Mozambique Channel. This species is also circular in shape, but larger sized (up to 14.9 mm in height, *P. catillus* up to 7.2 mm) and has a fine reticular sculpture on the left valve (*P. catillus* smooth). Moreover, fewer internal ribs (7 without rudimentary, *P. catillus* 13 and one rudimentary).

Parvamusium formosum (Melvill in Melvill & Standen, 1907)

Fig. 3A–B, J–K

Amusium formosum Melvill in Melvill & Standen, 1907: 807, pl. 55, figs 7, 7a. Type locality: Persian Gulf, Gulf of Oman (24°58'N 56°54'E), -285 m, dead, leg. F. W. Townsend.

Propeamusium sp. cf. *scitulum* (Smith): Oliver 1992: 70, text-fig. 5, 73, pl. 12, fig. 4 [not *Amusium scitulum* E.A. Smith, 1885].

Parvamusium formosum: Dijkstra & Knudsen 1998: 45, pl. 2, figs 5–8; Dijkstra & Janssen 2013: 191, figs 20–22, 39.

Description: Shell up to 10 mm in height, fragile, semi-transparent, subcircular, somewhat higher than wide, inequivalve, left valve slightly more convex than right valve, equilateral, auricles unequal, umbonal angle 100°–105°, colour whitish. Prodissoconch 120 µm long. Left valve almost smooth (central part of shell disc) or weakly sculptured with numerous, irregularly spaced, fine radial riblets, somewhat more prominent laterally, sometimes with very weak, closely spaced, commarginal lamellae near periphery or on radial riblets. Anterior auricle larger than posterior and sculptured with fine, close-set antimarginal and commarginal lamellae, posterior auricle nearly smooth or sculptured with very weak antimarginal lirae. Right valve with very weak, regularly spaced, commarginal lirae. Anterior auricle fine commarginally or reticulate sculptured, posterior auricle smooth or with very fine commarginal lirae. Byssal notch moderately deep, byssal fasciole rather small, no ctenolium. Hinge line straight. Resilifer triangular. Internal ribs usually 10 (sometimes with 1–7 rudimentary interstitial riblets in adult specimens) and 1 anterior and 2 posterior auricular riblets. Internal ribs commencing in late growth stage and extending to the submarginal area. Internal posteriorly placed ribs on left valve somewhat oblique.

Type material examined: Two syntypes (rv) NHMUK 1907.5.3.50, 26 syntypes (v) NMW 1955.158.674. Several syntypes deposited in other museums (Dijkstra, personal observation).

Other material examined: NW MADAGASCAR: West of Cap d' Ambre (12°08'S 48°56'E), -238–249 m, dead, campaign Miriky, stn DW3196, 28.vi.2009 (MNHN); west of Cap d' Ambre (12°07'S 48°58'E), -362–431 m, dead, campaign Miriky, stn DW3197, 28.vi.2009 (MNHN); between Nosy-Bé and Banc du Leven (12°55'S 48°11'E), -260–319 m, live, campaign Miriky, stn DW3228, 02.vii.2009 (MNHN); between Majunga and Cap Saint-André (15°35'S 45°43'E), -177–199 m, dead, campaign Miriky, stn DW3259, 10.vii.2009 (MNHN). S MADAGASCAR: Between Lokaro and Sainte Luce (24°53'S 47°28'E), -184–203 m, dead, expedition Atimo Vatae, stn DW3515, 30.iv.2010 (MNHN); Manantenina (24°23'S 47°31'E), -200–220 m, dead, expedition Atimo Vatae, stn DW3523, 01.v.2010 (MNHN); Manantenina (24°23'S 47°32'E), -395–407 m, dead, expedition Atimo Vatae, stn DW3525, 01.v.2010 (MNHN); S of Faux Cap (26°07'S 45°39'E), -264–280 m, dead, expedition Atimo Vatae, stn DW3552, 05.v.2010 (MNHN); S of Faux Cap (26°09'S 45°40'E), -455–458 m, dead, expedition Atimo Vatae, stn DW3555, 05.v.2010 (MNHN); E of Faux Cap (25°38'S 46°13'E), -128–133 m, dead, expedition Atimo Vatae, stn CP3561, 06.v.2010 (MNHN); E of Faux Cap (25°37'S 46°18'E), -347–355 m, dead, expedition Atimo Vatae, stn DW3563, 06.v.2010 (MNHN); E of Faux Cap (25°37'S 46°20'E), -433–456 m, dead, expedition Atimo Vatae, stn DW3564, 06.v.2010 (MNHN); E of Faux Cap (25°36'S 46°21'E), -618–624 m, dead, expedition Atimo Vatae, stn DW3565, 06.v.2010 (MNHN); E of Faux Cap (25°37'S 46°21'E), -618–624 m, dead, expedition Atimo Vatae, stn CP3566, 06.v.2010 (MNHN); S Pointe Barrow (25°30'S 44°16'E), -209–229 m, dead, expedition Atimo Vatae, stn DW3581, 10.v.2010 (MNHN); SE Pointe Barrow (25°28'S 44°25'E), -203–210 m, dead, expedition Atimo Vatae, stn CP3584,

10.v.2010 (MNHN); S Cap Sainte Marie (26°13'S 45°08'E), -225–282 m, dead, expedition Atimo Vatae, stn CP3613, 14.v.2010 (MNHN); S Cap Sainte Marie (26°13'S 45°08'E), -250–300 m, dead, expedition Atimo Vatae, stn CP3614, 14.v.2010 (MNHN); S Cap Sainte Marie (26°14'S 45°09'E), -284–286 m, dead, expedition Atimo Vatae, stn CP3615, 14.v.2010 (MNHN); SE Faux Cap (25°47'S 46°02'E), -133–178 m, dead, expedition Atimo Vatae, stn CP3620, 15.v.2010 (MNHN). MOZAMBIQUE CHANNEL: Inhambane transect (23°59'S 35°39'E), -206–210 m, live, campaign Mainbaza, stn CC3160, 15.iv.2009 (MNHN). SOUTH AFRICA: *KwaZulu-Natal*: Off Durban (29°53.4'S 31°11.2'E), -270 m, dead, very fine sand, solitary corals, NMDP stn XX16, dredged RV *Meiring Naudé*, 15.vi.1983.

Distribution and habitat: Red Sea, Gulf of Aden, Arabian Gulf and Persian Gulf. Now also extended southwards to the Mozambique Channel, northwestern and southern Madagascar and South Africa (new record). Living bathyally on soft substrata (mixed sediments of mud and sand). Present specimens live at -260–319 m.

Remarks: The present specimens from northwestern and southern Madagascar and South Africa are almost identical to the type material. The present specimens are slightly different in having a more coarse commarginal sculpture on the anterior auricle of the left valve (typically more delicate and closer spaced), and in having in a few specimens faint commarginal sculpture on the central disc shell of the left valve (in typical specimens lacking), but other morphological characters are similar.

Smooth juvenile specimens of *P. formosum* and *P. siebenrocki* could be easily confused, although the latter species has more prominent radial and wider spaced commarginal sculpture laterally and on the auricles.

A closely resembling species is *Parvamussium thetidis* (Hedley, 1902), recorded from tropical eastern Australia, the Coral Sea as far east as the New Hebrides Archipelago. This species is living bathyally deeper at -500–650 m (Dijkstra 1995: 35). *Parvamussium thetidis* has a delicate radial and commarginal sculpture on the left valve (*P. formosum* almost lacks commarginal sculpture), although the radial riblets are more prominently developed and the commarginal lamellae more closely spaced throughout the shell disc, and fewer internal ribs (*P. formosum* 10 + 1–7 rudimentary, *P. thetidis* 10 + sometimes one rudimentary).

Parvamussium kilburni sp. n.

Fig. 3C–I

Etymology: After the late Dr Richard (Dick) Neil Kilburn, formerly Head of the Department of Mollusca at the KwaZulu-Natal Museum, Pietermaritzburg, South Africa.

Description: Shell up to 12 mm in height, fragile, semi-transparent, subcircular, somewhat higher than wide, inequivalve, left valve slightly more convex than right valve, equilateral, auricles unequal, umbonal angle 100°–105°, colour of left valve creamy and reddish mottled, right valve transparent whitish. Prodissoconch 170 µm long. Left valve smooth on central part of shell disc, umbonal part glossy, sculptured with very closely spaced (c. 15 per mm) fine commarginal lamellae near ventral margin, very weak and fine radial sculpture postero-laterally, in most specimens lacking. Anterior auricle larger than posterior and sculptured with fine, close-set commarginal lamellae, posterior auricle smooth or very weakly sculptured with antimarginal lirae. Right valve with very weak, regularly spaced, commarginal lirae (c. 10 per mm). Anterior auricle with fine antimarginal lirae and very weak commarginal lirae near dorsal margin, posterior auricle with very fine and close-set commarginal lirae. Byssal notch moderately deep,

byssal fasciole rather small, no ctenolium. Hinge line straight. Resilifer triangular. Internal prominent ribs 10 or 11, in adult specimens with 1–5 rudimentary interstitial riblets near ventral margin and one auricular riblet anteriorly and posteriorly. Internal ribs commencing in early growth stage, extending to marginal area.

Dimensions (holotype): Height 11 mm, width 10 mm (part of margin broken off), convexity 2.2 mm.

Type material: Holotype (pr) NMSA D7689. Type locality: SOUTH AFRICA: *Zululand*: Off Dog Point (27°07.0'S 32°54.1'E), -250 m, live, medium sand, NMDP stn ZC7, dredged RV *Meiring Naudé*, 04.vi.1987.

Paratypes: SOUTH AFRICA: *Zululand*: Off Dog Point (27°07.0'S 32°54.1'E), -250 m, live, medium sand, NMDP stn ZC7, dredged RV *Meiring Naudé*, 04.vi.1987 (NMSA D7689, 2 lv); Off Dog Point (27°07.3'S 32°53.6'E), -200 m, live, fine sand, NMDP stn ZC6, dredged RV *Meiring Naudé*, 04.vi.1987 (NMSA D7773, 2 pr, 3 lv, 2 rv); NE of du Leven Point (27°54.8'S 32°38.5'E), -170 m, dead, sandstone rubble, coarse sand, NMDP stn ZL4, dredged RV *Meiring Naudé*, 09.vi.1988 (NMSA E3705, 3 lv, 2 rv); Off Cape Vidal (28°08.4'S 32°36.4'E), -165 m, dead, moderately fine sand, NMDP stn ZM8, dredged RV *Meiring Naudé*, 11.vi.1988 (NMSA E3789, 3 lv, 15 rv); Off Mission Rocks (28°17.4'S 32°34.6'E), -198 m, dead, medium sand, NMDP stn ZN6, dredged RV *Meiring Naudé*, 11.vi.1988 (NMSA E4757, 5 lv, 5 rv); SE of Neill Peak

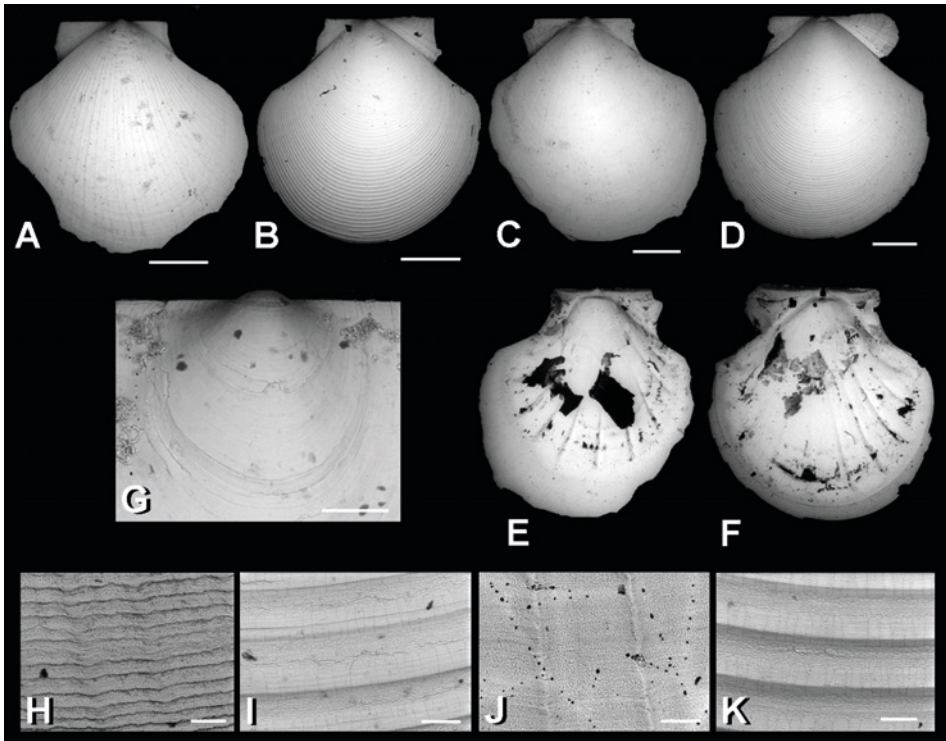


Fig. 3. *Parvamussium* spp.: (A, B, J, K) *P. formosum* (Melvill in Melvill & Standen, 1907): campaign Miriky, stn CP3228, (A) external view of the left valve, H = 9 mm, scale bar = 2 mm; (B) external view of the right valve, H = 7.8 mm, scale bar = 2 mm; (J) details of the left valve, campaign Miriky, stn CP3228, H = 9 mm, scale bar = 0.1 mm; (K) details of the right valve, H = 7.8 mm, scale bar = 0.1 mm (MNHN). (C–I) *P. kilburni* sp. n., holotype: N. Zululand, off Dog Point, (C) external view of the left valve, H = 10.5 mm, scale bar = 2 mm; (D) external view of the right valve, H = 9.1 mm, scale bar = 2 mm; (E) internal view of the left valve, H = 10.5 mm, scale bar = 2 mm; (F) internal view of the right valve, H = 9.1 mm, scale bar = 2 mm; (G) prodissoconch of the left valve, H = 10.5 mm, scale bar = 0.2 mm; (H) details of the left valve, H = 10.5 mm, scale bar = 0.1 mm; (I) details of the right valve, N. Zululand, off Dog Point, H = 10.5 mm, scale bar = 0.1 mm (NMSA D7689).

(Cunge) (28°44.2'S 32°23.0'E), -260–280 m, dead, muddy sand, NMDP stn ZP4, dredged RV *Meiring Naudé*, 12.vi.1988 (NMSA E4084, 1 lv); *KwaZulu-Natal*: Off Durban (29°53.2'S 31°11.2'E), -165 m, dead, fine muddy sand, corals, NMDP stn XX14, dredged RV *Meiring Naudé*, 16.vi.1983 (NMSA B5895, 1 lv); Off Umlaas Canal (30°02.2'S 31°03.1'E), -200 m, dead, coarse sand, NMDP stn XX69, dredged RV v, 09.vii.1985 (NMSA D882, 1 lv); Off Umlaas Canal (30°02.2'S 31°03.9'E), -250 m, dead, coarse sand, NMDP stn XX68, dredged RV *Meiring Naudé*, 09.vii.1985 (NMSA D936, 10 lv, 9 rv); Off Amanzimtoti (30°04.7'S 31°03.3'E), -300–305 m, dead, medium sand, NMDP stn XX66, dredged RV v, 09.vii.1985 (NMSA D1302, 1 lv, 6 rv); Off Amanzimtoti (30°05.3'S 31°02.5'E), -260–270 m, dead, medium sand, NMDP stn XX65, dredged RV *Meiring Naudé*, 09.vii.1985 (NMSA D1173, 8 lv, 7 rv); Off Amanzimtoti (30°05.6'S 31°00.6'E), -180 m, dead, medium sand, NMDP stn XX63, dredged RV *Meiring Naudé*, 09.vii.1985 (NMSA D1233, 5 lv, 4 rv); *Transkei*: Off Mgazi River (31°44.3'S 29°32.2'E), -250 m, dead, muddy sand, dredged, 04.vii.1985 (RV *Meiring Naudé*, stn J11) (NMSA C8924, 1 lv); Off Whale Rock (32°00.9'S 29°21.8'E), -400–420 m, dead, coarse sand, old shell debris, stones, dredged, 20.vii.1982 (RV *Meiring Naudé*, stn M7) (NMSA C2063, 2 lv, 2 rv); Off Mbashe River (32°21.2'S 29°01.4'E), -295–300 m, dead, old shell rubble, NMDP stn Q15, dredged RV *Meiring Naudé*, 06.vii.1985 (NMSA C8984, 1 lv).

Distribution and habitat: South Africa, from Zululand southwards to Transkei (27°S–32°S), living upper bathyally on sandy bottoms at -200–250 m.

Remarks: The closest resembling species is *Parvamussium virgatum* Dijkstra, 1991, recorded from Indonesia, Solomon Islands and Wallis and Futuna (Dijkstra & Maestrati 2008: 97). *Parvamussium kilburni* differs morphologically from *P. virgatum* by a smooth or very weakly commarginal sculptured disc shell of the left valve (*P. virgatum* with fine radial sculpture), by having more prominent developed interior ribs, commencing earlier and extending to the periphery (*P. virgatum* with finer, commencing in late growth stage and extending to the submarginal area).

Another closely resembling species is *Parvamussium formosum* (Melvill in Melvill & Standen, 1907), recorded from the northwestern Indian Ocean. This species has prominent radial and commarginal sculpture commencing in early growth stage on the left valve (*P. kilburni* lacks radial sculpture and has a commarginal sculpture only developed marginally in late ontogeny). *Parvamussium formosum* has also more prominent interior ribs with more interstitial rudimentary riblets (up to 7) in adult specimens.

Parvamussium puillandrei sp. n.

Fig. 2H–N

Etymology: After Dr Nicolas Puillandre, Assistant Professor at the MNHN and participant in the present campaign.

Description: Shell up to 12.9 mm in height, fragile, inequivalve, inequilateral, somewhat higher than wide, left valve slightly more inflated than right valve, whitish, auricles almost equal in size, relatively small, umbonal angle *c.* 90°. Prodissoconch 210 µm long. Left valve with prominent commarginal lamellae, commencing *c.* 0.5 mm below the umbonal top and covering the shell disc (*c.* 6–7 per mm on central part of disc) towards the ventral margin, crossing *c.* 10–15 irregularly spaced radial costae in early growth stage, commencing *c.* 2 mm below the umbonal top, increasing by interstitial secondary radial riblets towards the ventral margin to *c.* 30 in number. Auricles with closely spaced commarginal lamellae, which is somewhat more prominent on the anterior auricle. Hinge line straight. Right valve with regularly spaced slightly undulated commarginal lirae, weak in early ontogeny, more prominent laterally, covered with radially arranged fine vesicular sculpture. Anterior auricle well developed, sculptured with 6–7 fine radial riblets, covered with commarginal lamellae, which are strongly developed on antero-dorsal margin.

Posterior auricle covered with commarginal lamellae, which are more prominent on postero-dorsal margin. Marginal apron broken off in all specimens seen. Internal lirae 10, 3 of them rudimentary, plus 1 small posterior auricular lira on the left valve; 9 lirae plus 3 rudimentary, and 1 posterior auricular lira on right valve. Lirae commencing in early growth stage and enlarging towards the submarginal area (*c.* 3 mm from the periphery). Exterior sculpture of left valve slightly visible from the interior. Outer ligament small. Resilifer triangular. Byssal notch small. Fasciolar pseudo-ctenolium lacking.

Dimensions: Holotype: Height 12.9 mm, width 12.3 mm, convexity 3.0 mm.

Type material: Holotype, pr (MNHN IM-2007-39021), paratypes (MNHN IM-2007-39051, 1 pr; MNHN IM-2007-39296, 1 pr; MNHN IM-2000-30116, 2 lv). Type locality: NW MADAGASCAR: West of Cap d'Ambre (12°06'S 48°54'E), -560–653 m, live, campaign Miriky, stn DW3200, 28.vi.2009.

Other material examined: S MADAGASCAR: Manantenina (24°24'S 47°33'E), -424–438 m, dead, expedition Atimo Vatae, stn DW3528, RV *Nosy Bé II*, 01.v.2010 (MNHN, 2 lv); E of Faux Cap (25°37'S 46°20'E), -433–456 m, live, expedition Atimo Vatae, stn DW3564, RV *Nosy Bé II*, 06.v.2010 (MNHN, 21 pr, 1 lv); E of Faux Cap (25°36'S 46°21'E), -618–624 m, dead, expedition Atimo Vatae, stn DW3565, RV *Nosy Bé II*, 06.v.2010 (MNHN, 1 lv); E of Faux Cap (25°37'S 46°21'E), -618–624 m, dead, expedition Atimo Vatae, stn CP3566, RV *Nosy Bé II*, 06.v.2010 (MNHN, 1 rv); S Pointe Barrow (25°32'S 44°16'E), -549–576 m, live, expedition Atimo Vatae, stn CP3585, RV *Nosy Bé II*, 10.v.2010 (MNHN, 1 pr, 5 lv, 7 rv).

Distribution and habitat: To date northwestern and southern Madagascar. Living bathyally on soft substrata of mud and sand at a minimum depth range of -456–560 m.

Remarks: The only closely resembling congeneric species from the Indo-Pacific is *Parvamussium undisonum* Dijkstra, 1995, recorded from the southwestern Pacific (Dijkstra & Maestrati 2008: 96), live at -431–710 m. However, *P. puillandrei* differs morphologically from *P. undisonum* in having a more closely spaced commarginal sculpture (*P. puillandrei* 6–7 per mm, *P. undisonum* 5 per mm in the central shell disc) on both valves, in having more and stronger developed radial ribs on the left valve (*P. puillandrei* up to *c.* 20, *P. undisonum* up to *c.* 15) and more interstitial secondary radial riblets, in having a broader groove between the disc and the anterior auricle of the right valve (*P. undisonum* narrow), in lacking a pseudo-ctenolium (which is present in adult *P. undisonum*), and in having earlier developed internal ribs (internal ribs in *P. undisonum* commence in a later growth stage near the adductor insertion scar).

The pseudo-ctenolium, an unusual character in Propeamussiidae, is discussed by Waller (1984: 213, figs 5a–b) in *Parvamussium sayanum* (Dall, 1886), known from the tropical western Atlantic, and this feature is also observed in adult specimens of *P. undisonum*, lacking in the present species.

Parvamussium scitulum (E.A. Smith, 1885)

Fig. 4A–C

Amussium scitulum Smith, 1885: 312, pl. 23 figs 4–4b. Type locality: S of New Guinea (9°59'S 139°42'E), -51 m, dead, green mud, 10.ix.1874 (*Challenger*, stn 188).

Amusium (*Propeamussium*) [sic] *scitulum* var.? *cmadoritinctum* Kuroda, (1929–35) 1931: 77, figs 81–82. Type locality: Japan, Kyushu, Kagoshima Prefecture, Yakushima Island.

Parvamussium scitulum: Dijkstra 2011: 42, pl. 1016 figs 5, 6, 7, 8a–b; 2013: 21, pl. 3, figs 2a–d, pl. 4, fig. 10; Dijkstra & Maestrati 2012: 393; 2013b: 474; Dijkstra & Janssen 2013: 192, figs 40–42.

Description: Shell fragile, up to 12 mm in height, subcircular, inequivalve, inequilateral, right valve more convex than left, auricles rather small and unequal, umbonal angle 115°–120°. Colour of left valve stained, opaque, right valve dull or semi-transparent whitish. Prodissoconch 200 µm long. Left valve very weakly inflated, weakly sculptured

with delicate, variable radial striations, somewhat stronger near posterior margin than elsewhere. Microscopic close-set commarginal striae developed on disc of some specimens, somewhat more widely spaced near umbonal area. Anterior auricle with prominent commarginal lamellae close to flank of disc, decreasing in prominence or absent near antero-dorsal margin; posterior auricle with fine radial and commarginal striations, almost absent from some specimens. Right valve either smooth or weakly sculptured with a few growth lines. Internal riblets extending to submarginal area, 9 or 10 in most specimens, some specimens with 1 or 2 rudimentary interstitial riblets. Resilifer triangular. Hinge line straight. Byssal notch narrow.

Type material examined: *Amusium scitulum*: Lectotype (lv) NHMUK 1887.2.9.3319/1; 6 paralectotypes (v) NHMUK 1887.2.9.3319/2-7, designated by Dijkstra (1995: 31, figs 153–154).

Amusium scitulum emadoritinctum: Kikuchi Shell Museum, Kuroda collection. [not examined]

Other material examined: NW MADAGASCAR: West of Nosy-Bé (13°25'S 47°57'E), -71–158 m, dead, campaign Miriky, stn DW3230, 03.vii.2009 (MNHN); In front of Mahajamba Bay (14°53'S 46°56'E), -90–257 m, live, campaign Miriky, stn DW3245, 07.vii.2009 (MNHN). S MADAGASCAR: Manantenina (24°23'S 47°31'E), -200–220 m, dead, expedition Atimo Vatae, stn DW3523, RV *Nosy Bé II*, 01.v.2010 (MNHN); Sainte Luce (24°43'S 47°32'E), -296–307 m, dead, expedition Atimo Vatae, stn DW3534, RV *Nosy Bé II*, 02.v.2010 (MNHN); S of Faux Cap (26°03.2'S 45°32.1'E), -98 m, dead, expedition Atimo Vatae, stn DW3550, RV *Nosy Bé II*, 05.v.2010 (MNHN); Fort-Dauphin (25°13.5'S 47°13.8'E), -87–88 m, dead, expedition Atimo Vatae, stn CP3573, RV *Nosy Bé II*, 08.v.2010 (MNHN); SW Pointe Barrow (25°03'S 44°00'E), -113–135 m, dead, expedition Atimo Vatae, stn DW3588, RV *Nosy Bé II*, 11.v.2010 (MNHN). MOZAMBIQUE CHANNEL: Maputo transect (25°53'S 33°07'E), -112–127 m, live, campaign Mainbaza, stn CP3130, 09.iv.2009 (MNHN). MOZAMBIQUE: Inhaca Island: N of the Channel (26°03.1'S 33°01'E), -50–53 m, live, expedition Inhaca 2011, stn MD13 (= MD14), 30.xi.2011 (MNHN); in front of Ponta Malengane (26°03.6'S 33°01.8'E), -75 m, dead, expedition Inhaca 2011, stn MD26, 05.xii.2011 (MNHN); in front of Ponta Malengane (26°03.6'S 33°03.8'E), -130 m, dead, expedition Inhaca 2011, stn MD27, 05.xii.2011 (MNHN); North Baixo Danae (25°50.9'S 33°03.1'E), -50–53 m, dead, expedition Inhaca 2011, stn MD34, 08.xii.2011 (MNHN). Maputo: offshore (25°55'S 33°07'E), -140–160 m, dead, s/n, dredge, leg. J. Rosado, xi.2011 (MNHN). SOUTH AFRICA: Zululand: Off Gipsy Hill (27°47.4'S 32°38.9'E), -65–70 m, live, broken shell, NMDP stn ZK3, dredged RV *Meiring Naudé*, 08.vi.1988 (NMSA E3656).

Distribution and habitat: Southern Japan southwards to Australia, eastwards to the Austral Islands (Dijkstra 2013: 22), and now also westwards into the Indian Ocean from the Mozambique Channel, northwestern and southern Madagascar and northeastern South Africa (new record). Living free sublittorally and upper bathyally (Dijkstra & Maestrati 2012: 393) on soft substrata (mixed sediments of sand, muddy sand or mud with coral rubble or gravel). Present specimens live at -53–112 m (minimum depth range).

Remarks: Kuroda (1929–1935: 77) described a possible new variation of the present species from Japan, which is more brightly coloured and much larger in size than the type material of *Parvamussium scitulum*. Smith (1885: 312) already suggested that the type specimens from Papua New Guinea are possible juveniles.

The present specimens from northwestern and southern Madagascar and the Mozambique Channel are indeed larger in size (up to 9 mm in height, typically 4.5 mm), more colourful (typically whitish), and some specimens have one more internal rib, but other morphological characters are identical to the type material.

Parvamussium siebenrocki (Sturany, 1901)

Fig. 4D–F

Amusium siebenrocki Sturany, 1901: 269, pl. 4, figs 5–8. Type locality: Red Sea, near Shadwan Island (27°25'N 34°30'E), -1082 m, yellowish muddy sand, 02.iv.1896 (*Pola I*, stn 72).

Propeamussium (Parvamussium) siebenrocki: Oliver 1992: 70, 73, pl. 12, figs 3a–3b, text-figs 7a–b.

Parvamussium siebenrocki: Bosch, Dance, Moolenbeek & Oliver 1995: 232, fig. 1011; Dijkstra & Knudsen 1998: 46, pl. 1, figs 1–4; Dijkstra & Janssen 2013: 194, figs 23–25, 36–37, 43–45.

Description: Shell up to 9.1 mm in height, fragile, subcircular, inequivalve, nearly equilateral, right valve slightly more convex than left valve, auricles unequal, umbonal angle 110°, colour of left valve creamy with milky-white, orange or brown dots, right valve more uniformly whitish. Prodissoconch 200 µm long. Left valve sculptured with irregularly spaced and developed radial riblets and weak commarginal lamellae (most specimens), also almost smooth, lacking commarginal and most of radial sculpture in central disc area and rudimentary laterally (some specimens). Preradial stage only with fine commarginal lamellae. Anterior auricle with fine commarginal lamellae, posterior same sculpture, but more delicate. Right valve with regularly spaced commarginal lamellae. Anterior auricle with some small radial riblets near the byssal fasciole, and commarginal lamellae, prominent near dorsal margin. Posterior auricle only sculptured with commarginal lamellae. Internal ribs 7–10 (usually 9–10), sometimes with a few rudimentary interstitial riblets.

Type material examined: Lectotype (pr) NHMW 84.355, selected by Dijkstra & Janssen (2013: 194, pl. 4, figs 5–8); paralectotypes, NHMW 84.177.

Other material examined: NW MADAGASCAR: West of Cap d'Ambre (12°08'S 48°56'E), -238–249 m, dead, campaign Miriky, stn DW3196, 28.vi.2009 (MNHN). S MADAGASCAR: Between Lokaro and Sainte Luce (24°53'S 47°28'E), -184–203 m, dead, expedition Atimo Vatae, stn DW3515, 30.iv.2010 (MNHN); Manantenina (24°23'S 47°32'E), -154–168 m, dead, expedition Atimo Vatae, stn DW3522, 01.v.2010 (MNHN); Manantenina (24°23'S 47°31'E), -200–220 m, dead, expedition Atimo Vatae, stn DW3523, 01.v.2010 (MNHN); Manantenina (24°23'S 47°32'E), -307–319 m, dead, expedition Atimo Vatae, stn DW3524, 01.v.2010 (MNHN); Sainte Luce (24°43'S 47°32'E), -296–307 m, dead, expedition Atimo Vatae, stn DW3534, 02.v.2010 (MNHN); S Pointe Barrow (25°30'S 44°16'E), -209–229 m, dead, expedition Atimo Vatae, stn DW3581, 10.v.2010 (MNHN); S Pointe Barrow (25°31'S 44°16'E), -296–302 m, dead, expedition Atimo Vatae, stn CP3583, 10.v.2010 (MNHN); SE Pointe Barrow (25°28'S 44°25'E), -203–210 m, dead, expedition Atimo Vatae, stn CP3584, 10.v.2010 (MNHN); SE Pointe Barrow (25°03'S 44°00'E), -113–135 m, dead, expedition Atimo Vatae, stn DW3588, 11.v.2010 (MNHN); SW Pointe Barrow (25°03'S 44°00'E), -132–153 m, dead, expedition Atimo Vatae, stn CP3589, 11.v.2010 (MNHN); Lavanono (25°45'S 44°29'E), -122–123 m, dead, expedition Atimo Vatae, stn DW3599, 12.v.2010 (MNHN); S Cap Sainte Marie (26°13'S 45°08'E), -250–300 m, dead, expedition Atimo Vatae, stn CP3614, 14.v.2010 (MNHN). MOZAMBIQUE CHANNEL: Inhambane transect (23°59'S 35°39'E), -206–210 m, live, campaign Mainbaza, stn CC3160, 15.iv.2009 (MNHN); Maputo transect (25°53'S 33°07'E), -112–127 m, dead, campaign Mainbaza, stn CP3130, 09.iv.2009 (MNHN); Maputo transect (25°11'S 35°02'E), -101–102 m, dead, campaign Mainbaza, stn CP3132, 10.iv.2009 (MNHN); Maputo transect (25°11'S 35°10'E), -200–201 m, dead, campaign Mainbaza, stn CP3133, 10.iv.2009 (MNHN); Maputo transect (23°33'S 35°41'E), -171–180 m, dead, campaign Mainbaza, stn CP3144, 11.iv.2009 (MNHN); Zambeze transect (19°31'S 36°46'E), -261–264 m, live, campaign Mainbaza, stn CC3150, 13.iv.2009 (MNHN); Zambeze transect (19°34'S 36°45'E), -352–357 m, dead, campaign Mainbaza, stn CC3151, 13.iv.2009 (MNHN); Inhambane transect (23°55'S 35°37'E), -148–152 m, live, campaign Mainbaza, stn CC3159, 15.iv.2009 (MNHN). MOZAMBIQUE: Inhaca Island: In front of Ponta Malengane (26°03.6'S 33°03.8'E), -130 m, dead, expedition Inhaca 2011, stn MD27, 05.xii.2011 (MNHN); NE Ponta do Farol (25°54.8'S 33°06.6'E), -145 m, live, expedition Inhaca 2011, stn MD28, 05.xii.2011 (MNHN); SW Ilha dos Portugueses (25°59.7'S 32°54.2'E), -8 m, dead, expedition Inhaca 2011, stn MS12, 05.xii.2011 (MNHN). SOUTH AFRICA: Zululand: Off du Leven Point (27°55.0'S 32°38.8'E), -250 m, dead, NMDP stn ZL5, dredged RV *Meiring Naudé*, 09.vi.1988 (NMSA E3564 and S9362); SE of Neill Peak (Cunge) (28°43.0'S 32°21.7'E), -110–115 m, dead, mud, stones, NMDP stn ZP2, dredged RV *Meiring Naudé*, 12.vi.1988 (NMSA E3813). KwaZulu-Natal: SE of Sheffield Beach (29°30.3'S 31°45.7'E), -100–105 m, dead, glutinous grey mud, NMDP stn XX139, dredged RV *Meiring Naudé*, 14.vi.1988 (NMSA E5057); Off Tongaat Bluff (29°43.8'S 31°26.7'E), -240 m, dead, fine, soft mud, NMDP stn ZV1, dredged RV *Meiring Naudé*, 20.vi.1989 (NMSA E9907); Off Durban (29°53.2'S 31°11.2'E), -165 m, dead, fine muddy sand, corals, NMDP stn XX14, dredged RV *Meiring Naudé*, 16.vi.1983 (NMSA B5895). KwaZulu-Natal: Off Umlaas Canal (30°00.8'S 31°02.6'E), -100 m, dead, coarse sand, NMDP stn XX73, dredged RV *Meiring Naudé*, 10.vii.1985 (NMSA D1207); KwaZulu-Natal: Off Port Edward (31°06.4'S 30°18.0'E), -125 m, dead, living sponges, NMDP stn XX58, dredged RV *Meiring Naudé*, 08.vii.1985 (NMSA D917). Off Amanzimtoti (30°05.0'S 31°00.4'E), -100 m, dead, medium sand, NMDP stn XX60, dredged RV *Meiring*

Naudé, 08.vii.1985 (NMSA D1472); Off Park Rynie, -136 m, dead, sponge rubble, dredged by R. Kilburn, 05.iii.1981 (NMSA B3891); Off Park Rynie, -100 m, dead, sand, sponge rubble, dredged by R. Kilburn, 04.iii.1981 (NMSA B3574); Off Park Rynie, -110–130 m, dead, eroded shell & conglomerate, dredged by R. Kilburn, 02.iii.1981 (NMSA B3563); Off Umzinto (30°21.6'S 30°51.0'E), -84 m, dead, NMDP stn X2, dredged RV *Meiring Naudé*, 15.vii.1982 (NMSA E103). *Transkei*: between Mtamvuna and Mzamba River (31°05.6'S 30°18.6'E), -100 m, dead, large living sponges, rubble, NMDP stn XX6, dredged RV *Meiring Naudé*, 15.vi.1983 (NMSA C5436). *Transkei*: Off Port Grosvenor (29°57.6'S 31°26.2'E), -100–115 m, dead, sand, some mud, solitary coral, shells, NMDP stn D3, dredged RV *Meiring Naudé*, viii.1981 (NMSA C1347). *Transkei*: Off Port Grosvenor (31°25.6'S 29°58.0'E), -95–100 m, dead, coarse sand, very few gorgonians, NMDP stn D12, dredged RV *Meiring Naudé*, viii.1981 (NMSA C588); Off Whale Rock (31°58.8'S 29°16.8'E), -90 m, dead, sponge rubble, coarse sand, some rocks, NMDP stn M12, dredged RV *Meiring Naudé*, 03.vii.1985 (NMSA C9442); Off Whale Rock (32°01.7'S 29°18.2'E), -150–165 m, dead, coarse sand, discoid corals, NMDP stn M9, dredged RV *Meiring Naudé*, 20.vii.1982 (NMSA C2344); Off Bulungula River mouth (32°09.8'S 29°04.6'E), -90 m, dead, slightly muddy sand, NMDP stn O1, dredged RV *Meiring Naudé*, 17.vii.1982 (NMSA C2627); Off Nthlonyane River (32°15.4'S 29°00.8'E), -90–95 m, dead, lithothamnion pebbles, NMDP stn P5, dredged RV *Meiring Naudé*, 17.vii.1982 (NMSA C2555); Off Qora River (32°33.4'S 28°48.0'E), -100 m, dead, coarse sand, some sponge rubble, NMDP stn U6, dredged RV *Meiring Naudé*, 14.vi.1983 (NMSA C4858); Off Qora River (32°34.0'S 28°49.7'E), -400–420 m, dead, coarse slightly muddy sand, NMDP stn U13, dredged RV *Meiring Naudé*, 12.vii.1984 (NMSA C6861); Off Sandy Point (32°37.4'S 28°36.9'E), -90 m, dead, calcareous debris, coarse sand, NMDP stn W1, dredged RV *Meiring Naudé*, 11.vi.1983 (NMSA C4533, 1 lv, 3 rv); Off Qolora River (32°41.4'S 28°30.0'E), -80 m, dead, coarse sand, NMDP stn Y5, dredged RV *Meiring Naudé*, 13.vi.1983 (NMSA C3954); Off Sandy Point (32°42.9'S 28°48.6'E), -350 m, dead, coarse sand, broken shell, NMDP stn W14, dredged RV *Meiring Naudé*, 14.vii.1984 (NMSA C6783); Off Qolora River (32°46.2'S 28°37.5'E), -440–446 m, dead, fine sand, branching coral, NMDP stn Y1, dredged RV *Meiring Naudé*, 12.vi.1983 (NMSA C4067); Off Kei River (32°49.3'S 28°31.2'E), -138 m, dead, coarse sand, NMDP stn Z4, dredged RV *Meiring Naudé*, 13.vi.1983 (NMSA C5085).

Distribution and habitat: Red Sea, Gulf of Aden, Arabian Sea, Persian Gulf, southwards to eastern South Africa. Living upper bathyally on soft substrata (mixture sediments of mud and sand). Present specimens live at -145–261 m (minimum depth range).

Remarks: *Parvamussium cristatellum* (Dautzenberg & Bavay, 1912) recorded from the northern Indian Ocean, western, southwestern, and southern Pacific (Dijkstra & Maestrati 2012: 392) is morphologically very close to the present species. *Parvamussium cristatellum* differs somewhat in having a more prominent radial sculpture on the left valve, but other characters are similar.

Parvamussium strongae sp. n.

Fig. 4G–M

Etymology: After Dr Ellen E. Strong, Research Zoologist, Curator of Mollusca at the Department of Invertebrate Zoology of the National Museum of Natural History, Smithsonian Institution, Washington DC, U.S.A. Participant on the Mainbaza campaign.

Description: Shell up to 27 mm in height, fragile, inequivalve, inequilateral, both valves flattened, left valve slightly more inflated than right valve, auricles unequal in shape and size, umbonal angle 105°. Colour left valve creamy with white and orange spots, transparent, right valve whitish, opaque. Prodissoconch 190 µm long. Left valve glossy in early growth stage (c. 8 mm), shell disc smooth and transparent throughout to the subventral margin. Submarginal region (c. 3–5 mm) opaque with delicate spaced (6 per mm) commarginal lamellae. Auricles smooth in early growth stage with close-set commarginal lamellae near the periphery. Hinge line slightly raised. Right valve also glossy and transparent with whitish dots in early growth stage (c. 5 mm), with faint commarginal close-set growth lines, transformed into more prominent commarginal

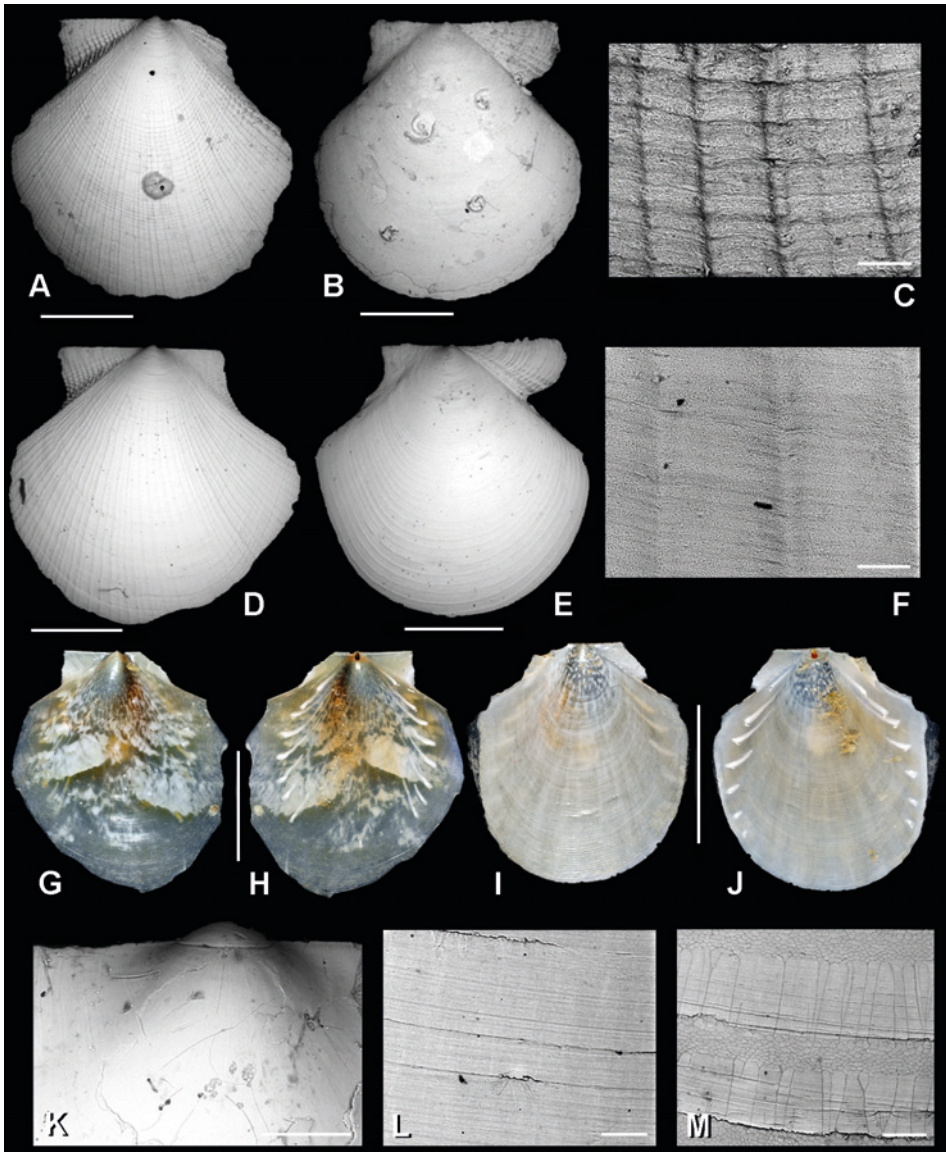


Fig. 4. *Parvamussium* spp.: (A–C) *P. scitulum* (E.A. Smith, 1885): campaign Mainbaza, stn CP3130, (A) external view of the left valve, H = 6.2 mm, scale bar = 2 mm; (B) external view of the right valve, H = 5.7 mm, scale bar = 2 mm; (C) details of the left valve, H = 6.2 mm, scale bar = 0.1 mm (MNHN). (D–F) *P. siebenrocki* (Sturany, 1901): campaign Mainbaza, stn CC3160, (D) external view of the left valve, H = 6.9 mm, scale bar = 2 mm; (E) external view of the right valve, H = 5.9 mm, scale bar = 2 mm; (F) details of the left valve, H = 6.9 mm, scale bar = 0.1 mm (MNHN). (G–M) *P. strongae* sp. n., holotype: campaign Miriky, stn DW3212, (G) external view of the left valve, H = 21.9 mm, scale bar = 1 cm; (H) internal view of the left valve, H = 21.9 mm, scale bar = 1 cm; (I) external view of the right valve, H = 17.4 mm, scale bar = 1 cm; (J) internal view of the right valve, H = 17.4 mm, scale bar = 1 cm; (K) prodissoconch of the left valve, H = 21.9 mm, scale bar = 0.2 mm; (L) details of the left valve, H = 21.9 mm, scale bar = 0.1 mm; (M) details of the right valve, H = 17.4 mm, scale bar = 0.1 mm (MNHN 39087).

lamellae (c. 6 per mm) near the ventral margin. Anterior auricle slightly curved with very close-set commarginal lirae, more prominent near the hinge. Posterior auricle almost smooth in early growth stage with commarginal lamellae near the margin. Marginal apron broken off. Rudimentary riblets anteriorly and posterior, 8 on each side of left valve, 7 on each side of right valve. Byssal notch small, byssal fasciole narrow.

Dimensions: Holotype: Height 22.1 mm, width 20.0 mm, convexity 3.9 mm.

Type material examined: Holotype, pr (MNHN IM-2007-39087). Type locality: NW MADAGASCAR: Between Nosy-Bé and Banc du Leven (12°34'S 47°54'E), -367–369 m, live, campaign Miriky, stn DW3212, 30.vi.2009. Paratype (lv): Northwest region: between Nosy-Bé and Banc du Leven (12°55'S 48°11'E), -260–319 m, live, campaign Miriky, stn DW3228, 02.vii.2009 (MNHN 39052, MarBol).

Other material examined: S MADAGASCAR: Manantenina (24°24'S 47°33'E), -424–438 m, dead, expedition Atimo Vatae, stn DW3528, RV *Nosy Bé II*, 01.v.2010 (MNHN, 2 lv); Sainte Luce (24°43'S 47°32'E), -296–307 m, dead, expedition Atimo Vatae, stn DW3534, RV *Nosy Bé II*, 02.v.2010 (MNHN, 2 lv, 3 rv).

Distribution and habitat: So far Madagascar Channel, northwestern and southern Madagascar. Living bathyally on soft substrata at -267–367 m (minimum depth range).

Remarks: A closely smooth bathyal species is *Parvamussium torresi* (E.A. Smith, 1885), recorded from the southwestern Pacific. This species could be distinguished from *P. strongae* by the following characters, i.e. in having a smaller size (*P. torresi* up to c. 10 mm in height, *P. strongae* c. 27 mm), in coloration (*P. torresi* is uniform whitish, *P. strongae* creamy with whitish and brownish maculations), and in development of internal ribs (*P. torresi* 10 well developed and prominent, *P. strongae* 14–16 rudimentary).

Two congeneric species with also similar anteriorly and posteriorly rudimentary internal riblets as in the present species are *Parvamussium vidalense* (Barnard, 1964), recorded from South Africa, and *Parvamussium vesiculatum* Dijkstra, 1995, known from the southwestern Pacific. These species could be distinguished from *P. strongae* in having a significant smaller size (up to c. 8 mm in height), in having a well-developed radial and commarginal sculpture on the left valve, and in having fewer rudimentary internal riblets (generally 3–4 anteriorly and posteriorly).

Parvamussium texturatum (Dautzenberg & Bavay, 1912)

Fig. 5D–F

Amussium texturatum Dautzenberg & Bavay, 1912: 37, pl. 27, figs 19–22; Barnard, 1964: 432. Type locality: Philippines, Sulu Sea (6°08'N 121°19'E), -275 m, live, coral bottom, dredge, 04.vii.1899 (*Siboga*, stn 105).

Parvamussium texturatum: Dijkstra 1995: 34, figs 103–106 [references, type data, description, distribution]; Dijkstra & Maestrati 2013b: 474.

Description: Shell up to 8 mm in height, fragile, almost circular, nearly opaque, weakly inflated, inequivalve, inequilateral, valves almost equally convex, auricles unequal in shape and size (anterior much larger than posterior), umbonal angle 95°–110°. Colour whitish or creamy with a few white or brown spots. Prodissoconch 200 µm high. Left valve only sculptured with prominent commarginal lamellae in early growth stage (pre-radial stage below dissoconch). Irregularly arranged radial costae (c. 10) commence after 1–2 mm below the umbonal top, increasing by secondary intercostal radial costulae, enlarging towards the ventral margin. Strongly developed commarginal lamellae are crossing the radial costae, forming more or less prominent squamae on the intersections. Auricles with very prominent and close-set commarginal lamellae, somewhat weaker on posterior auricle. Right valve sculptured with regularly spaced,

somewhat scaly, prominent commarginal lamellae. Anterior auricle with *c.* 4–7 radial riblets and weak overrunning commarginal lamellae. Posterior auricle with prominent close-set commarginal lamellae. Internal ribs, variable in length (in most specimens short) and number (*c.* 10 + 1–6 rudimentary), commencing generally in late ontogeny. Byssal notch narrow.

Type material examined: Holotype (pr) ZMA Moll. 3.12.022.

Other material examined: MOZAMBIQUE CHANNEL: Zambeze transect (19°34'S 36°45'E), -352–357 m, dead, campaign Mainbaza, stn CC3151, 13.iv.2009 (MNHN). S MADAGASCAR: S Pointe Barrow (25°32'S 44°16'E), -549–576 m, dead, expedition Atimo Vatae, stn CP3585, RV *Nosy Bé 11*, 10.v.2010 (MNHN).

Distribution and habitat: Philippines, Indonesia, Solomon Islands, Coral Sea, New Caledonia, Loyalty Islands, and southwestern Indian Ocean (Dijkstra 1995: 34; Dijkstra & Maestrati 2013*b*: 474). Living on soft substrata of mud and sand at -240–450 m. Present material only dead at -352–576 m.

Remarks: The present specimens are morphologically close to the holotype of the Sulu Sea, although the intercostal commarginal lamellae on the left valve are weaker, the scaly commarginal lamellae on the right valve lacking, and the internal ribs commencing in an earlier growth stage. However, the sculpture and also the internal ribs are rather variable and these variable characters are also examined in material from the southwestern Pacific (MNHN). A morphologically close congener is *Parvamussium conspectum* Dijkstra & Kastoro, 1997, known from eastern Indonesia. This species differs from *P. texturatum* by having a more elongated shape (*P. texturatum* is almost circular), coarser commarginal sculpture in early growth stage, and fewer internal ribs (*P. conspectum* 9, *P. texturatum* 10 + 1–6 rudimentary).

Parvamussium thyrideum (Melvill in Melvill & Standen, 1907)

Fig. 5J–L

Pecten thyrideus Melvill in Melvill & Standen, 1907: 809, pl. 55, figs 10–10a. Type locality: Gulf of Oman (24°58'N 56°54'E), -285 m, dead, shell-sand.

Propeamussium (*Parvamussium*) *thyrideum*: Oliver 1992: 70, 73, text-fig. 6.

Parvamussium thyrideum: Dijkstra & Knudsen 1998: 49, pl. 2, fig. 9; Dijkstra & Janssen 2013: 194, figs 46–47.

Description: Shell up to 5 mm in height, flattened, subcircular, left valve slightly more convex than right valve, opaque or semi-transparent, inequivalve, equilateral, auricles unequal, umbonal angle 110°, colour whitish or creamy with white dots. Prodissoconch 140 µm long. Left valve sculptured with 13–17 prominent, irregularly spaced, radial costae, commencing *c.* 1 mm below umbonal top and extending to the ventral margin, and weaker, more regularly and widely spaced commarginal lamellae, with fine scales on intersections. Secondary interstitial radial riblets are developed marginally. Preradial sculpture of delicate, close-set, commarginal lamellae. Auricles with prominent commarginal lamellae and weak antimarginal lirae. Right valve sculptured with very fine, closely spaced, commarginal lirae. Anterior auricle with 5–8 delicate antimarginal lirae, near dorsal margin crossed by commarginal lamellae. Posterior auricle with prominent commarginal lamellae. Byssal notch moderately deep, byssal fasciole small, no ctenolium. Hinge line straight. Resilifer broadly triangular. Variable rudimentary internal radial riblets are developed submarginally or even absent.

Type material examined: Syntypes NHMUK 1907.5.33-37, NMW 1955.158.679. Several syntypes are deposited in other museums (Dijkstra, personal observation).

Other material examined: S MADAGASCAR: Between Lokaro and Sainte Luce (24°51.9'S 47°28'E), -80–83 m, dead, expedition Atimo Vatae, stn DW3519, RV *Nosy Bé II*, 30.iv.2010 (MNHN); Manantenina (24°23'S 47°31'E), -200–220 m, dead, expedition Atimo Vatae, stn DW3523, RV *Nosy Bé II*, 01.v.2010 (MNHN).

Distribution and habitat: Red Sea, Gulf of Aden, Arabian Sea and Persian Gulf. Now also from southern Madagascar (new record). Upper bathyal depths. Living on soft substrata (mud, muddy sand or sand with shell grit). Present specimens dead at -80–220 m.

Remarks: The present specimens of southern Madagascar are almost similar to the type material. The specimen of stn DW3519 has internal rudimentary radial riblets, which are lacking in the type material. These riblets are strongly variable and only developed in adult specimens.

A close congener is *Parvamussium cancellus* (Dijkstra, 1991), recorded from the southwest Pacific, which differs morphologically from *P. thyrideum* by having a more prominent reticulate sculpture on the left valve with fewer intercalated secondary radial riblets.

Parvamussium cancellus was previously placed in *Cyclopecten*, based on juvenile and immature material, which lack internal rudimentary riblets. However, examined adult specimens of both species have rudimentary internal riblets (Dijkstra, pers. obs.).

Parvamussium torresi (E.A. Smith, 1885)

Fig. 5A–C

Amussium torresi E.A. Smith, 1885: 311, pl. 23, figs 3–3b. Type locality: Australia, Queensland, E of Cape York (11°38'15"S 143°59'38"E), -285 m, live, coral sand (*Challenger*, stn 185B).

Parvamussium torresi: Dijkstra 1995: 36, figs 51–54, 125–128 [References, type data, description, distribution, comparison]; Dijkstra & Kastoro 1997: 262, figs 90–94; Dijkstra & Maestrati 2008: 95.

Description: Shell up to 10 mm in height, fragile, subcircular, inequivalve, left valve slightly more convex than right valve, auricles unequal in size and shape, umbonal angle 100–105°. Internal riblets 10 in most specimens, some with 1 or 2 rudimentary interstitial riblets, plus 1 small auricular riblet on each side. Colour of most specimens semi-transparent white, dull whitish or stained with reddish or creamy spots. Prodissoconch 200 µm high. Left valve in early growth stage glossy and transparent (c. 2 mm of shell disc), after that dull throughout, very weakly sculptured with unevenly spaced commarginal growth lines or smooth; some specimens with minute, very close-set commarginal lamellae laterally, sometimes also ventrally. Auricles smooth or weakly sculptured with very closely spaced lamellae; anterior auricle considerable larger than posterior, with 2–4 radial riblets and close-set commarginal lamellae. Hinge line straight. Right valve with evenly spaced commarginal lirae, close-set near umbonal area, becoming more widely spaced towards ventral margin. Anterior auricle with 1–5 weak radial riblets, absent from posterior. Commarginal lamellae prominent near anterior margin, weaker near posterior margin. Hinge line somewhat raised due to prominent lamellae on antero- and postero-dorsal margins. Resilifer triangular. Byssal notch narrow.

Type material examined: Lectotype (pr) NHMUK 1887.2.9.3316, designated by Dijkstra (1995: 36, figs 125–128), 5 paralectotypes (v) NHMUK 1887.2.9.3317/1–5.

Other material examined: MOZAMBIQUE CHANNEL: Maputo transect (25°56'S 33°07'E), -193–194 m, dead, campaign Mainbaza, stn CP3131, 09.iv.2009 (MNHN); Maputo transect (25°11'S 35°10'E), -200–201 m, live, campaign MAINBAZA, stn CP3133, 10.iv.2009 (MNHN); Maputo transect (23°32'S 35°46'E), -264–277 m, live, campaign Mainbaza, stn CP3143, 11.iv.2009 (MNHN); Maputo transect (23°33'S 35°41'E),

-171–180 m, live, campaign Mainbaza, stn CP3144, 11.iv.2009 (MNHN); Inhambane transect (23°59'S 35°39'E), -206–210 m, live, campaign MAINBAZA, stn CC3160, 15.iv.2009 (MNHN); Inhambane transect (24°02'S 35°41'E), -266–267 m, live, campaign Mainbaza, stn CC3161, 15.iv.2009 (MNHN).

Distribution and habitat: Southern Philippine Islands: -350 m (Dijkstra 1990a); eastern Indonesia: -170–212 m (Dijkstra & Kastoro 1997); Chesterfield Islands (Coral Sea): -315–355 m, New Caledonia: -230–365 m (dead), Norfolk Ridge: -230 m (dead), Loyalty Islands: -100–600 m (dead), Hebrides: -260–300 m, Wallis and Futuna Islands: -250–330 m (dead) (Dijkstra 1995; 2001; Dijkstra & Maestrati 2008); Fiji: -290–300 m, Tonga: -263–400 m, Solomon Islands: -225–281 m (dead) (Dijkstra & Maestrati 2008). Now also extended westwards in the southwestern Indian Ocean, the Mozambique Channel (new record). The present species is free-living on soft substrata of mud or muddy sand at a bathyal depth of -170–583 m. Present material live at -180–264 m (minimum depth range).

Remarks: Juvenile specimens of *Parvamussium scitulum* and *P. torresi* are easily confused. Both species are very weakly sculptured or even smooth, but the convexity of the left valves is different (*P. scitulum* flattened, *P. torresi* slightly more inflated). The right valve of *P. torresi* is sculptured with weak commarginal lirae, which are lacking from most specimens of *P. scitulum*. The present material from the Mozambique Channel is morphologically almost identical to the type specimens from Torres Strait (NE Queensland), but are slightly different in colour (with reddish or creamy dots, typical specimens are whitish), and have a prominent transparent and glossy shell disc in early growth stage of the left valve (typical specimens are more dull).

Parvamussium vesiculatum Dijkstra, 1995

Fig. 5G–I

Parvamussium vesiculatum Dijkstra, 1995: 37, figs 59–62, 93–96; Dijkstra & Kastoro 1997: 265, figs 95–98; Dijkstra & Marshall 1997: 83, pl. 4, figs 11–16; Dijkstra 2001: 87; Dijkstra & Marshall 2008: 12, figs 10F–I, 11; Dijkstra & Maestrati 2008: 96; Dijkstra & Maestrati 2009: 43, pl. 3, figs 22–24; Dijkstra 2011: 44, pl. 1017, figs 1a–b. Type locality SE New Caledonia (22°47'S 167°14'E), -440–450 m, live, 30.viii.1985 (BIOCAL, stn DW 44).

Description: Shell up to 10 mm high, fragile, semi-transparent white, almost circular, inequivalve, inequilateral, left valve slightly more convex than right, auricles unequal in shape and size, umbonal angle 95°–105°. Inner surface with rudimentary riblets anteriorly and posteriorly, also weak on auricles. Prodissoconch 200 µm long. Left valve sculptured with widely spaced commarginal lirae with strongly developed, radially arranged nodules or hollow scales on intersections of commarginal and radial sculpture. Unevenly spaced radial riblets between commarginal lirae. Auricles with commarginal lamellae, prominent on anterior, slightly closer on posterior. Hinge line straight. Right valve with evenly spaced commarginal lirae, weak near umbonal region. Prodissoconch pellucid. Anterior auricle with 4 delicate radial riblets with commarginal lamellae continuing over them uninterrupted, developed into scales on dorsal margin. Byssal notch shallow, byssal fasciole narrow.

Type material examined: Holotype (pr) MNHN Moll 21167. Paratypes (36 pr + 27 v): 2 AMS C.201715, 12 ZMA Moll. 395030, 43 MNHN Moll 21168, 2 NMNZ M.268538, 2 NSMT-Mo 70542, 2 USNM 890874.

Other material examined: NW MADAGASCAR: West of Cap d'Ambre (12°08'S 48°56'E), -238–249 m, dead, campaign Miriky, stn DW3196, 28.vi.2009 (MNHN). S MADAGASCAR: Manantenina (24°23'S 47°31'E), -200–220 m, live, expedition Atimo Vatae, stn DW3523, RV *Nosy Bé 11*, 01.v.2010 (MNHN); Manantenina

(24°23'S 47°32'E), -307–319 m, dead, expedition Atimo Vatae, stn DW3524, RV *Nosy Bé II*, 01.v.2010 (MNHN); Manantenina (24°24'S 47°33'E), -402–407 m, dead, expedition Atimo Vatae, stn DW3529, RV *Nosy Bé II*, 01.v.2010 (MNHN); S of Faux Cap (26°07'S 45°39'E), -264–280 m, dead, expedition Atimo Vatae, stn DW3552, RV *Nosy Bé II*, 05.v.2010 (MNHN); S of Faux Cap (26°08'S 45°39'E), -280–333 m, dead, expedition Atimo Vatae, stn DW3553, RV *Nosy Bé II*, 05.v.2010 (MNHN); S Cap Sainte Marie (26°13'S 45°08'E), -225–282 m, dead, expedition Atimo Vatae, stn CP3613, RV *Nosy Bé II*, 14.v.2010 (MNHN); S Cap Sainte Marie (26°13'S 45°08'E), -250–300 m, dead, expedition Atimo Vatae, stn CP3614, RV *Nosy Bé II*, 14.v.2010 (MNHN).

Distribution and habitat: Southwestern Pacific from Taiwan southwards to Australia, eastwards to Tonga (Dijkstra & Maestrati 2008: 96), now also extended into the southwestern Indian Ocean from northwestern and southern Madagascar (new record). Living bathyally on soft substrata of mud and sand at -205–650 m. Present specimens live at -200–220 m.

Remarks: The present specimens from northwestern and southern Madagascar are morphologically identical to the type material, although one left valve is almost smooth and transparent and another left valve almost lacks the typical hollow scales on the intersections and has prominent internal ribs, which commence in early ontogeny. However, these characters are strongly variable and similar specimens are examined in material from the southwestern Pacific (MNHN).

Parvamussium vidalense (Barnard, 1964)

Fig. 5M

Cyclopecten vidalensis Barnard, 1964: 433, figs 14e–g. Type locality: South Africa: KwaZulu-Natal: Off Cape Vidal (NNE 1/4N, 9.5 miles), -146–183 m, dead, dredged.

Description: Shell up to 7.3 mm in height, fragile, opaque, subcircular, almost equilateral, left valve flattened, auricles unequal in shape and size (anterior larger than posterior), umbonal angle 105°, colour whitish. Prodissoconch 200 µm long. Left valve with commarginal sculpture in early growth stage (*c.* 10 widely spaced delicate commarginal lamellae up to 1 mm), then radial sculpture commences (about 10 radial riblets appear and secondary intercostal ones at 2 mm), showing a latticed sculptured at the central shell disc of prominent radial ribs and overrunning commarginal lamellae, with scales on intersections. Auricles with prominent closely spaced commarginal lamellae. Hinge line straight. Inner surface with short riblets laterally (4 anteriorly, 4 posteriorly) and 2 rudimentary ventrally.

Type material examined: Holotype (lv) SAM A9495.

Other material examined: S MADAGASCAR: S Cap Sainte Marie (26°13'S 45°08'E), -225–282 m, dead, expedition Atimo Vatae, stn CP3613, RV *Nosy Bé II*, 14.v.2010 (MNHN).

Distribution and habitat: South Africa, off KwaZulu-Natal. Now also southern Madagascar (new record). Previously only a single left valve (holotype) at -146–183 m. Present left valve dead at -225–282 m.

Remarks: The present specimen from southern Madagascar is morphologically identical to the type specimen. *Parvamussium vidalense* was provisionally placed in *Cyclopecten* by Barnard (1964: 433), but developed internal riblets justified placing in *Parvamussium*.

A close congener from the SW Pacific is *Parvamussium araneum* Dijkstra, 1991, which differs from *P. vidalense* by having finer and more closely spaced commarginal lamellae, more delicate radial riblets on the left valve, more spinous sculpture on the intersections, and less-developed internal riblets.

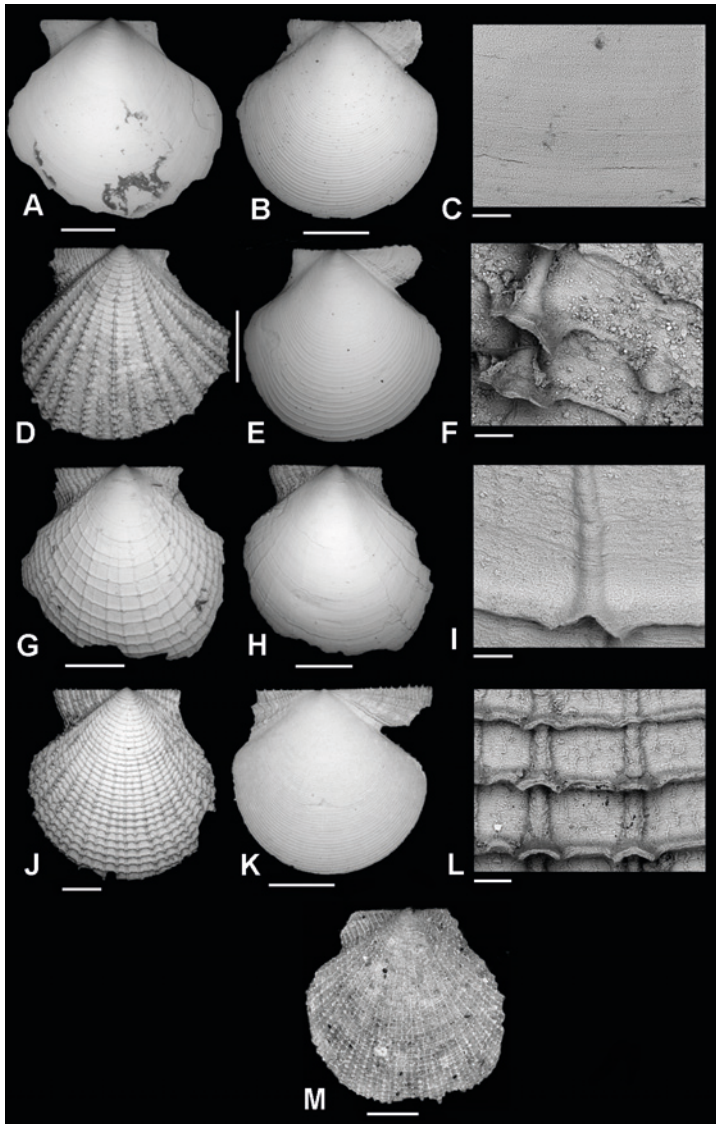


Fig. 5. *Parvamussium* spp.: (A–C) *P. torresi* (E.A. Smith, 1885): campaign Mainbaza, stn CP3143, (A) external view of the left valve, H = 7.8 mm, scale bar = 2 mm; (B) external view of the right valve, H = 6.6 mm, scale bar = 2 mm; (C) details of the left valve, H = 7.8 mm, scale bar = 0.1 mm (MNHN). (D–F) *P. texturatum* (Dautzenberg & Bavay, 1912): campaign Mainbaza, stn CC3151, (D) external view of the left valve, H = 5.7 mm, scale bar = 2 mm; (E) external view of the right valve, H = 5.7 mm, scale bar = 2 mm; (F) details of the left valve, H = 5.7 mm, scale bar = 0.1 mm (MNHN). (G–I) *P. vesiculatum* Dijkstra, 1995: campaign Miriky, stn DW3196, (G) external view of a left valve (typical), H = 6.6 mm, scale bar = 0.2 mm; (H) external view of a left valve (atypical), H = 7 mm, scale bar = 0.2 mm; (I) details of the left valve (typical), scale bar = 0.1 mm (MNHN). (J–L) *P. thyrideum* (Melvill in Melvill & Standen, 1907): expedition Atimo Vatae, stn DW3523, (J) external view of one left valve, H = 5.2 mm, scale bar = 1 mm (K) external view of one right valve, H = 3.1 mm, scale bar = 1 mm; ; (L) details of the left valve, H = 5.2 mm, scale bar = 0.1 mm (MNHN). (M) *P. vidalense* (Barnard, 1964), holotype: South Africa, KwaZulu-Natal, off Cape Vidal, external view of the left valve, H = 7.3 mm, scale bar = 2 mm (SAM A9495).

Genus *Cyclopecten* Verrill, 1897

Cyclopecten Verrill, 1897: 70. Type species (SD, Sykes, Smith & Crick 1898): *Pecten pustulosus* Verrill, 1873; Recent, northwestern Atlantic.

Remarks: For synonymy, diagnosis, distribution and discussion see Dijkstra (1995: 41) and Waller (2011: 17).

Key to species of *Cyclopecten* in the southwestern Indian Ocean

- Shell small, somewhat higher than wide, lv with prominent radial and weaker commarginal sculpture, intersections with nodules or lamellae, internal ribs lacking 1
- 1 Shell 8.9 mm high, lv opaque and creamy, rv semi-transparent whitish, lv with primary and secondary radial lirae and commarginal lirae, rv with commarginal lamellae *C. cassiculus* sp. n.
- Shell small, circular, lv commarginally sculptured with erect hollow spines, internal ribs lacking 2
- 2 Shell 6 mm high, opaque, whitish, lv with commarginal lamellae and erect hollow spines on lamellae, and with intercalated antimarginal microsculpture on late growth stage, rv similar but with weaker sculpture *C. horridus* Dijkstra, 1995
- Shell small, subcircular, hyaline, whitish, lv slightly inflated, rv almost flat, auricles unequal, internal ribs lacking 3
- 3 Shell 12 mm high, lv with narrow radial riblets and overrunning commarginal lirae, nodules on intersections, rv with closely spaced commarginal lirae *C. kantori* sp. n.
- Shell small, circular, lv with delicate reticulate sculpture, no internal ribs 4
- 4 Shell 6 mm high, opaque, whitish, lv with delicate, closely spaced radial and commarginal sculpture, rv with commarginal lamellae .. *C. kapalae* Dijkstra, 1990

Cyclopecten cassiculus sp. n.

Fig. 6A–G

Etymology: From the Latin *cassiculus* (m.) (small spider's web), after the sculpture of left valve that resembles a spider's web with fine raindrops on the intersections.

Description: Shell up to 8.9 mm in height, fragile, lv opaque, rv semi-transparent, somewhat higher than wide, inequivalve, flattened and somewhat rough, left valve slightly more convex than right valve, inequilateral, anterior auricle larger than posterior, umbonal angle 90°–95°, colour of left valve creamy, right valve whitish. Prodissoch 170 µm long. Left valve sculptured with very closely spaced commarginal lirae in early growth stage (c. 10 per mm), more prominent and widely spaced on central shell disc (c. 4–5 per mm), 8–10 fine radial lirae commence c. 0.8–1.0 mm below umbo, increasing to c. 15 strong primary lirae near periphery with interstitial secondary lirae, intersections with small nodules on primary radial lirae in early growth stage, more lamellar in adult stage, small nodules on secondary interstitial riblets, similar sculptured auricles almost continuous with shell disc. Right valve with very weak, regularly spaced, delicate commarginal lamellae (c. 10 per mm). Anterior auricle with 6–7 antimarginal noduliferous lirae, posterior auricle continuous with disc with very fine and close-set commarginal lirae. Byssal notch moderately deep, byssal fasciole rather small, no

ctenolium. Hinge line straight. Resilifer triangular. Internal ribs lacking.

Dimensions (holotype): height 8.9 mm, width 8.0 mm, convexity 2.9 mm.

Type material: Holotype, pr (MNHN IM-2007-41951), paratype, pr (MNHN IM-2007-41954). Type locality: MADAGASCAR: Near Mahajamba Bay (14°50'S 46°57'E), -340–446 m, live, campaign Miriky, stn CP3248, RV *Miriky*, leg. P. Bouchet & Y. Kantor, 07.vii.2009.

Paratype: MADAGASCAR: Between Majunga and Cap Saint-André (15°32'S 45°45'E), -327–730 m, live, campaign Miriky, stn CP3265, RV *Miriky*, leg. P. Bouchet & Y. Kantor, 10.vii.2009.

Distribution and habitat: NW Madagascar, living upper bathyally at -327–340 m (minimum depth range).

Remarks: The closest resembling species is *Parvamussium cassium* Dijkstra, 1991, recorded from deep water (-450–600 m) off Indonesia. *Cyclopecten cassiculus* morphologically differs from *P. cassium* by having prominent radial and fine commarginal lirae (in *P. cassium* weaker and more equal of prominence), in having secondary intercostal radial lirae in late ontogeny (*P. cassium* in earlier growth stage), in having fine interstitial radial lirae, up to 6 near ventral margin (one radial lira in *P. cassium*), and in having coarser nodules and lamellae on intersections of lirae (*P. cassium* very small nodules). Both species are lacking internal ribs, although *P. cassium* has a short auricular riblet (very weak in the present species).

A somewhat resembling species is *Parvamussium vidalense* (Barnard, 1964), recorded from eastern South Africa and herein also from southern Madagascar. This species has a reticular sculpture on the left valve of more closely spaced, finer radial and commarginal lirae with short spines or curved lamellae on the radial and commarginal intersections. Moreover, several rudimentary interior ribs are present (lacking in *C. cassiculus*).

Cyclopecten horridus Dijkstra, 1995

Fig. 6H–I

Cyclopecten horridus Dijkstra, 1995: 41, figs 63–64, 98; Dijkstra & Marshall 1997: 87; 2008: 16, 12E–H, 13. Type locality: Loyalty Islands, 20°29'S 166°43'E, -600 m, live, RV *Alis*, leg. P. Bouchet, B. Métivier & B. Richer de Forges-IRD, 16.02.1989 (MUSORSTOM 6, stn DW 420).

Description: Shell up to 6 mm in height, fragile, circular, inequivalve, almost equilateral, left valve more inflated than right valve, auricles nearly equally sized, umbonal angle 120°–125°, colour dull whitish. Prodissoconch 170 µm long. Left valve sculptured with regularly spaced commarginal lamellae, close-set in early growth stage, enlarging towards periphery. Prominent hemitubular scales on commarginal lamellae arranged in radial rows that multiply by intercalation (Dijkstra & Marshall 2008: figs 12E, 12H). Auricles similar sculptured and continuous with shell disc. Right valve with regularly arranged closely spaced commarginal lirae sculptured with delicate spines near ventral margin. Anterior auricle with 3 radial riblets and overrunning commarginal lamellae. Posterior auricle almost continuous with shell disc with commarginal lirae. Hinge line straight. Antero-dorsal margin with scales, squamae weakly on postero-dorsal margin. Byssal notch strongly developed.

Type material examined: Holotype, pr (MNHN IM-2000-21163).

Other material examined: SOUTH AFRICA: *Transkei*: Off Whale Rock (32°01.3'S 29°19.3'E), -150–200 m, dead, sponge rubble, NMDP stn M8, dredged RV *Meiring Naudé*, 20.vii.1982 (NMSA E65).

Distribution and habitat: New Caledonia, Loyalty Islands and Kermadec Ridge (Dijkstra & Marshall 2008: 16). Now also from off Transkei, South Africa (new record). Live at -350–600 m. Present specimens dead at -150–200 m.

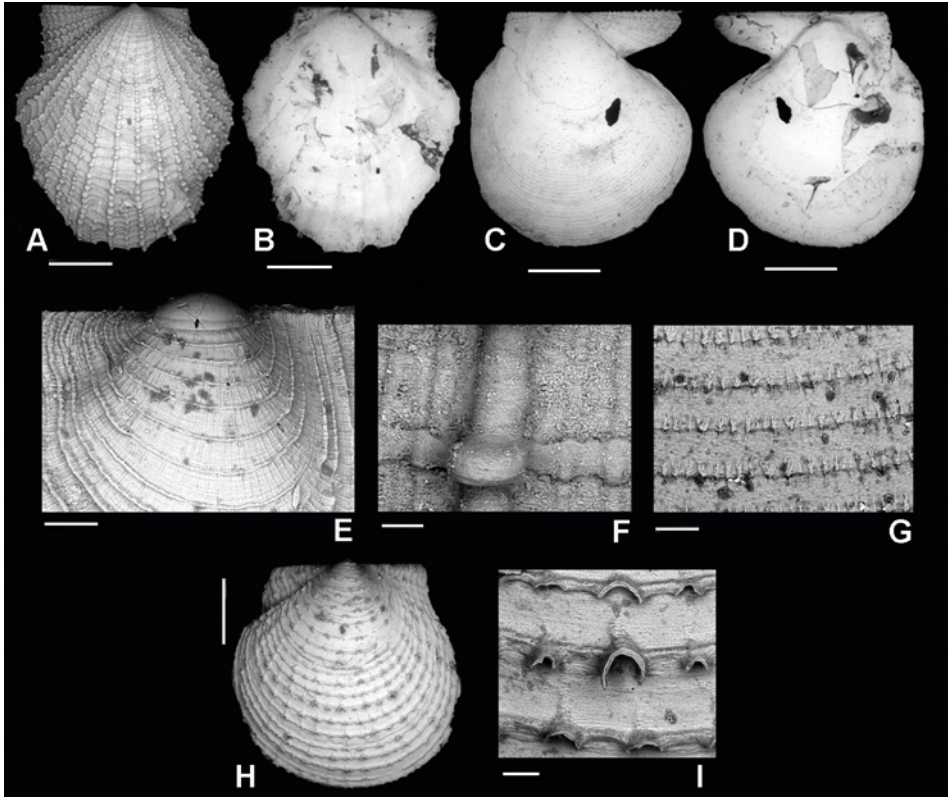


Fig. 6. *Cyclopecten* spp.: (A–G) *C. cassiculus* sp. n., holotype: campaign Miriky, stn CP3248, (A) external view of the left valve, H = 8.5 mm, scale bar = 2 mm; (B) internal view of the left valve, H = 8.5 mm, scale bar = 2 mm; (C) external view of the right valve, H = 7 mm, scale bar = 2 mm; (D) internal view of the right valve, H = 7 mm, scale bar = 2 mm; (E) prodissoconch of the left valve, H = 8.5 mm, scale bar = 0.1 mm; (F) details of the left valve, H = 8.5 mm, scale bar = 0.1 mm; (G) details of the right valve, H = 7 mm, scale bar = 0.1 mm (MNHN 41951). (H, I) *C. horridus* Dijkstra, 1995: South Africa, *Transkei*, off Whale Rock, (H) external view of the left valve, H = 3.3 mm, scale bar = 1 mm; (I) details of the left valve, H = 3.3 mm, scale bar = 0.1 mm (NMSA E65).

Remarks: The present specimens are almost indistinguishable from the type material. The hemitubular scales on the commarginal lirae of the left valve are coarser and more widely spaced. However, intermediate variations are also observed from the southwestern Pacific (MNHN). Other morphological characters are similar.

Cyclopecten erythraeensis Dijkstra & Janssen, 2013, recently recorded from the Red Sea, differs from *C. horridus* by having a more closely spaced and delicate commarginal sculpture on the left valve with finer and less-hemitubular scales.

Cyclopecten kantori sp. n.

Fig. 7A–G

Etymology: After Dr Yuri I. Kantor, leading researcher of the Department of Invertebrate Morphology at the A.N. Severtzov Institute of Ecology and Evolution, Russian Academy of Sciences in Moscow. Participant of several French expeditions.

Description: Shell up to 11.9 mm in height, fragile, subcircular, inequivalve, almost equilateral, left valve more inflated than right valve (nearly flat), auricles dissimilar in shape, anterior auricle larger than posterior one, umbonal angle 120°, internal ribs lacking, semi-translucent whitish. Prodissoconch 220 µm long. Left valve reticulately sculptured throughout shell disc by narrow radial riblets and overrunning commarginal lirae with delicate solide nodules on intersections. On central part of disc *c.* 10 radial riblets per mm, *c.* 7–8 commarginal lirae. Reticular sculpture commences in early growth stage, radial riblets enlarge gradually in ontogeny by intercostal riblets towards the ventral margin. Commarginal lirae more prominent than radial riblets, very closely spaced in early growth stage, gradually wider in later ontogeny. Auricular sculpture similar to that of shell disc with stronger solid nodules on the intersections. Right valve sculptured with commarginal lirae, closely spaced (*c.* 30 per mm) near umbonal area, coarser and wider on central part of disc (*c.* 8 per mm). Posterior auricle continuous with shell disc, sculptured with fine close-set commarginal lirae, anterior auricle and byssal fasciole separated from shell disc by sharply incised groove, sculptured with prominent commarginal lirae and 8 crowded radial riblets with nodular intersections. Byssal notch moderately deep, byssal fasciole narrow.

Dimensions: Holotype: Height 11.9 mm, width 11.1 mm, convexity 3.2 mm.

Type material: Holotype, pr (MNHN IM-2007-38440). Type locality: NW MADAGASCAR: In front of Narendry Bay (14°30'S 47°27'E), -274–325 m, live, campaign Miriky, stn CP3241, 06.vii.2009.

Distribution and habitat: So far northwestern Madagascar, living bathyally on soft substrata at -274–325 m.

Remarks: The morphologically closest congeneric species is the abyssally (-2928–2930 m) living similar sized *Cyclopecten textus* Dijkstra & Marshall, 2008, recorded from the Lord Howe Rise. This species could be distinguished from *C. kantori* by the following characters: by shell shape (*C. textus* is almost circular, *C. kantori* somewhat higher than wide), by shape of auricles (*C. textus* has smaller auricles (*c.* 2 mm) measured between end of hinge and disc, *C. kantori* somewhat broader (2.5 mm)), by commarginal sculpture of the left valve (*C. textus* has less commarginal sculpture in early ontogeny, *P. kantori* more close-set), and by reticulate sculpture in the central part of the disc of left valve (*C. textus* more squarely, *C. kantori* more elongate).

A somewhat similar reticulated sculptured bathyally living species is *Parvamussium retiolum* Dijkstra, 1995, recorded from the southwestern Pacific. This species could be easily distinguished from *C. kantori* by its more oblique elongate shape (*C. kantori* sub-circular), and by its well-developed internal ribs (lacking in *C. kantori*).

Cyclopecten kapalae Dijkstra, 1990

Fig. 7H–J

Cyclopecten kapalae Dijkstra, 1990b: 29, figs 1–5; Dijkstra & Marshall 1997: 87, pl. 6, figs 7–12; Dijkstra & Marshall 2008: 16, figs 14, 15A–F; Dijkstra & Maestrati 2008: 97; 2012: 393. Type locality: Australia, New South Wales, off Sydney (33°31'33"S, 152°08'07"E), -907–914 m, live, sand, ooze, sediments, 10.xii.1980 (FRV *Kapala*, stn K80-20-08).

Description: Shell up to 6 mm in height, fragile, almost circular, slightly higher than wide, inequivalve, equilateral, left valve somewhat more inflated than right, anterior and posterior auricles dissimilar in shape and size, umbonal angle 90°–95°, dirty to milky white opaque, some specimens semi-translucent. Prodissoconch 170 µm long.

Left valve with reticulate sculpture of weak unevenly spaced radial costae and slightly more prominent commarginal lamellae, interstices microscopically scratched. Radial and commarginal sculpture commence in early ontogeny, *c.* 1 mm below umbonal top. Radial riblets increasing in prominence towards ventral margin. Anterior auricle with coarser commarginal lamellae than posterior one, lacking radial riblets. Right valve with commarginal lamellae, somewhat higher and coarser at ventral margin than higher up, interstices with microscopic scratches. Anterior and posterior auricles also with commarginal lamellae, slightly more irregular on anterior one. Byssal fasciole small, byssal notch hardly distinguished from outer margin of anterior auricle. Hinge line almost straight. Hinge dentition with strong irregular grooves. Internal ribs lacking.

Type material examined: Holotype (pr): AMS C.155831.1.

Paratypes (47 v): AMS C.155800, C.155813, C.155814, C.155822, C.155823, C.155831.2, C.155832, C.155837. See Dijkstra (1990b: 31).

Other material examined: MOZAMBIQUE CHANNEL: Zambeze transect (19°36'S 36°47'E), -636 m, live, campaign Mainbaza, stn CC3154, 13.iv.2009 (MNHN); Maputo transect (25°13'S 35°21'E), -700–707 m, live, campaign Mainbaza, stn CP3138, 10.iv.2009 (MNHN); Maputo transect (23°33'S 35°55'E), -684–698 m, dead, campaign Mainbaza, stn CP3141, 11.iv.2009 (MNHN); Inhambane transect (24°22'S 35°42'E), -708–715 m, live, campaign Mainbaza, stn CC3166, 15.iv.2009 (MNHN). S MADAGASCAR: Sainte Luce (24°43'S 47°32'E), -296–307 m, dead, expedition Atimo Vatae, stn DW3534, RV *Nosy Bé II*, 02.v.2010 (MNHN); Lavanono (25°43'S 44°24'E), -729–732 m, dead, expedition Atimo Vatae, stn CP3597, RV *Nosy Bé II*, 12.v.2010 (MNHN); S Cap Sainte Marie (26°14'S 45°09'E), -284–286 m, dead, expedition Atimo Vatae, stn CP3615, RV *Nosy Bé II*, 14.v.2010 (MNHN).

Distribution and habitat: Solomon Islands (Dijkstra & Maestrati 2008: 97), southeastern Australia (Dijkstra 1990b: 29), Norfolk Island and Kermadec Islands (Dijkstra & Marshall 1997: 17), Vanuatu (Dijkstra & Maestrati 2012: 393). Now also extended into the southwestern Indian Ocean, from the Mozambique Channel and southern Madagascar (new record). Living bathyally (-512–914 m) on soft substrata of mud and sand with sediments. Present specimens live at -707–708 m (minimum depth range).

Remarks: Present specimens from the Mozambique Channel and southern Madagascar are morphologically indistinguishable from the type material. The reticulate sculpture on the left valve is somewhat variable in prominence of the present material, but this feature is also observed in material from the southwestern Pacific (MNHN).

Genus *Similipecten* Winckworth, 1932

Similipecten Winckworth, 1932: 241, 250. Type species (OD): *Pecten similis* Laskey, 1811; Recent, eastern Atlantic.

Remarks: For diagnosis, distribution and discussion see Dijkstra & Knudsen (1998: 49).

Similipecten eous (Melvill in Melvill & Standen, 1907)

Fig. 8G–H

Pecten eous Melvill in Melvill & Standen, 1907: 808, pl. 55, fig. 9. Type locality: Gulf of Oman (24°58'N 56°54'E), -285 m, shell-sand.

Similipecten eous: Oliver 1992: 74, text-figs 9a–b; Bosch, Dance, Moolenbeek & Oliver 1995: 232; Dijkstra & Knudsen 1998: 50, pl. 3, figs 10–11; Dijkstra 2013: 22, pl. 3, figs 3a–d, 4a–c; Dijkstra & Janssen 2013: 199, figs 50–51.

Description: Shell small, up to 4.1 mm in height, fragile, almost circular, translucent or opaque milky-whitish or creamy, inequivalve, subequilateral, right valve more convex than left one. Prodissoconch 200 µm long. Left valve smooth, some specimens with

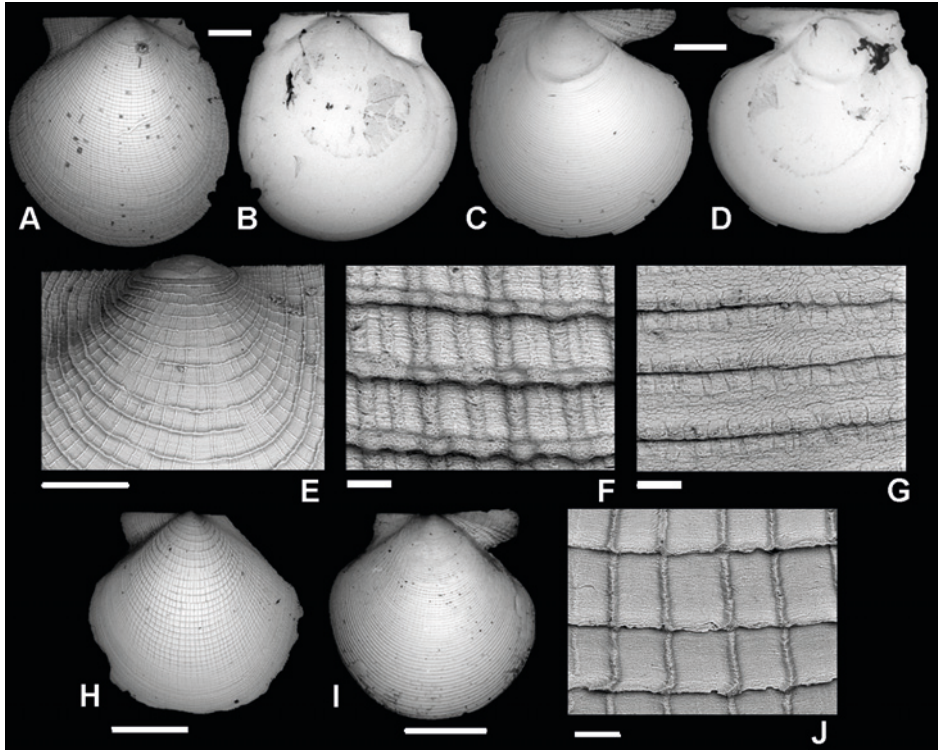


Fig. 7 (A–J). *Cyclopecten* spp.: (A–G) *C. kantori* sp. n., holotype: campaign Miriky, stn CP3241, (A) external view of the left valve, H = 11.3 mm, scale bar = 2 mm; (B) internal view of the left valve, H = 11.3 mm, scale bar = 2 mm; (C) external view of the right valve, H = 9.8 mm, scale bar = 2 mm; (D) internal view of the right valve, H = 9.8 mm, scale bar = 2 mm; (E) prodissoconch of the left valve, H = 11.3 mm, scale bar = 0.2 mm; (F) details of the left valve, H = 11.3 mm, scale bar = 0.1 mm; (G) details of the right valve, H = 9.8 mm, scale bar = 0.2 mm (MNHN 38440). (H–J) *C. kapalae* Dijkstra, 1990: campaign Mainbaza, stn CC3166, (H) external view of the left valve, H = 5.6 mm, scale bar = 2 mm; (I) external view of the right valve, H = 4.9 mm, scale bar = 2 mm; (J) details of the left valve, H = 5.6 mm, scale bar = 0.1 mm (MNHN).

minute commarginal lirae near the ventral margin. Right valve also smooth, with a microscopic granular structure. Anterior auricles with commarginal lamellae or lirae, more prominent near side of disc, posterior auricles smooth and continuous with disc. Internal riblets and ctenolium are lacking. Byssal notch small.

Type material examined: Lectotype NHMUK 1907.5.3.18, designated by Dijkstra & Knudsen (1998: 50); 2 paralectotypes NHMUK 1907.5.3.19–20, 17 paralectotypes NMW 1955.158.673. Several paralectotypes deposited in other museums (Dijkstra, personal observation).

Other material examined: MOZAMBIQUE CHANNEL: Maputo transect (25°11'S 35°02'E), -101–102 m, dead, campaign Mainbaza, stn CP3132, 10.iv.2009 (MNHN); Maputo transect (25°53'S 23°07'E), -112–127 m, live, campaign Mainbaza, stn CP3130, 09.iv.2009 (MNHN). MOZAMBIQUE: Inhaca Island: In front of Ponta Malengane (26°03.6'S 33°01.8'E), -75 m, dead, expedition Inhaca 2011, stn MD26, 05.xii.2011 (MNHN). Maputo: offshore (25°55'S 33°07'E), -140–160 m, dead, s/n, dredge, leg. J. Rosado, xi.2011 (MNHN). S MADAGASCAR: E of Faux Cap (25°38'S 46°13'E), -128–133 m, dead, expedition Atimo Vatae, stn CP3561, RV *Nosy Bé II*, 06.v.2010 (MNHN); S Pointe Barrow (25°30'S 44°16'E), -209–229 m, dead, expedition Atimo Vatae, stn DW3581, RV *Nosy Bé II*, 10.v.2010 (MNHN); SE Pointe Barrow (25°28'S 44°25'E), -203–210 m, dead, expedition Atimo Vatae, stn CP3584, RV *Nosy Bé II*, 10.v.2010 (MNHN); SE Pointe Barrow (25°03'S 44°00'E), -113–135 m, dead, expedition Atimo Vatae, stn DW3588, RV *Nosy*

Bé 11, 11.v.2010 (MNH). SOUTH AFRICA: *KwaZulu-Natal*: Off Umlaas Canal (29°58.5'S 31°00.8'E), -75 m, dead, muddy sand, NMDP stn XX77, dredged RV *Meiring Naudé*, 10.vii.1985 (NMSA D4899).

Distribution and habitat: Red Sea, Gulf of Oman, Arabian Sea, Persian Gulf, Indonesia and Philippines (Dijkstra & Knudsen 1998: 51; Dijkstra 2013: 22). Now also Mozambique Channel, southern Madagascar and northeastern South Africa (new record). Living sublittorally to upper bathyally (-97–410 m, Dijkstra 2013: 22) on soft substrata (mud, muddy sand, shell grit). Present material live at -112–127 m.

Remarks: The present specimens from the Mozambique Channel and southern Madagascar are morphologically similar to the type material from the Gulf of Oman. A closely resembling species, *Similipecten similis* (Laskey, 1811) from the eastern Atlantic, is larger in size (up to 8 mm in height) and more brightly coloured, rarely with some rudimentary interior ribs. These are lacking in *S. eous*. For comparison with *Similipecten herosae* Dijkstra & Maestrati, 2008 from Tonga, see Dijkstra and Maestrati (2008: 101).

Family Cyclochlamydidae Dijkstra & Maestrati, 2012

Remarks: For diagnosis and remarks on this family see Dijkstra and Maestrati (2012: 393).

Genus *Cyclochlamys* Finlay, 1926

Cyclochlamys Finlay, 1926: 452. Type species (OD): *Pecten (Pseudamusium) transenna* Suter, 1913; Recent New Zealand.

Remarks: For description and distribution of the genus *Cyclochlamys* see Dijkstra and Marshall (2008: 22).

Cyclochlamys bacachorda sp. n.

Fig. 8A–F

Etymology: From the Latin *baca* (f.) (pearl), *chorda* (f.) (string), after commarginal lirae with closely arranged small tubercles on left valve.

Description: Shell up to 3 mm in height, fragile, subcircular to circular, somewhat wider than high, strongly inequivalve, almost equilateral, left valve more inflated than right valve, umbonal angle 105°, colourless and transparent. Auricles of similar size and almost continuous with shell disc. Prodissoconch 270 µm long. Left valve smooth or sculptured with fine commarginal ridges in early growth stage (up to 2 mm maximum), coarse and prominent commarginal lirae or lamellae with close-set tubercles on intersections near ventral margin (3–5 per mm), closely spaced fine radial threads (c. 10 per mm) multiply by intercalation. Auricles with close-set commarginal lirae or lamellae (5–8). Right valve with outer layer of commarginally elongate, hexagonal prisms, and broad, flexible ventral apron. Anterior auricle demarcated with shell disc, throughout commarginally sculptured, posterior continuous with shell disc and smooth.

Dimensions (holotype): height 3.0 mm, width 3.4 mm, convexity 0.7 mm.

Type material: Holotype, pr (NMSA E55/T4029). Type locality: SOUTH AFRICA: Off Nthlonyane River (32°17.2'S 29°04.9'E), -220–230 m, live, branching sponges, gorgonians, NMDP stn P2, dredged RV *Meiring Naudé*, 17.vii.1982.

Paratypes: SOUTH AFRICA: *KwaZulu-Natal*: Off Durban (29°51.9'S 31°09.6'E), -80–90 m, grey sandy mud, NMDP stn XX110, dredged RV *Meiring Naudé*, 09.vii.1986 (NMSA D4904, 1 lv); Off Umlaas

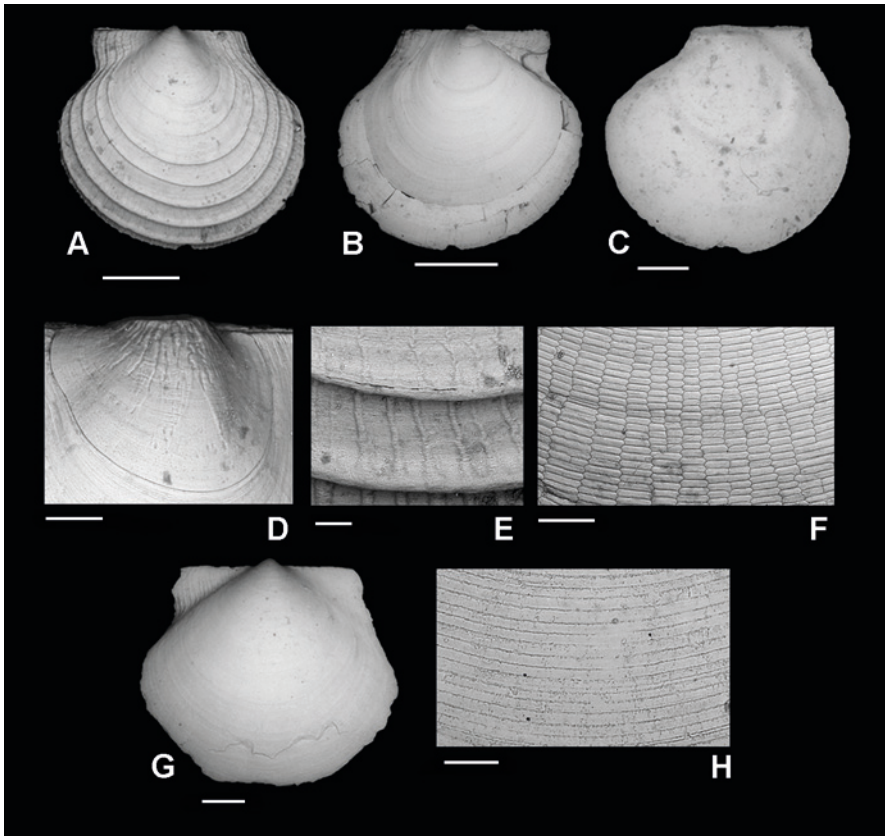


Fig. 8. *Cycloclamys bacachorda* sp. n., holotype: South Africa, off Nthlonyane River, (A) external view of the left valve, H = 3 mm, scale bar = 1 mm; (B) external view of the right valve, H = , scale bar = 1 mm; (D) prodissoconch of the left valve, H = 3 mm, scale bar = 0.1 mm; (E) details of the left valve, H = 3 mm, scale bar = 0.1 mm; (F) details of the right valve, H = 3 mm, scale bar = 0.1 mm (NMSA E55/T4029); paratype, (C) external view of the right valve, H = 2.2 mm, scale bar = 0.5 mm (NMSA P0325/T4030). (G–H) *Similipecten eous* (Melvill in Melvill & Standen, 1907): campaign Mainbaza, stn CP3132, (H) external view of a left valve, H = 2.6 mm, scale bar = 1 mm; (H) details of a left valve, H = 2.6 mm, scale bar = 0.1 mm (MNHN).

Canal (29°58.5'S 31°00.8'E), -75 m, dead, muddy sand, NMDP stn XX77, dredged RV *Meiring Naudé*, 10.vii.1985 (NMSA D4899, 1 rv). *Transkei*: Off Mtamvuna River (31°08.9'S 30°15.7'E), -111 m, dead, sponge, NMDP stn A14, dredged RV *Meiring Naudé*, 18.viii.1981 (NMSA E14, 1 lv); Off Port Grosvenor (31°25.6'S 29°58.0'E), -100–110 m, dead, pebbles, some sand, NMDP stn D6, dredged RV *Meiring Naudé*, 13.viii.1981 (NMSA A81, 1 lv); Off Whale Rock (32°01.3'S 29°19.3'E), -150–200 m, dead, sponge rubble, NMDP stn M8, dredged RV *Meiring Naudé*, 20.vii.1982 (NMSA E65, 5 lv, 14 rv); Off Nthlonyane River (32°17.2'S 29°04.9'E), -220–230 m, live, branching sponges, gorgonians, TL - NMDP stn P2, dredged RV *Meiring Naudé*, 17.vii.1982 (NMSA P0325/T4030, 1 pr, 1 rv); Off Qolora River (32°41.4'S 28°30.0'E), -80 m, dead, coarse sand, NMDP stn Y5, dredged RV *Meiring Naudé*, 13.vi.1983 (NMSA E114); Off Qolora River (32°46.1'S 28°35.0'E), -114 m, live, sponge rubble, NMDP stn Y8, dredged RV *Meiring Naudé*, 13.vi.1983 (NMSA E41, 2 pr, 1 lv, 1 rv).

Distribution and habitat: South Africa, from off KwaZulu-Natal southwards to Transkei (29°S–32°S). Living upper bathyally amongst sponges and gorgonians at a maximum depth range of -114–230 m, minimum depth range -114–220 m, shells at -75–230 m.

TABLE 1.

Minimum (live) and maximum (dead) depth range, SW Pacific (SWP); as well as whether they were live (o) or dead (+) collected and a new regional record (x). SW Pacific Pectinoidea that are similar or share affinities with SW Indian Ocean (SWI) species are listed in the far right column.

SWI Ocean Species	Depth	MC		NWM		SM		SA		Similar SWP species
Propeamussiidae										Propeamussiidae
<i>Propeamussium</i>										<i>Propeamussium</i>
<i>andamanicum</i>	1600–1715	o	x	o	x					<i>andamanicum</i>
<i>arabicum</i>	331–409	o	x	o	x					<i>siratama</i>
<i>caducum</i>	408–850			o	x					<i>caducum</i>
<i>jeffreysii</i>	357–850	o	x	o	x	o	x	+	x	<i>jeffreysii</i>
<i>rosadoi</i> sp. n.	247–620			o		o				<i>rubrotinctum</i>
<i>sibogai</i>	346–549	o	x	o	x	+	x	o		<i>sibogai</i>
<i>watsoni</i>	780			o	x	o	x			<i>watsoni</i>
<i>Parvamussium</i>										<i>Parvamussium</i>
<i>catillus</i> sp. n.	1092–1195	o								<i>multiliratum</i>
<i>formosum</i>	210–260	o	x	o	x	+	x	+	x	<i>thetidis</i>
<i>kilburni</i> sp. n.	200–250							o		<i>virgatum</i>
<i>puillandrei</i> sp. n.	560			o		o				<i>undisonum</i>
<i>scitulum</i>	70–112	o	x	+	x	+	x	o	x	<i>scitulum</i>
<i>siebenrocki</i>	145–261	o		+		+		+		<i>crystalatum</i>
<i>strongae</i> sp. n.	267–367			o		+				<i>torresi</i>
<i>texturatum</i>	352–357	+				+				<i>texturatum</i>
<i>thyrideum</i>	80–220					+	x			<i>cancelus</i>
<i>torresi</i>	180–266	o	x							<i>torresi</i>
<i>vesiculatum</i>	238–249			+	x	o	x			<i>vesiculatum</i>
<i>vidalense</i>	225–282					+	x			<i>araneum</i>
<i>Cyclopecten</i>										<i>Cyclopecten</i>
<i>cassiculus</i> sp. n.	327–340			o						<i>cassium</i>
<i>horridus</i>	150–200							+	x	<i>horridus</i>
<i>kantori</i> n.sp.	274			o						<i>textus</i>
<i>kapalae</i>	636–708	o	x			+	x			<i>kapalae</i>
<i>Similipecten</i>										<i>Similipecten</i>
<i>eous</i>	112	o	x			+	x	+	x	<i>eous</i>
Cyclochlamydidae										Cyclochlamydidae
<i>Cyclochlamys</i>										<i>Cyclochlamys</i>
<i>bachorda</i> sp. n.	114–220							o		<i>austrina</i>
live		11		12		5		4		live
dead		1		3		10		5		dead
new records			9		9		10		5	new records

Remarks: A somewhat resembling species by sculpture of the left valve is *Cyclochlams aupouria* (Powell, 1937), recorded from northern New Zealand. However, *C. bacachorda* differs from *C. aupouria* by having a coarser texture on the left valve of commarginal lirae or lamellae and wider spaced interstitial radial riblets (*C. bacachorda* c. 10 per mm, *C. aupouria* c. 20 per mm), and by having a smooth or weakly sculptured shell disc in early ontogeny (*C. aupouria* with commarginal lamellae and radial threads immediately commencing after larval stage). The prodissoconch of *Cyclochlams austrina* Dijkstra & Marshall, 2008, a species known from southern New Zealand, resembles that of *C. bacachorda* by having somewhat similar diverged anastomosing threads.

DISCUSSION

Twenty-five species of bathyal Pectinoidea (24 Propeamussiidae, 1 Cyclochlamydidae) are now recorded from the southwestern Indian Ocean (Mozambique Channel and off the northeastern region of South Africa). Twenty species are live collected at -112–1715 m (minimum depth range), three species are sampled by shells only at -150–357 m (see Table 1). Seven species of *Propeamussium* are living at -247–1715 m, *Propeamussium andamanicum* in the lower bathyal zone (-1600–1715 m), the other six species in shallower bathyal depths (-247–850 m). *Propeamussium jeffreysii* has the largest bathymetric living range of -493 m. Nine species of *Parvamussium* are living at -70–1195 m. *Parvamussium scitulum* is the deepest living species at -1092–1195 m, *Parvamussium scitulum* the shallowest in the upper bathyal zone at -70–112 m. Three *Cyclopecten* species are living at -274–708 m, *Cyclopecten kapalae* in -636–708 m, *Cyclopecten kantori* at -274 m. *Similipecten eous* is living in the upper bathyal zone (-112 m). The only representative species of Cyclochlamydidae, *Cyclochlams bacachorda*, is also living in the upper bathyal zone.

All the species from the southwest Indian Ocean are morphologically related to the tropical southwestern Pacific (12 species are similar, 13 species closely related).

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