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Living Scallops of Australia and Adjacent Waters  
(Mollusca: Bivalvia: Pectinoidea:  
Propeamussiidae, Cyclochlamydidae and Pectinidae)

*by*

Henk H. Dijkstra and Alan G. Beu



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## Living Scallops of Australia and Adjacent Waters (Mollusca: Bivalvia: Pectinoidea: Propeamussiidae, Cyclochlamydidae and Pectinidae)

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**ABSTRACT.** Recent Pectinoidea (Propeamussiidae, Cyclochlamydidae and Pectinidae) of Australia and neighbouring seas are revised and 105 pectinoidean species (30 species of Propeamussiidae, 2 of Cyclochlamydidae and 73 of Pectinidae) are recorded and compared with similar species from the tropical Indo-West Pacific and temperate Australasian regions. Seven species (five Propeamussiidae: *Parvamussium lamprelli*, *P. slacksmithae*, *P. whissoni*, *Cyclopecten reticulatus*, *Similipecten colmani*, and two Pectinidae: *Hyalopecten ponderi*, *Mimachlamys spinicostata*) are newly named. A further 29 species (12 Propeamussiidae and 17 Pectinidae) are new records from Australia. Subfamily Pedinae Bronn, 1862 and tribe Pedini have priority over subfamily Chlamydinae von Teppner, 1922 and tribe Chlamydini, and are adopted. The following taxa are newly synonymized: *Amussium electrum* Pelseneer, 1911 = *Propeamussium caducum* (Smith, 1885), *Amussium scrobiculatum* Schepman, 1908 = *Jxtamussium maldivense* (Smith, 1903), *Pecten lentiginosus* Reeve, 1853 and *Mimachlamys gavena* Iredale, 1939 = *Mimachlamys punctata* (Gmelin, 1791), *Pecten ustulatus* Reeve, 1853 = *Mimachlamys gloriosa* (Reeve, 1853). Lectotypes are designated for *Pecten superbus* G. B. Sowerby II, 1842, *Annachlamys leopardus rena* Iredale, 1939, *Pecten reevei* A. Adams & Reeve, 1850, *P. macassarensis* Chenu, 1845, *P. amaliae* Kobelt, 1887, *P. irregularis* G. B. Sowerby II, 1842, *P. cuneatus* Reeve, 1853, *Mimachlamys deliciosa* Iredale, 1939, *O. punctata* Gmelin, 1791, *Chlamys wilhelminae maculata* Bavay, 1904, *Pecten bednalli* Tate, 1887, *P. challengerii* Smith, 1891, *P. albolineatus* G. B. Sowerby II, 1842, and *P. lentiginosus* Reeve, 1853. Neotypes are designated for *Amusium magneticum* Röding, 1798, *Ostrea pedum* Röding, 1798, *Pleuronectia laevigata* Swainson, 1840, *Pecten funebris* Reeve, 1853, *Pecten roseopunctatus* Reeve, 1853, *P. elegantissimus* Deshayes, 1863, *P. quadriliratus* Lischke, 1870, and *Pecten (Amussium) milneedwardsi* Gregorio, 1898, and *Mesopeplum caroli* Iredale, 1929. A new combination is introduced for *Mimachlamys punctata* (Gmelin, 1791) (= *Pecten lentiginosus* Reeve, 1853).

**KEYWORDS.** new taxa; new records; new synonyms; distribution; terminology; Bivalvia; Pectinoidea

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## Introduction

Pectinoidea (scallops) are highly diverse, common marine bivalves whose almost circular, mostly radially ribbed shells are familiar to biologists, ecologists and shell collectors the world over. Many species are also of economic importance, as they are fished commercially throughout Australia, as almost everywhere else in the world. Species of Pectinidae (the more familiar shallow-water scallops) are relatively large and most are brightly coloured. In contrast, the much smaller scallops of the Cyclochlamydidae and Propeamussiidae (“glass scallops”) are mostly translucent and less colourful, and are less familiar than Pectinidae because of their deeper-water habitat. Nevertheless, they are remarkably diverse around Australia. The present revision primarily investigates the taxonomy of the Recent Australian pectinoid fauna at the species level. Apart from the brief ones of Pectinidae by Thornley (1967, 1968a, b), no comprehensive, critical review of Propeamussiidae, Cyclochlamydidae and Pectinidae from Australia and neighbouring seas has been published previously.

During the eighteenth and early nineteenth centuries, European scientific explorer-naturalists, visiting the unexplored regions of “Terra Australis”, brought “naturalia”, including undescribed pectinid molluscs, to their countries, mainly to Great Britain and France (Dance, 1986). Until 1819 these pectinids were left unnamed and it was Lamarck (1819) who described five species of Pectinidae (*Pecten bifrons*, *P. flabellatus*, *P. asperrimus*, *P. lividus* and *P. hexactes*) from the temperate region of Australia. This material was collected by a French expedition (1800–1804) to southwestern Australia and Tasmania (Dijkstra, 1994). Afterwards much Australian pectinid material was brought to Great Britain and described by British conchologists (Wood, G. B. Sowerby II), but mainly by Reeve (1852–1853), based on material from the collections of Cuming and Saul. In his “Conchologia Iconica”, Reeve (1852–1853) described 15 new species of Pectinidae (*Pecten strangei*, *P. fumatus*, *P. modestus*, *P. filusus*, *P. luculenta*, *P. cruentatus*, *P. prunum*, *P. funebris*, *P. ustulatus*, *P. spectrum*, *P. gloriosus*, *P. cumingii*, *P. leopardus*, *P. dringi* and *P. blandus*), mostly from Moreton Bay, Queensland (Loch, 1989) and a few from Bathurst Island, Northern Territory, probably supplied by Dring to Cuming. One of these newly described species, *Pecten pulchella*, was also described from Moreton Bay and supplied by Strange to Cuming. However, *Pecten pulchella* certainly has a wrong locality and does not occur around Australia (Dijkstra, 1996). One newly described species, also with erroneous locality, could have come from Australia. *Pecten pica* Reeve, 1852, with the erroneous locality “New Zealand”, is indistinguishable from the Queensland morph of *Pecten singaporena* G. B. Sowerby II, 1842 (*Volachlamys singaporena*; see below).

During the late nineteenth and early twentieth centuries, Australian conchologists such as Tate, Hedley, and others incidentally described new pectinoids, but Iredale was the author who paid the most attention to both the lower and higher taxa of Pectinidae. Between 1925 and 1949 he described 22 new genera and 19 new species. In 1967–1968 Thornley listed for the first time a critical review of the Australian pectinoids (55 species) in three articles (Thornley, 1967, 1968a, b) as a tool for a further detailed study. Thornley received advice from Mr D. Hall, who had an extensive

collection of Australian pectinids and was working on a monograph. Unfortunately his manuscript (now in NBC, together with his collection) never saw the light of day.

Until recently no identification guide to the Australian Bivalvia has been undertaken. However, two volumes on bivalves have been produced recently by Lamprell & Whitehead (1992) and Lamprell & Healy (1998), including 69 described and mostly figured pectinoid species (7 Propeamussiidae and 62 Pectinidae). Beu & Darragh (2001) revised the Cenozoic fossil Pectinidae of southern Australia, and named one species of *Mimachlamys* that occurs both in the Pleistocene fauna across southern Australia and in the Recent fauna of southern Western Australia. Most recently, Dijkstra & Marshall (2008) revised the Recent Pectinoidea of New Zealand, with results bearing on several of the species recorded here from Australia. We also take account of revised phylogenetic treatments of the Pectinoidea published by Waller (2006a, b, 2011) and several subsequent workers, in which the subfamilial and tribe position of several genera was adjusted.

Recent investigation of the Pectinoidea of Australia and neighbouring seas showed that the known fauna comprises 104 pectinoidean species (30 Propeamussiidae, 2 Cyclochlamydidae and 72 Pectinidae). They are compared here with similar species from the tropical Indo-West Pacific and temperate Australasian regions. Of these, seven species (5 Propeamussiidae and 2 Pectinidae) are new to science and 29 species (12 Propeamussiidae and 17 Pectinidae) are new records from Australia.

Classifications of the Pectinidae based on morphological characters and those based on molecular sequences have led to differing results in recent years. Waller (1986, 1991, 1993, 2006a, b, 2007, 2011) proposed a classification based mainly on newly recognized characters of the sculpture of the pre-radial (juvenile) disc of the left valve, on the microsculpture of the disc, and on the development of exterior radial ribbing on the disc. He revealed a logical evolutionary sequence in which the least specialized and stratigraphically earliest of modern scallops, originally identified as Chlamydinæ, tribe Chlamydini (here replaced by the earlier synonym Pedinæ, tribe Pedini) have irregular rib patterns, complex exterior microsculpture and unsophisticated internal and hinge characters. In contrast, the most specialized scallops (Pectininae, tribes Pectinini and Amusiini) have simple patterns of exterior sculpture with undivided radial ribs or no obvious radial sculpture, simple commarginal microsculpture, sharp-edged internal expressions of the exterior ribs (internal rib carinae), the most complex hinges of all scallops, and (in *Pecten*) the largest unsculptured juvenile stage of all scallops. The fossil record supports the validity of this evolutionary sequence. Pedini have a record since Mesozoic time, whereas *Pecten* is one of the youngest scallop genera, appearing in Europe only during the early Miocene and becoming widespread during Miocene and Pliocene time. Most of the smooth “saucer scallops” *Amusium*, *Euvola* and related genera evolved from *Pecten* and related genera. Despite this, several of the classifications of scallops suggested from molecular sequences (Barucca *et al.*, 2004; Puslednik & Serb, 2008) have indicated the opposite history of scallop evolution, concluding that Aequipectinini, Pectinini and Amusiini were the earliest-evolved scallops and Pedini were the most recent scallops to evolve. Some other classifications suggested from molecular

sequences (e.g., Matsumoto & Hayami, 2000) have arrived at the same classification as Waller's based on morphology. More recent studies (López-Piñón *et al.*, 2008; Alejandrino *et al.*, 2011; Feng *et al.*, 2011; Malkowsky & Klussmann-Kolb, 2012; Mynhardt *et al.*, 2014; Sherratt *et al.*, 2016; Serb, 2016; Serb *et al.*, 2017) have derived complex phylogenies with essentially the stratigraphically correct order of taxa, but several have the taxa of Pedinae in unexpected positions compared with those in Waller's (2006a) phylogeny. Puslednik & Serb (2008: fig. 3) demonstrated the strongly distinct phylogenies of scallops that can be derived from the same molecular sequences using different outgroups, and it seems to us that the classification of scallops based on such sequences is still at an early stage. Many more taxa need to be included before a phylogeny can be developed that reflects the real evolutionary history of the family. A good example is provided by the position of *Mesopeplum convexum* (Quoy & Gaimard, 1835) in Sherratt *et al.* (2016: fig. 2); it is basal to the subdivision into Pedinae and Pectininae, at a previously unrecognized level between *Delectopecten* (Camptonectinae) and all other Pectinidae. This suggests that a fundamental reclassification is required. Here we largely follow the classification established by Waller (1986, 1991, 1993, 2006a,b, 2007, 2011) and await a more final one based on molecular sequences before adopting any major changes to the classification of Pectinidae. Nevertheless, a few new generic positions were suggested to us by T. R. Waller, and we have repositioned a few genera accordingly (*Minnivola* and *Volachlamys* transferred to Mimachlamydini; *Serratovola* transferred to Aequipectinini). We have not followed T. R. Waller's suggestion that *Glorichlamys* should be transferred to Palliolinae, and we retain *Annachlamys* and *Ylistrum* in their recent positions in Pectinini and Amusiini respectively, realising that these positions likely will change in future.

In the synoptical classification of the Bivalvia by Carter *et al.* (2011: 9), the name Chlamydinae is replaced by Pedinae Bronn, 1862 and the new tribe Pedini is erected. Pedini is separate in this classification from Chlamydini, Crassadomini, Fortipectinini and Mimachlamydini, so presumably contains only *Pedum* Bruguière, 1792 (content not stated). Bronn (1862: 474, 477, 498) proposed a subfamily Pedana, including only *Pedum*, separate from Pectinana, in which he included *Amusium*, *Hinnites*, *Pecten*, "*Vola* (*Neithea*)" and *Hemipecten*. Bronn's (1862: pl. 41, figs 8A–C) illustrations of *Pedum spondyloideum* "Lmk." clearly show *P. spondyloideum* (Gmelin, 1791) as identified here. Here we recognize *Pedum* as a genus of Chlamydini, as used by Waller (1993: 203). Dufour *et al.* (2006: figs 1, 2) also demonstrated from molecular sequences that *Pedum spondyloideum* is most closely related to *Chlamys islandica* (Linnaeus, 1758) of the pectinids they studied, and falls within Chlamydini. Therefore, we follow priority and adopt Pedinae Bronn, 1862 in place of Chlamydinae von Teppner,

1922 and Pedini Bronn, 1862 in place of Chlamydini von Teppner, 1922. Carter *et al.* (2011: 11) also included Propeamussiidae in Suborder Entoliidina, Superfamily Entolioidea, well separated from Pectinoidea, a position that requires molecular substantiation. Here we retain Propeamussiidae in its more usual position in Pectinoidea.

## Material and methods

Pectinoid material used for this investigation derives from several sources. The majority is in the extensive collections of the Australian Museum in Sydney, the Western Australian Museum in Perth and the private reference collection of the first author (now part of NBC), to which are added the collections of the other major Australian museums, the collections of the Zoological Museum of Amsterdam (now in NBC), and several Australian private pectinid collections (see acknowledgments). Comparative material from the Indo-West Pacific and Australasian regions and type material was studied in the major European and Australian museums. All available literature on the Australian Pectinoidea has been consulted.

Higher taxa in this monograph are treated in the following sequence: type species, diagnosis, distribution and key to species. Species are treated in the sequence: synonymy, type material, material examined from Australia and neighbouring seas (clockwise starting from Queensland), description, dimensions of illustrated specimens, distribution and habitat, followed by comparative remarks. Comparative material from the Indo-West Pacific is enumerated from west to east and from north to south. Taxonomic and nomenclatural terminology used in this work is listed in the appendix.

Specimens under c. 10 mm in major dimension have been illustrated by scanning electron microscopy (SEM; most with a Jeol JCM-6000 Neoscope in GNS Science, Lower Hutt). This includes most Propeamussiidae, all Cyclochlamydidae, and most specimens of *Hyalopecten*, *Delectopecten*, *Palliolum* and *Haumea* in Pectinidae. Some specimens of *Propeamussium* and *Delectopecten* species were large enough to require light photography. All larger Pectinidae are illustrated in colour, supplemented with black-and-white photographs of specimens whitened with magnesium oxide to reveal details of the exterior sculpture, hinge, and other interior characters such as internal rib carinae. As far as possible, colour and black-and-white images of the same specimens have been prepared in matching figures. Morphological terminology mainly follows Waller (1978, 1984, 1991, 1993), Waller & Marincovich (1992), Beu & Darragh (2001) and Carter *et al.* (2012).

Records in the species distribution maps are marked by different symbols (circles, stars, triangles, squares) for different species. Closely similar coordinates are marked by one symbol. Records with coordinates lower than 10°N and greater than 156°E are not shown on the maps.

## Abbreviations and text conventions

Abbreviations for institutions and museums are as follows:

AM	Australian Museum, Sydney NSW, Australia; catalogue numbers prefixed "C."	QVM	Queen Victoria Museum and Art Gallery, Launceston TAS, Australia
ANSP	Academy of Natural Sciences, Philadelphia, USA	RGFD	private collection of Rika Goethaels & Fernand De Donder, Vilvoorde-Peutie, Belgium
CMC	Canterbury Museum, Christchurch, New Zealand	RGM	Rijksmuseum van Geologie en Mineralogie, Leiden (fossils now in Naturalis Biodiversity Centre), The Netherlands
GNS	GNS Science, Lower Hutt, New Zealand	RMNH	Now NBC, Naturalis Biodiversity Center, Leiden, The Netherlands
GW	private collection of Gary Wilson, Albany WA, Australia	SAM	South Australian Museum, Adelaide SA, Australia
HM	private collection of Hugh Morrison <i>q.v.</i>	SMTD	Senckenberg Naturhistorische Sammlung Dresden (formerly Staatliches Museum für Tierkunde), Dresden, Germany
HMP	private collection of Hugh Morrison, Kingsley WA, Australia	TCL	private collection of the late T. C. Lan, Taiwan
IGPS	Institute of Geology and Paleontology, Tohoku University, Sendai, Japan	TMH	Tasmanian Museum and Art Gallery, Hobart TAS, Australia
IOAS	Institute of Oceanology, Academia Sinica, Qingdao, China	UMZC	University Museum of Zoology, Cambridge, United Kingdom
KBIN	Royal Belgian Institute of Natural History, Brussels	UUZM	Uppsala University Museum of Evolution, Uppsala, Sweden
LMAD	Loebbecke Museum und Aquazoo, Düsseldorf, Germany	WAM	Western Australian Museum, Perth WA, Australia
LSL	Linnean Society, London, United Kingdom	ZMA	Zoological Museum of Amsterdam, Amsterdam [now part of NBC The Netherlands]
MHNG	Muséum d'Histoire Naturelle de Genève, Geneva, Switzerland	ZMB	Museum of Natural History, Berlin, Germany
MNHN	Muséum national d'Histoire naturelle, Paris, France	ZMUC	Zoology Museum, University of Copenhagen, Denmark
MSNP	Museo di Storia Naturale et del Territorio, Università di Pisa, Calci, Italy	ZSI	Zoological Survey of India, New Alipur, Kolkata, India
NBC	Naturalis Biodiversity Centre, Leiden, The Netherlands	Abbreviations of Australian states and surrounding seas:	
NHMUK	Natural History Museum, London [formerly BMNH], United Kingdom	AS	Arafura Sea
NIWA	National Institute of Water and Atmosphere, Wellington, New Zealand	CS	Coral Sea
NMNS	National Museum of Nature and Science, Tokyo, Japan	GBR	Great Barrier Reef
NMNZ	Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand	NSW	New South Wales, Australia
NMV	Museum Victoria, Melbourne VIC, Australia	NT	Northern Territory, Australia
NTM	Museum and Art Gallery of the Northern Territory, Darwin NT, Australia	QLD	Queensland, Australia
OUZM	Oxford University Zoology Museum, Oxford, United Kingdom	SA	South Australia
PD	private collection of Peter F. Duncan, Maroochydore QLD, Australia	TAS	Tasmania, Australia
PPO-LIPI	Puslitbang Oseanologi-LIPI [Research Center for Oceanography, Indonesian Institutes of Sciences, Jakarta, Indonesia]	TIS	Timor Sea
PRC	private collection of Phillip R. Crandall, Hawaii, USA	TS	Tasman Sea
		VIC	Victoria, Australia
		WA	Western Australia
		Abbreviations used in descriptions:	
		<i>D</i>	depth (greatest convexity of articulated valves)
		<i>H</i>	height (dorsal–ventral)
		<i>L</i>	length (anterior–posterior, orthogonal to <i>H</i> )
		<i>lv</i>	left valve(s) or upper valve(s)
		<i>pr</i>	paired (articulated) valves
		<i>rv</i>	right valve(s) or lower valve(s)

## Systematic Account

### Bivalvia

**Pteriomorpha Beurlen, 1944**

[emend. Boss, 1982]

**Eupteriomorpha Boss, 1982**

**Ostreoida Waller, 1978**

**Pectinina Waller, 1978**

**Pectinoidea Rafinesque, 1815**

[emend. Waller, 1978]

### Propeamussiidae Abbott, 1954

Propeamussiidae Abbott, 1954: 361, 369.

**Diagnostic characters.** Free or byssate Pectinoidea with outer foliated calcitic layer on left valve and outer prismatic calcitic layer on right valve, present on the main part of the disc; inner layer crossed-lamellar aragonite beyond pallial line, in some species almost to distal margins; byssal notch without ctenolium.

**Discussion.** Hertlein (1969: N350) placed *Propeamussium* de Gregorio, 1884 with the subgenus *Parvamussium* Sacco, 1897a, together with *Amusium* Röding, 1798 and *Korobkovia* Glibert & van de Poel, 1965 in his *Amusium* group, although noting that these genera may have been derived from different groups of Pectinidae. Abbott (1954), however, introduced a new family name Propeamussiidae, emended by Waller (1978: 353), for representative species of *Propeamussium*. Waller (1972b) compared the microstructure of the shells of Pectinidae and Propeamussiidae and described their evolutionary and functional significance. He pointed out that the extensive layer of prismatic calcite forming the outer surface of the right valve of Propeamussiidae is represented on only a very small umbonal area of the right valve in Pectinidae. Waller (1984) also included several other related genera in Propeamussiidae, viz. *Parvamussium* Sacco, 1897a, *Cyclopecten* Verrill, 1897, *Similipecten* Winckworth, 1932, and *Catillopecten* Iredale, 1939. Hayami (1988a) mentioned also *Polynemamussium* Habe, 1951 as an extant genus in Propeamussiidae, and treated *Parvamussium* as a synonym of *Propeamussium*. Subsequently, Hayami & Kase (1993: 54) raised *Parvamussium* in rank to a genus. Schein-Fatton (1985) introduced *Bathypecten* as a genus of Pectinidae, and Schein (1989) transferred it to the Propeamussiinae, which she regarded as a subfamily of Pectinidae, together with *Cyclopecten*, *Parvamussium*, *Propeamussium* and *Similipecten*. However, Dijkstra & Gofas (2004) considered *Bathypecten* to be a junior synonym of *Catillopecten*. Dijkstra & Maestrati (2012) introduced a new family Cyclochlamydidae for the genera *Cyclochlamys* and *Chlamydeila*, formerly placed in Propeamussiidae, together with a new genus *Micropecten* Dijkstra & Maestrati, 2012. As Hayami (1988b) and Waller (1991, 1993, 2006a) mentioned, the suprageneric classification of the Pectinoidea is still under study and not finalized. Currently *Propeamussium*, *Parvamussium*, *Cyclopecten*, *Similipecten* and *Catillopecten* are considered to be valid genera in Propeamussiidae. Table 1 compares the diagnostic characters of genera of Propeamussiidae and Cyclochlamydidae occurring in Australia.

**Table 1.** Morphological characters of genera of Propeamussiidae and Cyclochlamydidae occurring in Australia.

characters	<i>Propeamussium</i>	<i>Parvamussium</i>	<i>Cyclopecten</i>	<i>Similipecten</i>	<i>Catillopecten</i>	<i>Cyclochlamys</i>	<i>Chlamydeila</i>
size	10–85 mm	5–20 mm	3–20 mm	5–25 mm	10–20 mm	1–2 mm	1–6 mm
shape	orbicular to oval	orbicular to oblique	orbicular to oblique	(sub) orbicular	orbicular	(sub) orbicular	orbicular to oblique
lateral gape	present	absent	absent	absent	absent	absent	absent
byssal notch	absent	present	present	present	present	present	present
auricles	equal or nearly so	unequal	unequal	unequal	unequal	unequal	unequal
internal ribs	early ontogeny to centre or submarginal	commence later extend to marginal apron	absent or rudimentary in most species	absent in most species	absent	absent	absent
sculpture lv	weak commarginal, radial or reticulate	commarginal, radial or reticulate	commarginal, radial or reticulate	commarginal, radial or smooth	commarginal or nearly smooth	commarginal, radial or reticulate	commarginal or smooth
sculpture rv	commarginal	commarginal	commarginal	absent	weak commarginal	radial or smooth	smooth

### Key to genera of Propeamussiidae occurring in Australia

- 1 Shell with auricles equal in size, lacking byssal notch in adult, internal riblets commencing early, and external sculpture weak ..... *Propeamussium*
- Shell with unequal auricles, and with byssal notch and internal riblets ..... 2
- 2 Shell prominently commarginally sculptured on rv, internally with riblets commencing after early growth stage ..... *Parvamussium*
- Shell of most specimens lacking internal riblets ..... 3
- 3 Shell prominently radially and/or commarginally sculptured externally, with vesicles on many specimens; internal riblets lacking from most specimens, rudimentary on a few ..... *Cyclopecten*
- Shell lacking commarginal sculpture on rv ..... 4
- 4 Shell with raised anterior auricle and broad hinge dentition ..... *Similipecten*
- Shell commarginally undulated ..... 5
- 5 Shell flattened, commarginally sculptured on both valves ..... *Catillopecten*

#### *Propeamussium* de Gregorio, 1884

*Propeamussium* de Gregorio, 1884: 119 (proposed as a subgenus of *Pecten*). Type species (by original designation): *Pecten (Propeamussium) ceciliae* de Gregorio, 1884; Miocene, Sicily, Italy.

*Paramussium* Verrill, 1897: 72. Type species (by original designation): *Amussium dalli* E. A. Smith (1885: 308); Recent, off Bermuda, W Atlantic, 796 m.

*Occultamussium* Korobkov, 1937: 56 (proposed as a subgenus of *Amussium*). Type species (by original designation): *Pecten semiradiatus* Mayer, 1861; upper Eocene, Tyrol, Austria.

*Pseudopalliorum* Oyama, 1944: 244 (proposed as a subgenus of *Propeamussium*). Type species (by original designation): *Pecten interradiatus* Gabb (1869: 199, 251); Eocene, E of New Idria, San Bernardino County, California, U.S.A.

*Bathyamussium* Oyama, 1951: 79 (proposed as a subgenus of *Ctenamussium*). Type species (by original designation): *Amussium jeffreysii* E. A. Smith (1885: 310); Recent, N Sulu Sea, Philippine Islands, 686 m.

*Micramussium* Oyama, 1951: 80 (proposed as a subgenus of *Ctenamussium*). Type species (by original designation): *Ctenamussium (Micramussium) siratama* Oyama (1951: 80); Recent, Sagami Bay, Japan, 234–291 m.

*Flavamussium* Oyama, 1951: 81 (proposed as a subgenus of *Parvamussium*). Type species (by original designation): *Amussium caducum* E. A. Smith (1885: 309); Recent, W of Luzon, Philippine Islands, 1280 m.

*Luteamussium* Oyama, 1951: 82. Type species (by original designation): *Amussium sibogai* Dautzenberg & Bavay (1904: 207); Recent, Bali Sea, Indonesia, 289 m.

**Diagnosis.** Shell almost equivalve, fragile, rather small in most species, translucent in most species, laterally compressed, gaping along lateral margins; left valve smooth or sculptured with fine radial and/or commarginal riblets or striae, right valve with commarginal lines or lirae; auricles almost equal to equal; byssal notch moderately slight; ctenolium lacking; internal riblets commence in early ontogeny and extend to near the central region or to the pallial line.

**Distribution.** Eocene?–Recent. Cosmopolitan, 275–2740 m (Waller, 1971). Waller (2006a) thought that Jurassic species previously included in *Propeamussium* would be better assigned to *Parvamussium*. Schneider *et al.* (2013: 221) also

stated that “All Jurassic to Oligocene propeamussiids that have been studied thoroughly to date belong to *Parvamussium* ... *Propeamussium* did not evolve earlier than the Miocene.” D. Jablonski (pers. comm. 27 Jun 2017) pointed out that *P. interradiatum* (Gabb 1869), occurring in the Lutetian–Bartonian (Eocene) Tejon Formation, California, USA (Stewart, 1930: 123; Addicott, 1971; Moore, 1984: 7) “seems a potential species of *Propeamussium* given the equal auricles and nature of the internal ribs”. Further study is required of pre-Miocene records of these subtly distinct genera before the range of *Propeamussium* is certain, but a range from at least Eocene onwards seems likely.

**Discussion.** Grau (1959) restated the original diagnosis of *Propeamussium* de Gregorio, 1884, and of the type species *P. ceciliae*, with a translation into English. The type specimen subsequently was figured by de Gregorio (1898: pl. 4, figs 10–12). Gregorio’s figures 13 and 14, also mentioned by Grau (1959: 9), do not show the type species. Hertlein (1969: N350) supposedly refigured the right [sic] valve of the holotype, although North (1951b: 123) reported that he could not trace the holotype.

Gräu (1959: 9) placed *Paramussium*, *Pseudopalliorum*, *Flavamussium* and *Luteamussium* in the synonymy of *Propeamussium*, and Hertlein (1969: N350) subsequently added also *Occultamussium* and *Actinopecten* Bonarelli, 1951 with a question mark. Hayami (1988a) enumerated also *Parvamussium* Sacco, 1897a (type species: *Pecten duodecimlamellatus* Bronn, 1832: 624), *Ctenamussium* [sic] Iredale, 1929 (type species: *Amussium thetidis* Hedley, 1902: 304), *Glyptamussium* Oyama, 1944 [sic] (= *Glyptamussium* Iredale, 1939) (type species: *Amussium torresi* E. A. Smith, 1885: 311), *Bathyamussium* Oyama, 1951 (type species: *Amussium jeffreysii* E. A. Smith, 1885: 310) and *Micramussium* Oyama, 1951 (type species: *Ctenamussium (Micramussium) siratama* Oyama, 1951: 80) as synonyms of *Propeamussium*. The type species of *Ctenamussium* and *Glyptamussium* are morphologically inseparable from *Parvamussium*, whereas the type species of *Bathyamussium* and *Micramussium* are more nearly similar to the morphological characters of *Propeamussium*.

For the distinctive shell microstructure of Propeamussiidae see Waller (1972b) and Schein (1989).



Key to species of *Propeamussium* from Australia

- 1 Shell c. 50 mm high, slightly oblong, hyaline, lv almost smooth, commarginal sculpture near ventral margin, 8–10 delicate internal riblets ..... *P. alcocki*  
 — Shell oblong, auricles somewhat raised ..... 2
- 2 Shell c. 25 mm high, hyaline, brownish, lv smooth and glossy, 10 internal riblets slightly nodulose at distal ends ..... *P. caducum*  
 — Shell small, circular, flattened, lv with reticulate sculpture ..... 3
- 3 Shell c. 15 mm high, opaque, 12 strong internal riblets without distinct terminal nodules ..... *P. meridionale*  
 — Shell large, circular, lv with delicate commarginal growth lines ..... 4
- 4 Shell c. 55 mm high, hyaline, creamy or brownish, lv almost smooth, 8 strong, broad internal riblets ..... *P. sibogai*  
 — Shell small, circular, flattened, weakly sculptured ..... 5
- 5 Shell c. 19 mm high, hyaline, pale brown or whitish, lv with very weak reticular sculpture in early ontogeny, 7–9 internal riblets ..... *P. siratama*  
 — Shell large, circular, rather solid, lv radially sculptured ..... 6
- 6 Shell c. 60 mm high, opaque, whitish, lv with delicate radial sculpture in early growth stage, commarginal lamellae near ventral margin, 10 internal riblets ..... *P. watsoni*

***Propeamussium alcocki* (E. A. Smith, 1894)**

Figs 1A,D, 2

*Amussium alcocki* Smith, 1894: 172, pl. 5, figs 15–16; Alcock & Anderson, 1897: pl. 2, figs 3–3a; Alcock, 1902: 282, fig. 79; Smith, 1906: 255; Thiele & Jaeckel, 1931: 8; Winckworth, 1940: 26.

*Propeamussium alcocki* (Smith).—Abbott & Dance, 1982: 303; Dijkstra, 1995b: 13, figs 1–4, 133–137; Dijkstra & Kastoro, 1997: 247, figs 1–4; Dijkstra & Marshall, 1997: 4, pl. 1, figs 1–6; Dijkstra, 2001: 74; Dijkstra & Maestrati, 2008: 78; Dijkstra & Janssen, 2013: 183, figs 4–6.

**Type data.** Lectotype (pr) ZSI 6154/9, designated by Dijkstra (1995b: 13), 2 paralectotypes (pr): AM C.003278, NHMUK1894.9.11.1, NMW1955.158.785. Type locality: Laccadive Sea, 15°02'N 72°34'E, alive, 1353 m (*Investigator* stn 105).

**Comments on type data.** The type specimens are somewhat damaged near the margins, and the right valves of three of them (ZSI, NHMUK, NMW) have been restored.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Swain Reefs, 23°15'S 153°18'E, alive, 424 m (6 pr, QM MO33657). WESTERN AUSTRALIA: Exmouth, North West Cape, off Yardie Creek, 400–450 m, trawled alive on coral & rubble bottom (1 pr, HMP0234).

For records from the Arafura Sea (Tanimbar Islands), Coral Sea (Chesterfield Islands), northern Tasman Sea (Norfolk Island), New Caledonia, Wallis and Futuna Islands, Vanuatu, Solomon Islands, Fiji and Tonga, see Dijkstra (1995b: 13), Dijkstra & Kastoro (1997: 247), Dijkstra & Marshall (1997: 74), Dijkstra (2001: 74) and Dijkstra & Maestrati (2008: 79).

**Description.** Shell fragile, hyaline, up to c. 50 mm high, semicircular, inequivalve, inequilateral, left valve slightly more convex than right, prodissoconch c. 240 µm in height.

Left valve with a few commarginal growth lines, and 1–3

delicate radial lirae near posterior margin. Anterior margin more convex than posterior. Auricles equal, smooth, anterior margin somewhat raised. Eight to 10 internal riblets entering from near resilifer to two-thirds length of adult disc, somewhat finer than on right valve; one auricular ridge on each side.

Right valve with wide-set commarginal lirae, commencing at c. 3 mm shell length, with granulate interstitial microsculpture. Auricles with narrow commarginal striations, prominent scales on posterior and anterior dorsal margins. Resilifer triangular. No byssal notch.

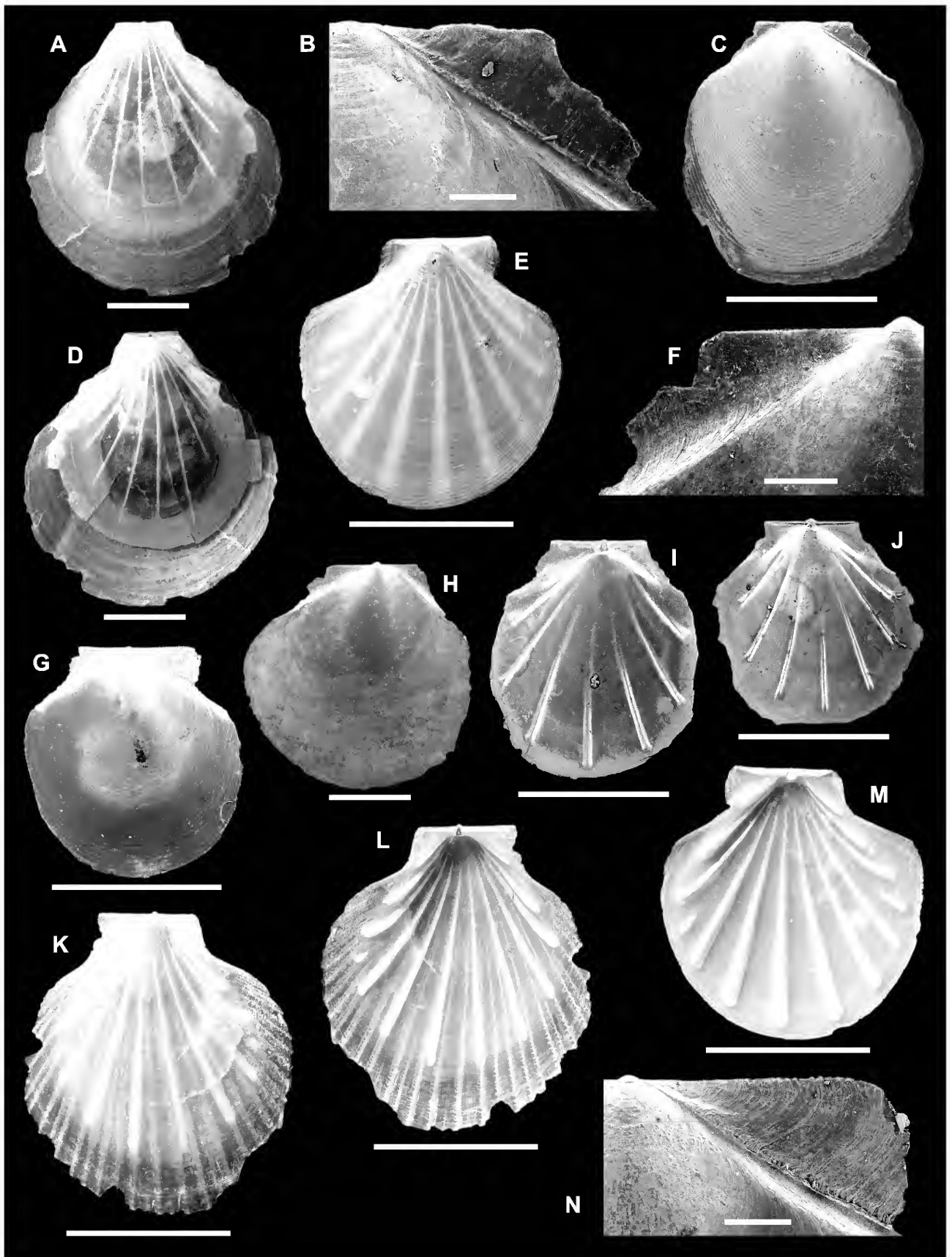
**Dimensions.** Illustrated specimen, WA, Exmouth, off Yardie Creek, 400–450 m (HMP0234): rv: H 26.1 mm (ventral skirt broken off), L 26.1 mm; lv: H 33.4, L 31.2 mm; D 4.3 mm.

**Habitat.** Living in the bathyal zone free on soft sediment, muddy sand or sandy mud.

**Distribution.** Gulf of Aden, 1469 m, Laccadive Sea: 1337–1410 m, Bay of Bengal, 1026 m (Knudsen, 1967); Arafura Sea, Indonesia, 884–1266 m (Dijkstra & Kastoro, 1997; Chesterfield Islands, Coral Sea, 650 m, dead; Loyalty Islands, 780–800 m (Dijkstra, 1995b); New Caledonia, 708–860 m (Dijkstra, 1995b; Dijkstra, 2001); Wallis and Futuna Islands, 1015–1300 m; Vanuatu, 690–750 m (Dijkstra, 2001); Norfolk Island, 949–952 m (Dijkstra & Marshall, 1997), Solomon Islands, 1001–1012 m; Fiji, 427–787 m; Tonga, 824 m (Dijkstra & Maestrati, 2008). Maximum depth range of live-taken specimens is 424–1469 m. Present specimens from Australia alive at 424 m.

**Remarks.** *Propeamussium alcocki* is morphologically close to *Propeamussium watsoni* (E. A. Smith, 1885), which is known from similar localities (Dijkstra, 1995b), but differs somewhat in transparency (*P. alcocki* hyaline, *P. watsoni* opaque and whitish), in shape (*P. alcocki* slightly more elongate, *P. watsoni* circular), in texture of the left valve (*P. alcocki* smooth, *P. watsoni* with delicate radial sculpture in





**Figure 1.** *A, D*, *Propeamussium alcocki* (Smith), pair, HMP0234, off Yardie Creek, Exmouth, WA, 400–450 m; lv exterior (A), rv exterior (D). *B, C, I*, *Propeamussium caducum* (Smith), rv only, AM C.165479, FRV *Kapala* stn K77-03-09, off Ulladulla, NSW, 35°30'–35°32'S 150°48'–150°47'E, 549 m; anterior auricle exterior (B), exterior (C), interior (I). *E, K–M*, *Propeamussium investigatoris* (Smith), separate valves, QM MO18021d, E of GBR, QLD, 17°35'S 146°53'E, 458–500 m; rv exterior and interior (E, M), lv exterior and interior (K–L). *F–H, J, N*, *Propeamussium siratama* (Oyama, 1951), separate valves, AM C.165218, E of GBR, QLD, 18°11.01'S 147°25.5'E, 472–490 m; lv anterior auricle exterior (F), rv exterior (G), lv exterior (H), lv interior (J), rv anterior auricle exterior (N). Scale bars represent 10 mm (A, D–E, K–M), 0.5 mm (B, F, N), 5 mm (C, G–J).

early ontogeny), and in internal riblets (*P. alcocki* delicate and weak, *P. watsoni* more solid).

Knudsen (1967: 281) considered the two names to be synonymous, with variations in shape (circular to almost oblong), commarginal sculpture of the right valve (varies in position), and radial sculpture of the left valve (varies in development) of examined material from the Indian Ocean. These variations are not observed in material from the Southwest Pacific (Dijkstra, 1995b: 13), and we consider these to be two separate species.

### *Propeamussium caducum* (E. A. Smith, 1885)

Figs 1B–C, I, 2

*Amussium caducum* Smith, 1885: 309, pl. 23, figs 1–1c; Smith, 1894: 173; Smith, 1895: 18; Smith, 1904: 13; Smith, 1906: 255; Melville & Standen, 1907: 807; Thiele & Jaeckel, 1931: 7; Winckworth, 1940: 26.

*Amussium electrum* Pelseener, 1911: pl. 12, figs 4A–B, 5 [syn. nov.].

*Amussium weberi* Dautzenberg & Bavay, 1912: 32, pl. 28, figs 9–13.

*Propeamussium nakazawai* Kuroda, 1932: 87, figs 101–102 (*nomen nudum*).

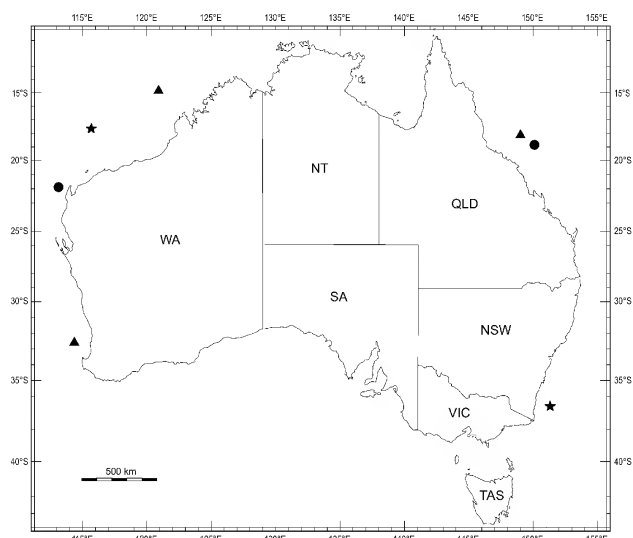
*Parvamussium (Flavamussium) caducum* (Smith).—Oyama, 1951: 81, pl. 13, figs 11–12; Kira, 1967: 138, pl. 49, fig. 15.

*Propeamussium caducum* (Smith).—Hayami, 1988a: 476; Okutani *et al.*, 1989: 58, figs; Dijkstra, 1991: 6, figs 1–2; Dijkstra, 1995b: 15, figs 9–10, 129–132; Dijkstra & Kastoro, 1997: 247, figs 5–8; Hayami, 2000: 913, pl. 454, fig. 1; Dijkstra, 2001: 75; Wang, 2002: 152, pl. 2, fig. 2; Dijkstra & Maestrati, 2008: 82; Xu & Zhang, 2008: 77, fig. 208; Huber, 2010: 223; Dijkstra & Janssen, 2013: 187, figs 10–12; Dijkstra & Maestrati, 2015: 589, figs 1E–F.

*Propeamussium (Propeamussium) caducum* (Smith).—Wang, 1984a: 599, pl. 1, figs 3–4, text fig. 2; Dijkstra, 1990a: 9–10.

**Comments on synonyms.** Synonymy established by Oyama (1951), and subsequently followed by Knudsen (1967) and Habe (1977).

**Type data.** *Amussium caducum* Smith: lectotype (pr) designated by Dijkstra (1995b: 17) NHMUK 1887.2.9.3310,



**Figure 2.** Distribution of *Propeamussium alcocki* (Smith) (circles), *P. caducum* (Smith) (stars) and *P. siratama* (Oyama) (triangles).

4 paralectotypes (pr) NHMUK 1887.2.9.3311/1–4. Type locality: Philippine Islands, W of Luzon, 12°21'N 122°15'E, alive, 1280 m (*Challenger* stn 207).

*Amussium electrum* Pelseener, 1911: holotype (only soft parts figured) KBIN not traced (see Remarks).

*Amussium weberi* Dautzenberg & Bavay: lectotype (pr) designated by Dijkstra (1995b: 17), figured by Dautzenberg & Bavay (1912: figs 9–10, 12–13 [text incorrect, should be “Mer de Bali, drag. 538 m”]) ZMA Moll.3.12.013 (*Siboga* stn 316); paralectotypes: 5 pr KBIN IG10.591 (stn 314), pr MCZ064492 (stn 314), 2 v RMNH.MOL.112107 (stn. 316), 2 pr + 7 v ZMA Moll.3.12.014 (stn 316), pr ZMA Moll.3.12.015 (stn 85), pr ZMA Moll.3.12.016 (stn 87), 4 v ZMA Moll.3.12.017 (stn 212), 7 v ZMA Moll.3.12.018 (stn 314). Type locality: Indonesia, Bali Sea, 7°19.4'S 116°49.5'E, alive, 538 m (*Siboga* stn 316).

*Propeamussium nakazawai* Kuroda: holotype not seen. Type locality: Japan, Suruga Bay, alive, 549–732 m.

**Comments on type data.** The anterior and posterior margins of the left valve and the marginal apron of the right valve of the lectotype of *Amussium caducum* are broken off; consequently the measurements differ slightly from the original ones. The ventral apron (skirt) of the right valve is thin and frequently broken on all *Propeamussium* species.

Although Kuroda (1932: 87) proposed a new species name with type figures, measurements and type locality, it was not described nor compared with any other species. According to ICZN (1999, Article 13.1), *Propeamussium nakazawai* is a *nomen nudum*.

**Additional material examined.** —AUSTRALIA: NEW SOUTH WALES: off Ulladulla, 35°30'–35°32'S 150°48'–150°47'E, dead, 549 m (4 v, C.165479). WESTERN AUSTRALIA: off Port Hedland, 160 mls NW, 18°42'S 116°21'E–116°23'E, alive, 694–704 m (1 pr, WAM 552.91). —JAPAN: Aichi Prefecture, Mikawa, Issiki, alive, 200–250 m (3 pr, ZMA Moll.144707); off Kii Peninsula, Wakayama, alive, 137–183 m (1 pr, ZMA Moll.144720); off Mie Prefecture, alive, 400 m (3 pr, ZMA Moll.141585). —PHILIPPINE ISLANDS: off Cebu, alive, 680 m (1 pr, ZMA Moll.144706). —INDONESIA: N of Sumbawa, Bay of Sanggar, 08°18.7'S 118°18'E, alive, 500–550 m (2 pr, ZMA Moll.144585); Tanimbar Islands, 08°36'S 131°33'E, alive, 676–699 m (12 pr, ZMA Moll.139806). —NEW CALEDONIA: S New Caledonia, 22°10'S 166°02'E, alive, 650–724 m (1 pr, ZMA Moll.146247).

**Description.** Shell fragile, glossy, translucent or opaque, up to c. 25 mm high, inequivalve, equilateral, somewhat higher than wide, left valve slightly more convex than right, with lateral gape, umbonal angle c. 90°, prodissoconch c. 215 µm in height (Knudsen, 1967). Cream or brownish, right valve more deeply coloured than left.

Left valve smooth, with commarginal growth lines, no radial striations. Auricles small, also smooth, somewhat raised near margins.

Right valve with wide-set commarginal lirae, commencing at 3 mm shell height and extending to submarginal area, with interstitial microscopic radial scratches. Auricles with very delicate commarginal striae, prominent scales produced on marginal areas of hinge. Dorsal margin straight near umbo, then rising near anterior and posterior ends. Internal riblets 10 in number in most specimens, 9 or 11 in a few, slightly nodulose at distal ends. Riblets of right valve somewhat more prominent than in left valve. No byssal notch.

**Habitat.** Living in the bathyal zone, free on soft sediment (sand and mud).

**Distribution.** Gulf of Aden, 1295 m; Zanzibar area, 786 m, now extended further southwards to the northwestern area of Madagascar, 243–1020 m; Arabian Sea and Bay of Bengal,

691–1483 m; Japanese waters, c. 200 m and Philippine Islands, 548–1500 m (Knudsen, 1967; Dijkstra & Maestrati, 2015); Indonesian Archipelago, 452–840 m (Knudsen, 1967; Dijkstra, 1991; Dijkstra & Kastoro, 1997); New Caledonia, 450–960 m (Dijkstra, 1995b, 2001); Vanuatu, 602–650 m (Dijkstra, 2001); Solomon Islands, 367–696 m (Dijkstra & Maestrati, 2008). Now also known from Australia (New South Wales and Western Australia). Present material from Australia alive at 694–704 m. Maximum depth range of live-taken specimens is c. 200–1500 m.

**Remarks.** Pelseneer (1911) did not describe or figure the shell of *Amusium electrum*; he described and figured only the soft parts, which he had used for his comprehensive anatomical study. These valves and soft parts have not been recovered in the KBIN. The specific epithet is probably reduced from Bavay's manuscript name *Amusium electricum* [in KBIN], which he later changed to *Amusium weberi*. However, as the anatomy was described by Pelseneer (1911), *A. electrum* is an available name, a further synonym of *P. caducum*. *Propeamusium weberi* is morphologically similar to *P. caducum*, although in typical material the coloration (*P. caducum* hyaline and whitish, *P. weberi* hyaline and creamy) and internal riblets (*P. caducum* 8, *P. weberi* 7) are slightly different. However, intermediate variations are also observed.

*Propeamusium caducum* is a **new record** for Australia and in all morphological characters Australian specimens are identical to the type specimens from the Philippine Islands.

### *Propeamusium investigatoris* (E. A. Smith, 1906)

Figs 1E,K–M, 3

*Amusium investigatoris* Smith, 1906: 255.

*Amusium margaritiferum* Dautzenberg & Bavay, 1912: 36, pl. 27, figs 15–18.

*Propeamusium maorium* (Dell, 1956).—Dijkstra, 1995b: 18, figs 11–14; Dijkstra & Marshall, 1997: 77, pl. 2, figs 1–5 (see also Dijkstra, 2001: 76) (misidentification).

*Propeamusium investigatoris* (Smith).—Dijkstra & Kastoro, 1997: 248, figs 11–15; Dijkstra, 2001: 75, figs 1–4; Dijkstra & Marshall, 2008: 2, figs 1, 2A–E; Dijkstra & Maestrati, 2008: 82; Spencer *et al.*, 2009: 198.

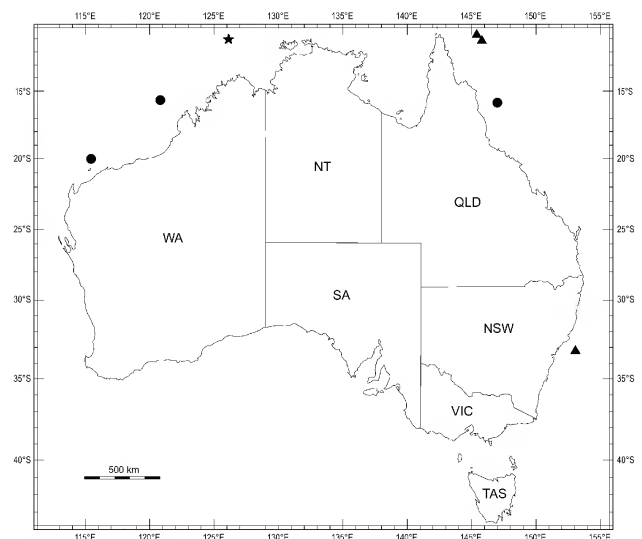
**Type data.** *Amusium investigatoris*: lectotype (pr) ZSI M835/1, designated by Dijkstra & Kastoro (1997: 250), 2 paralectotypes (pr) NHMUK 1906.10.12.99–100. Type locality: India, W of Travancore, 08°37'N 75°37'E, alive, 410–519 m (*Investigator* stn 248). For comments on type material see Dijkstra & Kastoro (1997: 250).

*Amusium margaritiferum*: holotype (pr) ZMA Moll.3.12.021. Type locality: Indonesia, Moluccas, channel between Makjan and Halmaheira, 0°23.8'N 127°29'E, alive, 472 m (*Siboga* stn 137).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: E of GBR, 17°35'S 146°53'E, alive, 458–500 m (3 pr + 1 v, QM MO18021; 1 pr, QM MO17763 [in part]). WESTERN AUSTRALIA: off Barrow Island, 375–400 m, alive in sponges on rubble and mud (1 pr, HM) [smooth var.]; W of Lacepede Islands, approx. 16°55'S 119°52'E, 400–450 m, dredged alive on fine mud (1 pr, HM).

**Description.** Shell up to 25 mm high, fragile, semi-translucent, oval to circular, inequivalve, equilateral, weakly inflated, left valve more convex than right, umbonal angle 100–110°. Prodissoconch c. 220 µm high. Left valve orange-tinted, right valve whitish.

Left valve sculptured with many unevenly spaced



**Figure 3.** Distribution of *Propeamusium investigatoris* (Smith) (circles), *P. sibogai* (Dautzenberg & Bavay) (star) and *P. watsoni* (Smith) (triangles).

radial riblets, squamous in late growth stage. Latticed microsculpture only in early growth stage (up to c. 10 mm in height). Anterior and posterior auricles with 7–10 delicate squamous radial riblets, weaker on right valve.

Right valve with fine, evenly spaced commarginal lamellae. Internal riblets 10 on most specimens, some with 2–4 intercostal rudimentary riblets near the margin and 2 auricular riblets. Dorsal margin straight. Resilifer triangular. Byssal notch and fasciole lacking.

**Dimensions.** Illustrated specimen, Qld, E of GBR, 17°35'S 146°53'E, alive, 458–500 m (QM MO18021), 2 separate valves: rv: H 16.7, L 16.2; lv: H 18.7, L 16.4 mm; largest lv (incomplete ventral skirt; not illustrated): H 18.9, L 20.1 mm.

**Habitat.** Living in the bathyal zone, free on soft sediment (sand and mud).

**Distribution.** Northern Indian Ocean, 410–519 m (Smith, 1906); Indonesian Archipelago, 176–466 m (Dijkstra & Kastoro, 1997); Coral Sea, New Caledonia and Loyalty Islands, 600–960 m [as *Propeamusium maorium*] (Dijkstra, 1995b, 2001); Norfolk Island and Kermadec Islands, 512–549 m [as *Propeamusium maorium*] (Dijkstra & Marshall, 1997); Vanuatu, 602–650 m (Dijkstra, 2001); New Zealand, as far south as the Bay of Plenty (off Plate I., 37°30'S 176°48'E), 292–621 m, living at 337–585 m (Dijkstra & Marshall, 2008: 2, fig. 1); Solomon Islands, 367–500 m; Fiji, 395–699 m and Tonga: 395–710 m (Dijkstra & Maestrati, 2008). Present material from Australia living at 458–500 m.

**Remarks.** The present specimens from Australia differ slightly from the type material in having somewhat finer radial sculpture on the left valve, in lacking the latticed microsculpture in early ontogeny, and by the more whitish colour of the left valve (type material orange-tinted). We are grateful to Gary Rosenberg for pointing out that the name *investigatoris* is the genitive form of the noun “investigator” and is not declinable.

For comparison with *Propeamusium jeffreysii* (Smith, 1885) see Dijkstra & Kastoro (1997: 250).

*Propeamusium investigatoris* is a **new record** for Australia.

***Propeamussium meridionale* (E. A. Smith, 1885)**

Figs 4D–E, G–H

*Amussium meridionale* Smith, 1885: 316, pl. 24, figs 1–1a.  
*Amusium (Propeamussium) [sic] malpelonium* Dall, 1908: 405, pl. 6, fig. 9.

*Propeamussium meridionale* (Smith).–Grau, 1959: 12, pl. 1; Knudsen, 1970: 94, pl. 12, figs 5–9, text-fig. 58; Dell, 1990: 37; Dijkstra, 1995b: 19, figs 15–18, 143–146 [lectotype]; Dijkstra, 2001: 78; Dijkstra & Marshall, 2008: 3, figs 1, 3A–G; Dijkstra & Maestrati, 2008: 83; Spencer *et al.*, 2009: 198; Dijkstra & Janssen, 2013: 187, figs 13–14; Dijkstra & Maestrati, 2013b: 470.

*Propeamussium malpelonium* (Dall).–Grau, 1959: 14, pl. 2, fig. 1.

*Verlamussium [sic] meridionale* (Smith).–Powell, 1960: 175.  
*Propeamussium (Propeamussium) malpelonium* (Dall).–Clarke, 1962: 59.

*Verlamussium [sic] meridionale* (Smith).–Clarke, 1962: 60.  
*Amussium meridionale* Smith.–Knudsen, 1967: 277, pl. 1, fig. 16, text fig. 17.

*Amusium (Propeamussium) [sic] malpelonium* Dall.–Boss *et al.*, 1968: 197.

*Propeamussium (Propeamussium) meridionale* (Smith).–Dijkstra, 1990a: 2, 9, pl. 1, figs 1–2.

**Type data.** *Amussium meridionale*: lectotype (pr) NHMUK 1887.2.9.3337, designated by Dijkstra (1995b: 19), 2 paralectotypes (lv) NHMUK 1887.2.9.3335/1–2. Type locality: Southern Indian Ocean, 50°01'S 123°E, alive, 3292 m (*Challenger* stn 158).

*Amusium (Propeamussium) [sic] malpelonium*: 16 syntypes (7 pr + 9 v) USNM122871, type locality: Panama, SW of Isla Jicarón, 06°17'N 82°05'W, alive, 3058 m (*Albatross* stn 3360); 17 syntypes (8 pr + 9 v) USNM122872, type locality: Panama, S of Punta Burica, 06°10'N 83°06'W, alive, 2690 m (*Albatross* stn 3361); 20+ syntypes (pr) USNM122873, type locality: Colombia, SW of Isla De Malpelo, 02°35'N 83°53'W, alive, 3354 m (*Albatross* stn 3374); 6 syntypes (pr) USNM122874, type locality: Colombia, NE of Isla de Malpelo, 04°56'N 80°52'30"W, alive, 3241 m (*Albatross* stn 3381).

For comments on the type material of *Propeamussium meridionale* see Dijkstra (1995b: 19), and for *P. malpelonium* see Kabat (1996: 13).

**Extralimital material examined.** There are no records from the continental shelf of Australia. Smith (1885: 316) recorded *Propeamussium meridionale* from *Challenger* Expedition stn 158 (50°01'S 123°04'E) in the northern region of the Southern Ocean, south of Western Australia in 1800 fathoms [3292 m], outside the continental shelf of the mainland. —NEW CALEDONIA: 24°28'S 168°08'E, 2160 m, alive (2 pr, ZMA Moll.145142). —TASMAN SEA: Lord Howe Rise, 27°13.34'S 160°43.41'E, 1989 m, grey ooze, alive (1 pr, C.165413); 36°55.7'S 159°31.5'E, 4954–4981 m, alive (2 pr, ZMA Moll.145035). —NEW ZEALAND: Three Kings Rise, Tasman Basin, and Bounty Trough (to 46°38.80'S 178°30.03'E, 2780 m), living at 760–4981 m (Dijkstra & Marshall, 2008: 5, fig. 1).

**Description.** Shell up to c. 15 mm high, fragile, somewhat inequivalve, almost circular, left valve slightly more convex than right valve, auricles equal, umbonal angle about 120°. Prodissoconch c. 200 µm high (Knudsen, 1967). Pellucid white.

Left valve sculptured with delicate radial lirae, commencing at 3 mm shell length, extending almost to ventral margin. Prominent commarginal lamellae extend to ventral margin, intersected by radial lirae to produce a somewhat reticulate sculpture. Auricles equal, with antimarginal striae. Some delicate lamellae near anterior and posterior margins.

Right valve covered with evenly spaced commarginal lirae, more close-set near margins. Auricles differently sculptured: anterior with more prominent antimarginal lirae than posterior, commarginal lamellae present near dorsal margin. Internal riblets variable in number, 12 in most specimens, without distinct terminal nodules. Dorsal margin straight with fine scales along margin. Resilifer triangular. No byssal notch.

**Habitat.** Living in the bathyal and abyssal zones, free on soft muddy bottoms.

**Distribution.** Southern Western Australia, 3292 m; East of Marion Island, Indian Ocean, 2516 m (Smith, 1885); northern Arabian Sea, 1893 m; Zanzibar area, East Africa, 2926 m; Maldives Islands, 1829–2051 m; Gulf of Aden, 2000 m (Knudsen, 1967); Indian Ocean, 3390–4820 m; Tasman Sea, 4670 m; Kermadec area, 2470–2640 m (Knudsen, 1970); Chesterfield Islands, Coral Sea, 1100 m; New Caledonia, 690–920 m, 2160–2470 m, and Loyalty Islands, 760–2350 m (Dijkstra, 1995b, 2001);

Wallis and Futuna Islands, 700–900 m; Vanuatu, 641–786 m (Dijkstra, 2001); Norfolk Ridge, 923 m (dead); Fiji, 650–707 m; Tonga, 200–983 m (dead) (Dijkstra & Maestrati, 2008). The maximum depth range of live-taken specimens is 641–4954 m. Present specimens from the Tasman Sea living at 1989 m and 4954 m.

**Remarks.** Knudsen (1970: 96) considered that the present species is morphologically identical to *Propeamussium malpelonium* (Dall, 1908), recorded from abyssal depths in the tropical eastern Pacific. Dijkstra (1990a: 2) suggested that *Propeamussium zoniferum* (Dautzenberg & Bavay, 1912), known from bathyal depths off Indonesia, is very similar to *P. meridionale* and differs only a little in the sculpture of the left valve (*P. zoniferum* is almost smooth and hyaline, *P. meridionale* opaque with delicate radial and commarginal sculpture).

Hicks & Marshall (1985: 228) stated that most gut samples of this carnivorous species contain harpacticoid copepods. Knudsen (1970: 96) also found crustaceans in the stomach. For information on reproduction and biology of the present species see also Knudsen (1970: 96).

***Propeamussium sibogai*  
(Dautzenberg & Bavay, 1904)**

Fig. 3

*Amussium sibogai* Dautzenberg & Bavay, 1904: 207, figs 1–4; Dautzenberg & Bavay, 1912: 31, pl. 28, figs 1–4.

*Amussium sibogae [sic]* Dautzenberg & Bavay.–Pelseneer, 1911: pl. 11, fig. 8 (soft parts).

*Luteamussium sibogai* (Dautzenberg & Bavay).–Oyama, 1951: 82, fig. 1; Kira, 1967: 138, pl. 49, fig. 14.

*Propeamussium sibogai* (Dautzenberg & Bavay).–Knudsen, 1967: 272, pl. 1, figs 23–24; Abbott & Dance, 1982: 303, fig.; Hayami, 1988a: 479, 480, figs; Okutani *et al.*, 1989: 59, fig.; Rombouts, 1991: 66, pl. 27, figs 1–1a.; Lamprell & Whitehead, 1992: [16], pl. 6, fig. 34; Dijkstra, 1995b: 23, figs 19–22; Dijkstra & Kastoro, 1997: 253, figs 24–29; Dijkstra & Marshall, 1997: 79, pl. 3, figs 1–3; Dijkstra, 2001: 81; Wang, 2002: 151, pl. 5, fig. 7; Dijkstra & Marshall, 2008: 5, figs 1, 3H–J; Dijkstra & Maestrati, 2008: 84; Xu & Zhang, 2008: 77, fig. 207; Spencer *et al.*, 2009: 198; Huber, 2010: 224; Dijkstra, 2011: 44, pl.

1017, figs 4a–b; Dijkstra, 2013: 14, pl. 1, figs 4a–d, pl. 4, fig. 4; Dijkstra & Maestrati, 2013b: 470; Dijkstra & Maestrati, 2015: 594, figs 11–J.

*Amussium* cf. *sibogai* (Dautzenberg & Bavay).—Barnard, 1969: 655, pl. 1, figs a–d.

*Propeamussium* (*Luteamussium*) *sibogai* (Dautzenberg & Bavay).—Koyama *et al.*, 1981: 62.

*Propeamussium* (*Propeamussium*) *sibogai* (Dautzenberg & Bavay).—Wang, 1984a: 599, pl. 1, figs 1–2, text fig. 1; Dijkstra, 1990a: 9.

*Luteamussium* [sic] *sibogae* [sic] (Dautzenberg & Bavay).—Kosuge, 1985: 59, pl. 23, fig. 12.

**Type data.** Holotype (pr) ZMA Moll.3.04.001. Type locality: Indonesia, Bali Sea, 7°15'S 115°15'E, alive, 289 m (*Siboga* stn 12).

**Additional material examined.** So far only recorded by Kosuge (1985) from northwestern Australia (Timor Sea). —MOZAMBIQUE: Mozambique Channel, dead, 450–600 m (6 v, ZMA Moll.144723). —SOUTH AFRICA: Natal, S of Durban, alive, 300–400 m (5 pr, ZMA Moll.144726). —JAPAN: Wakayama Prefecture, off Wakayama, Kii-suido [= Kii Channel], alive, 137–183 m (3 pr, ZMA Moll.144719); Kyushu Island, alive, 274 m (1 pr, ZMA Moll.140554). —PHILIPPINE ISLANDS: Bohol, Pamilacan Island, 9°30'N 123°55'E, alive, 90–145 m (1 pr, C.165536). —INDONESIA: Kai Islands, 06°05'S 132°44'E, alive, 210–268 m (1 pr, ZMA Moll.139805). —NEW CALEDONIA: 21°02.3'S 167°31.6'E, alive, 430 m (3 pr, ZMA Moll.145154). —KERMADEC ISLANDS: Colville Ridge, N of Raoul Island, 24°17.7'S 178°50.1'W, 589–591 m (1 v, NIWA P948); off Curtis Island, Kermadec Islands, 30°31.0'S 178°39.0'W, 710–725 m (fragment, NIWA T256); 30°45'S 178°40'W, 300 m (1 v, NMNZ M.223545) (Dijkstra & Marshall, 2008: 5, fig. 1).

**Description.** Shell fragile, hyaline, almost circular, inequivalve, somewhat inequilateral, slightly oblique, up to c. 55 mm high, left valve more convex than right valve, gaping rather strongly, auricles small and equal in size, umbonal angle about 125°. Prodissoconch c. 210 µm high (Knudsen, 1967). Left valve creamy brown, right valve cream.

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. Dorsal margin straight. Internal riblets 8 in most specimens, deep brown on left valve, white and broader on right valve. Marginal riblets with 4 or 5 small nodules, visible through lateral gape.

Right valve with widely spaced commarginal lirae, weaker at periphery, and microscopic interstitial granules (prismatic calcite layer). Marginal apron lacking from most specimens due to the very thin layer of prismatic calcite (Hayami, 1988a: fig. 4). Auricles smooth. Resilifer narrowly triangular. No byssal notch.

**Habitat.** Living in the bathyal zone, free on soft sediment (muddy sand or mud).

**Distribution.** Southern Japanese waters to tropical Indo-West Pacific, 150–300 m, ?alive (Hayami, 2000); Bali Sea, Indonesia, 289 m (Dautzenberg & Bavay, 1912); Banda Sea, Indonesia, 210–348 m (Dijkstra & Kastoro, 1997; Knudsen, 1967); Philippine Islands, 50–710 m (Dijkstra, 2011; 2013); Arafura Sea, 390 m; and off Durban, South Africa, 435–450 m (Knudsen, 1967), now extended into the Mozambique Channel and northwestern and southern Madagascar, in 340–750 m (Dijkstra & Maestrati, 2015); New Caledonia, 400–680 m; Loyalty Islands, 430–575 m; Wallis and Futuna Islands, 355–430 m; and Vanuatu, 425–455 m (Dijkstra, 1995b, 2001); Fiji, 392–506 m; Tonga, 331–549 m (dead); Solomon Islands, 464–482 (dead) (Dijkstra & Maestrati, 2008). The maximum depth range of live-taken specimens is c. 150–710 m.

**Remarks.** *Propeamussium sibogai* is not recorded from the continental shelf of Australia, but inhabits the surrounding seas: Timor Sea (Kosuge, 1985), Arafura Sea (Knudsen, 1967), and Coral Sea (Dijkstra, 1995b).

### *Propeamussium siratama* (Oyama, 1951)

Figs 1F–H, J, N, 2

*Ctenamussium* (*Micramussium*) *siratama* Oyama, 1951: 80, pl. 13 figs 5–7.

*Propeamussium siratama* (Oyama).—Dijkstra & Kastoro, 1997: 253, figs 20–23; Hayami, 2000: 913, pl. 454 fig. 6; Dijkstra, 2001: 81, figs 21–24; 2013: 15, pl. 2, figs 1a–d, pl. 4, fig. 5; Dijkstra & Maestrati, 2008: 85; 2009: 39, pl. 1 figs 1–4; 2012: 392.

**Type data.** Holotype (H 7.4 mm, pr). The type material is possibly in the Toba Aquarium at Toba, Japan, but Oyama (pers. comm.) could not trace it there. Type locality: Japan, Sagami Sea, off Manazuruzaki, 159–128 fathoms [= 291–234 m], alive.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: E of GBR, 18°11.01'S 147°25.5'E, alive, 472–490 m (2 pr + 1 v [lv: smooth], C.165218). —WESTERN AUSTRALIA: W of Rottnest Island, 31°02'S 114°48'E, dead, 275–285 m (4 v, WAM 443.91); NW of Cape Leveque, 14°49.0'–14°50.8'S 121°36.1'–121°35.6'E, dead, 300–302 m (3 v, WAM 465.91). —JAPAN: Mie Prefecture, Kii Peninsula, off Owase City, alive, 500 m, dredged (3 pr, ZMA Moll.145634). TAIWAN: NE–coast, off Tashi, 24°48.8'N 122°06.0'E, alive, 367–424 m, dredged (many prs, MNHN). —PHILIPPINES: Luzon, Balayan Bay, 13°49'N 120°50'E, alive, 299–320 m, dredged (1 pr, ZMA Moll.145105). —INDONESIA: Kei Islands, 05°23'S 132°27'E, alive, 413–436 m, trawled (many prs, MNHN). —PAPUA NEW GUINEA: SE Manus Island, 02°14'S 147°16'E, alive, 611–618 m, trawled (3 pr, MNHN). —SOLOMON ISLANDS: Choiseul Island, 06°34.7'S 156°10.5'E, alive, 609–625 m, trawled (3 pr, MNHN). —NEW CALEDONIA: E New Caledonia, 20°34'S 164°57'E, alive, 497–520 m, dredged (2 pr, MNHN). —FIJI: SE Viti Levu, 17°30.9'S 178°53.3'E, alive, 879–897 m, trawled (3 pr, MNHN).

**Description.** Shell fragile, up to c. 19 mm high, most specimens up to c. 10–12 mm in height, circular, nearly equivalve, equilateral, slightly inflated, auricles equal in shape and size, umbonal angle 110–115°. Prodissoconch c. 200 µm in height. Colour whitish or pale-brown transparent.

Left valve weakly sculptured (or almost lacking) with fine, irregularly spaced radial lirae from early growth stage until beyond central part of disc, with microscopic regularly spaced commarginal lamellae, smooth central part and periphery. Auricles frequently smooth, sometimes with fine commarginal lirae.

Right valve sculptured with delicate, regularly spaced commarginal lirae, more prominent near ventral margin. Inner surface with 7–9 ribs, with a riblet on each side near the auricles. Hine line straight. No byssal fasciole, or byssal notch. Ctenolium lacking.

**Distribution.** Japan: 100–300 m (Hayami, 2000: 913), Taiwan: 310–440 m (Dijkstra & Maestrati, 2009: 39); Philippines: 400–602 m (Dijkstra, 2013: 15); Indonesia: 283–285 m (Dijkstra & Kastoro, 1997: 253), Solomons and Fiji: 273–1004 m (Dijkstra & Maestrati, 2008: 85); New Caledonia: 316–533 m (Dijkstra, 2001: 82); Vanuatu: 509–659 m (Dijkstra & Maestrati, 2012: 392).

Present material from Australia alive in 472–490 m. The bathymetric range of live-taken specimens is 100–1004 m.

**Remarks.** The present specimens from Australia fit the original description (type material untraceable) and studied material from Japan (ZMA, NSMT), but differ in having fewer internal riblets (7 + 2 small auricular riblets, typically 8 + 2 small auricular riblets). Other morphological characters



are identical. Oyama (1951) did not state the etymology of the species name, but did not decline it, whereas all other species name in his paper are declined to agree with the generic name. We follow Oyama (1951), assuming it is an indeclinable noun.

*Propeamussium siratama* is a **new record** for Australia.

### *Propeamussium watsoni* (E. A. Smith, 1885)

Figs 3, 4A–C,F

*Amussium watsoni* Smith, 1885: 309, pl. 22, figs 8–8c; Clarke, 1962: 61; Knudsen, 1967: 280, pl. 1, fig. 18.

*Amussium alcocki* Smith.–Thiele & Jaeckel, 1931: 8 (misidentification).

*Propeamussium watsoni bayonnaisense* Okutani, 1962: 15, pl. 2, figs 1–2; Okutani, 1966: 8.

*Propeamussium watsoni* (Smith).–Kiseleva, 1971: 221; Abbott & Dance, 1982: 303, fig.; Hayami, 1988b: 476, figs 2–6; Dijkstra, 1995b: 24, figs 27–30, 123–124 [lectotype]; Hayami, 2000: 913, pl. 454, fig. 5; Dijkstra & Maestrati, 2010: 334; Dijkstra & Maestrati, 2013a: 362; Dijkstra & Maestrati, 2013b: 470; Dijkstra & Maestrati, 2015: 595, figs 1K–L.

**Type data.** *Amussium watsoni* Smith: lectotype (pr) NHMUK1887.2.9.3307, designated by Dijkstra (1995b: 24), 2 paralectotypes (pr) NHMUK1887.2.9.3308/1–2. Type locality: NE of New Guinea, 2°23'S 144°04'E, alive, 1957 m (*Challenger* stn 218).

*Propeamussium watsoni bayonnaisense* Okutani: holotype (pr) NSMT Mo.62759, 3 + 3 v + fragments, paratypes NSMT Mo.62760. Type locality: Japan, 24 miles off Bayonnaise Rocks, 32°00.0'N 140°21.4'E, alive, 2140–2160 m.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: ENE of Cape York Peninsula, 10°34.28'S 144°13.33'E, alive, 815–825 m (5 pr, C.165216); E of Cape York Peninsula, 10°37.17'S 144°21.99'E, alive, 990–1053 m (2 pr, C.165217). NEW SOUTH WALES: off Broken Bay, 33°30'–33°34'S 152°08'–152°11'E, alive, 875 m (1 pr [var.], C.165223). TASMAN SEA: Lord Howe Rise, 28°05.76'S 163°06.04'E, alive, 1051 m (1 pr, C.165411).

**Description.** Shell up to c. 60 mm high, inequivalve, almost circular, slightly higher than wide, somewhat inequilateral, umbonal angle c. 125°. Prodissoconch c. 240 µm high. Opaque, left valve milky-white, right valve cream.

Left valve more convex than right valve, with commarginal lamellae near ventral margin and delicate radial lirae that commence at c. 3 mm shell length and extend to central part of disc; lamellae and lirae variable. Auricles equal, commarginal lamellae prominent on anterior, finer and more closely arranged on posterior. Most specimens with 10 internal riblets 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.

**Dimensions.** Illustrated specimen, AM C.165216, QLD, ENE of Cape York Peninsula, 815–825 m; rv, ventral skirt broken off: H 31.1, L 31.9 mm; lv: H 43.4, L 41.8 mm; D 6.3 mm.

**Habitat.** Living in the bathyal and abyssal zones, free on soft sediment (muddy sand or mud).

**Distribution.** Gulf of Aden, 1469 m (Thiele & Jaeckel, 1931); Arabian Sea, 1354 m; Zanzibar area, E Africa, 914 m (Knudsen, 1967), now extended to northwestern and southern Madagascar, 780–821 m (Dijkstra & Maestrati, 2015); Laccadive Sea, 1337–1410; Bay of Bengal, 1026 m; and NE of Irian Jaya, Indonesia, 1958 m (Smith, 1885); Strait of Malacca, 1140 m (Knudsen, 1967: 281); Philippine Islands, 1800–1950 m (Dijkstra, 1995b); Japan, 2020–2160 m [as *P. watsoni bayonnaisense*] (Okutani, 1962, 1966); Chesterfield Islands, Coral Sea, 650–970 m; New Caledonia, 825–1500 m; Loyalty Islands, 780–800 m (Dijkstra, 1995b, 2001); Vanuatu, 980–990 m (Dijkstra, 2001); Austral Islands, 900–1300 m, dead (Dijkstra & Maestrati, 2010). The maximum depth range of live-taken specimens is 815–2160 m. Present material from Australia living at 815–1053 m.

**Remarks.** Knudsen (1967: 281) considered *Propeamussium watsoni bayonnaisense* to be part of the variation of *P. watsoni*. Examined material from Australia is morphologically similar to the type specimens from NE Indonesia, although the radial sculpture of the left valve is more delicate, but the sculpture is rather variable in development in this species.

*Propeamussium watsoni* is a **new record** for Australia.

### *Parvamussium* Sacco, 1897

*Parvamussium* Sacco, 1897a: 102. [Proposed as a subgenus of *Amussium* Herrmannsen, 1846 (invalid emendation of *Amusium* Röding, 1798)]; no diagnosis provided, but type species designated. *Parvamussium* Sacco, 1897b: 48 (diagnosis). Type species (by original designation): *Pecten (Pleuonectes) duodecimlamellatus* Bronn (1832: 624); upper Miocene, Tabbiano, northern Italy.

*Variamussium* Sacco, 1897a: 102. [Proposed as a subgenus of *Amussium* Herrmannsen, 1846]; no diagnosis given, but type species designated. *Variamussium* Sacco, 1897b: 49 (diagnosis). Type species (by original designation): *Amussium cancellatum* E. A. Smith (1885: 315); Recent, off Bermuda, W Atlantic, 796 m.

*Ctenamussium* Iredale, 1929: 164. Type species (by original designation): *Amusium thetidis* Hedley (1902: 304); Recent, off Port Kembla, New South Wales, Australia, 115–137 m.

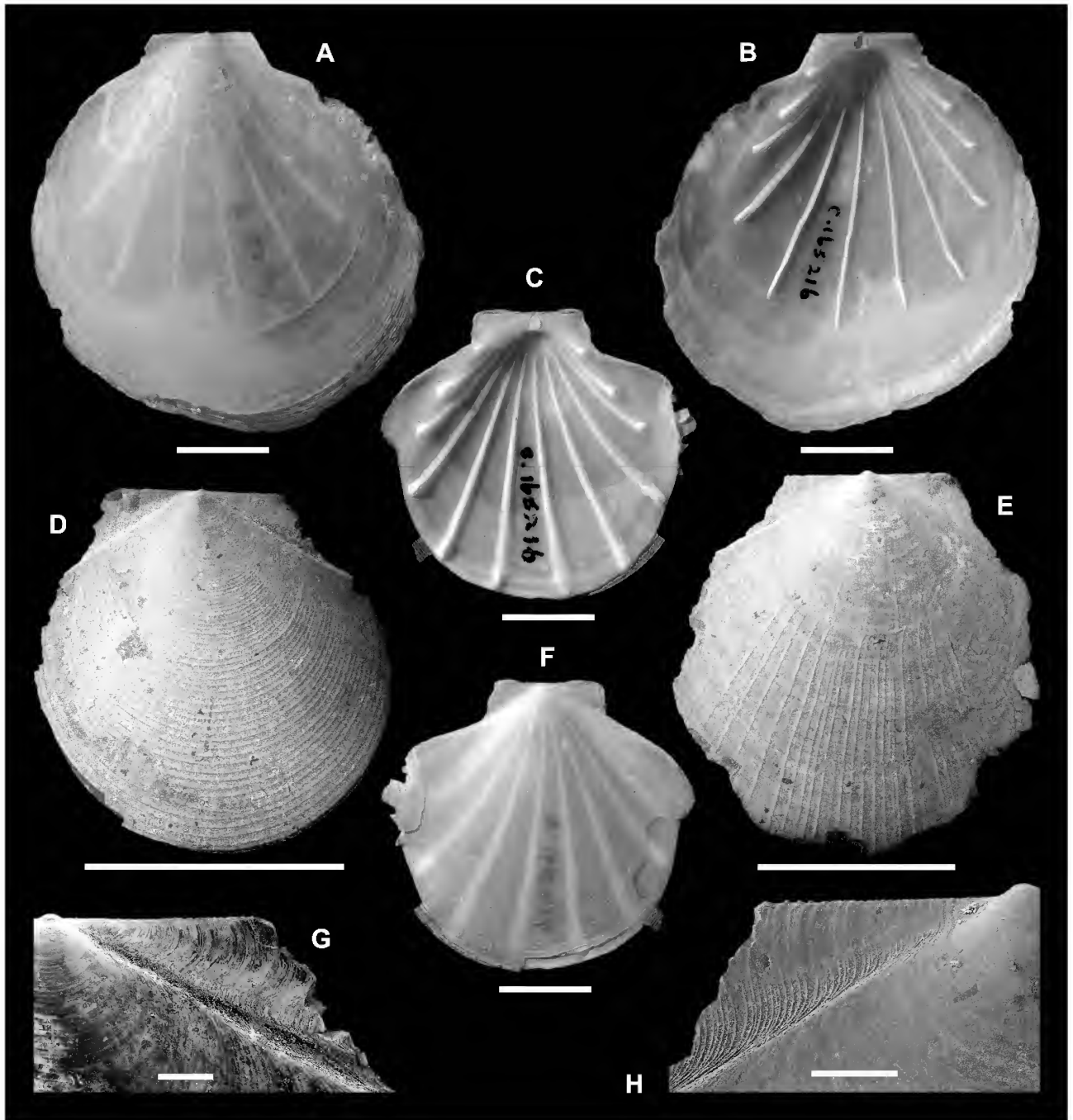
*Glyptamussium* Iredale, 1939: 370. Type species (by original designation): *Amussium torresi* Smith (1885: 311); Recent, E of Cape York, QLD, Australia, 283 m.

*Squamamussium* Oyama, 1944: 245. [Proposed as a subgenus of *Propeamussium*]. Type species (by original designation): *Amussium squamigerum* Smith (1885: 312); Recent, off E Puerto Rico, West Indies, 713 m.

*Polynemamussium* Habe, 1951: 72. [Proposed as a subgenus of *Parvamussium*]. Type species (by original designation): *Pecten intuscostatus* Yokoyama (1920: 156); Pleistocene, Kami-Miyata, Miura City, Kanagawa Prefecture, Japan.

**Diagnosis.** Shell inequivalve, circular to oblique, most species small, to c. 20 mm high, laterally compressed, with no lateral gape; left valve of most species strongly sculptured with radial and/or commarginal riblets or striae, right valve with commarginal lamellae; auricles unequal; byssal notch well-developed; no ctenolium; internal riblets commence in late ontogeny and extend to submarginal or marginal region.

**Distribution.** Triassic or Jurassic–Recent (Waller, 2006b, 2011; Schneider *et al.*, 2013; Ros-Franch *et al.*, 2014). Waller (2006b) considered that all Jurassic records of *Propeamussium* refer to *Parvamussium* species. He also thought that Triassic records of *Parvamussium* are too poorly preserved for certain generic assignment, and might



**Figure 4** A–C, F, *Propeamussium watsoni* (Smith), pair, AM C.165216, ENE of Cape York Peninsula, QLD, 815–825 m, lv exterior (A) and interior (B), rv interior (C) and exterior (F). D, E, G, H, *Propeamussium meridionale* (Smith), separate valves, AM C.165413, ORV *Franklin* stn 89-33, Lord Howe Rise, Tasman Sea, 27°13.34'S 160°43.41'E, 1989 m, rv exterior (D), lv exterior (E), rv anterior auricle exterior (G), lv anterior auricle exterior (H). Scale bars represent 10 mm (A–C, F), 5 mm (D, E), 0.5 mm (G, H).

belong to *Filamussium* Waller, 2006b. However, Ros-Franch *et al.* (2014) considered *Filamussium* to be a synonym of *Parvamussium*. Further research clearly is required on the time range of *Parvamussium*. Cosmopolitan, 18–2120 m.

**Discussion.** *Parvamussium* differs from *Propeamussium* mainly in the presence of a byssal notch (no byssus is observed in *Propeamussium*), the inequality of the auricles (equal in *Propeamussium*), more prominent sculpture (absent or very weak in *Propeamussium*), the position and number of internal radial riblets (commencing in early ontogeny and extending to central part in *Propeamussium*), and the absence of lateral gapes (present in *Propeamussium*).

Grau (1959: 15) and Hertlein (1969: N350) treated *Parvamussium* as a subgenus of *Propeamussium* and listed *Variamussium*, *Ctenamussium*, *Glyptamussium*, *Xenamussium*, *Squamamussium*, *Polynemamussium*, *Bathyamussium*, *Micramussium* as synonyms of *Parvamussium*. Hertlein (1969: N350) also mentioned in the synonymy *Graptamussium* Oyama, 1944, which is an error for *Glyptamussium*. The morphological characters of *Bathyamussium* and *Micramussium* are identical to those of *Propeamussium* (see remarks under *Propeamussium*), and characters of *Xenamussium* Oyama, 1951 are identical to those of *Cyclopecten* Verrill, 1897 (see remarks under *Cyclopecten*).

### Key to species of *Parvamussium* from Australia

- 1 Shell small, c. 9 mm high, circular, almost opaque, whitish, auricles unequal, byssal notch small, lv with radial and commarginal sculpture, 3 rudimentary internal riblets ..... *P. araneum*
- Shell small, subcircular, translucent white, auricles unequal, byssal notch shallow, lv with commarginal and interstitial radial sculpture, 11–13 internal riblets ..... 2
- 2 Shell c. 7 mm high, whitish, left valve more convex than right valve, equivalve, almost equilateral, auricles dissimilar in shape, lv with commarginal lamellae and weak interstitial radial riblets, rv with regularly spaced commarginal lirae, lv with 12–13 internal riblets, rv with 11 internal riblets ..... *P. cancellorum*
- Shell small, circular, hyaline, both valves smooth, 12–13 internal riblets ..... 3
- 3 Shell c. 9 mm high, whitish, both valves weakly inflated, almost equally convex, inequivalve, equilateral, 12–13 narrow internal riblets ..... *P. lamprelli*
- Shell small, oblong, hyaline, lv delicate sculptured, 10 internal riblets ..... 4
- 4 Shell c. 14 mm high, slightly posteriorly oblique, whitish, lv delicately radially sculptured, central part almost smooth, commarginal lamellae near ventral margin, 10 or 11 internal riblets, most specimens with 10 ..... *P. maorium*
- Shell small, fragile, circular, hyaline, lv commarginally sculptured, 14 internal riblets ..... 5
- 5 Shell c. 9 mm high, flattened, lv with widely spaced prominent commarginal lamellae, 14 internal riblets plus a few rudimentary ones ..... *P. multiliratum*
- Shell small, circular, hyaline or opaque, auricles almost equal, a few rudimentary internal riblets ..... 6
- 6 Shell c. 8 mm high, both valves almost smooth, lv flattened, 1–3 rudimentary internal riblets ..... *P. pauciliratum*
- Shell small, oblong, posteriorly oblique, lv with delicate reticulate sculpture, 10 internal riblets ..... 7
- 7 Shell c. 16 mm high, opaque, whitish, lv with fine radial and commarginal sculpture, 10 prominent internal riblets with a few rudimentary ..... *P. retiolium*
- Shell small, almost circular, lv flattened, delicately radially sculptured, 9–10 internal riblets ..... 8
- 8 Shell c. 10 mm high, lv stained and opaque, weakly radially and commarginally sculptured, rv almost smooth, whitish, 9–10 internal riblets, with a few rudimentary in some specimens ..... *P. scitulum*
- Shell small, circular, hyaline, valves equally convex, smooth, auricles almost equal, internal riblets rudimentary ..... 9
- 9 Shell c. 6 mm high, valves smooth and glossy, with white maculations, internal riblets rudimentary, 2 anteriorly and 2 posteriorly ..... *P. slacksmithae*
- Shell small, almost circular, lv sculptured with fine scaly radial riblets, 10 internal riblets ..... 10
- 10 Shell c. 11 mm high, lv stained and opaque, sculptured with fine unevenly spaced scaly radial riblets, rv whitish, 10 internal riblets, with a few rudimentary ones in some specimens ..... *P. squalidulum*
- Shell small, almost circular, opaque, lv heavily sculptured, 10 internal riblets ..... 11



- 11 Shell c. 10 mm high, creamy with white spots, lv with unevenly set prominent radial sculpture and close-set commarginal lamellae, 8–10 internal riblets, 10 in most specimens ..... *P. thetidis*
- Shell small, almost circular, lv smooth and glossy, 10 internal riblets ..... 12
- 12 Shell c. 9 mm high, lv opaque and whitish, lv sculptured with only delicate commarginal lamellae near ventral margin, 10 internal riblets, with a few rudimentary in some specimens ..... *P. torresi*
- Shell small, almost circular, lv coarsely sculptured with vesicles, few rudimentary internal riblets ..... 13
- 13 Shell c. 6 mm high, lv with commarginal lirae and radially arranged vesicles, few rudimentary internal riblets anteriorly and posteriorly ..... *P. vesiculatus*

### *Parvamussium araneum* Dijkstra, 1991

Figs 5, 6A–D,F,K

*Parvamussium araneum* Dijkstra, 1991: 8, figs 3–10; Dijkstra & Kastoro, 1997: 255, figs 30–38; Dijkstra, 2001: 82; Dijkstra & Maestrati, 2008: 85; Dijkstra, 2011: 40, pl. 1015, figs 1a–b; Dijkstra, 2013: 17, pl. 2, figs 2a–b, 3a–b, pl. 4, figs 6a–b.

**Type data.** Holotype (pr) RMNH 56531, 6 paratypes (1 pr + 5 v) RMNH 56532, RMNH 56533. Type locality: Indonesia, NE of coast of Sumba, E of Melolo, 9°51.8'S 120°46.4'E, alive, 240 m (SNELLIUS-II stn 4.060).

**Additional material examined.**—AUSTRALIA: QUEENSLAND: 18.5 ml E of North Reef, 23°11.5'S 152°14.5'E, alive, 188 m (13 v, C.165518).

For additional material examined from Indonesia see Dijkstra (1991: 8) and Dijkstra & Kastoro (1997: 255), and for Vanuatu see Dijkstra (2001: 82).

**Description.** Shell up to c. 9 mm high, weakly convex, circular, auricles unequal, umbonal angle c. 105°, hyaline to opaque, milky-white.

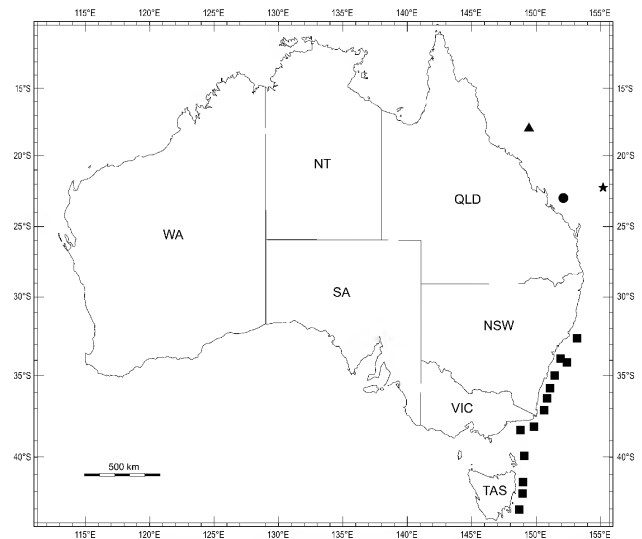
Left valve with c. 25 evenly spaced radial costae, increasing in number near ventral margin, crossed by commarginal lamellae, less conspicuous than costae (forming reticulate sculpture), with spines at intersections. Near umbonal area only commarginal lamellae present, with delicate interstitial irregular threads. Identical sculpture on auricles.

Right valve sculptured with evenly spaced commarginal lamellae, more close-set near umbonal area, with interstitial scratches. Auricles with irregular reticulate sculpture. Byssal notch narrow.

Inner surface of both valves with 3 rudimentary riblets, one additional on posterior auricle. Dorsal margin straight. Resilifer triangular.

**Habitat.** Living on the outer continental shelf and in the bathyal zone, byssally attached or free on sediment (rubble, sand or mud).

**Distribution.** Indonesian Archipelago, 240–300 m (Dijkstra, 1991; Dijkstra & Kastoro, 1997); Philippines, 201–357 m (Dijkstra, 2011, 2013); Vanuatu, 154–179 m (Dijkstra, 2001); Fiji, 567–699 m; Tonga, 523–806 m; Solomon Islands, 194–286 m (dead) (Dijkstra & Maestrati, 2008). Maximum depth range of live-taken specimens is 154–699 m. Present specimens from Australia (Queensland) living at 188 m.



**Figure 5.** Distribution of *Parvamussium araneum* Dijkstra (circle), *P. conspectum* Dijkstra & Kastoro (star), *P. lamprelli* sp. nov. (triangle) and *P. maorium* Dell (squares).

**Remarks.** The present specimens from Queensland are identical to the type specimens of *Parvamussium araneum* from Indonesia.

*Parvamussium araneum* is a **new record** for Australia.

### *Parvamussium cancellorum* Dijkstra & Marshall, 2008

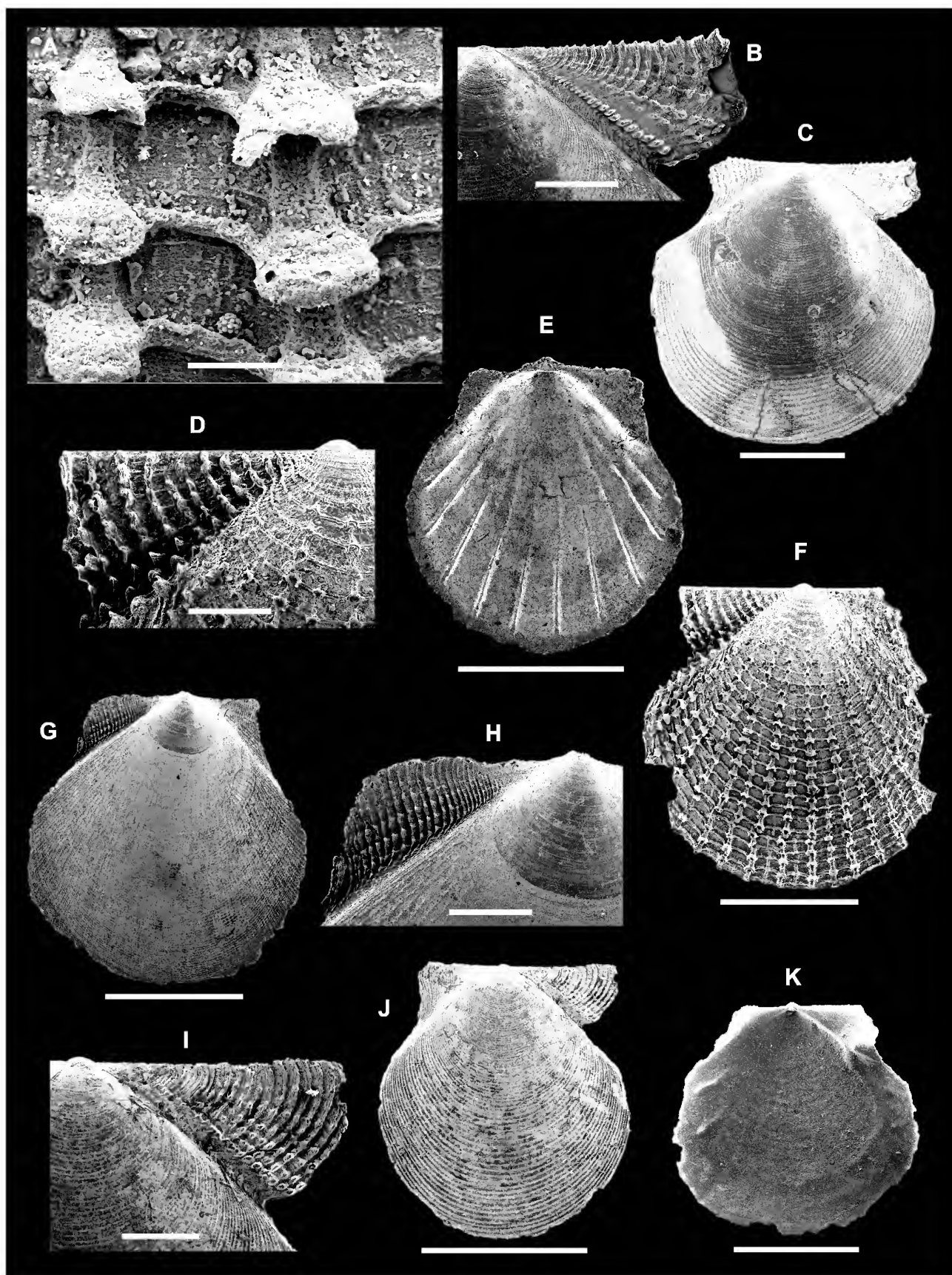
Fig. 6E,G–J

*Parvamussium cancellorum* Dijkstra & Marshall, 2008: 6, figs 4A–G, 5; Spencer *et al.*, 2009: 198.

**Type data.** Holotype (lv) NMNZ M.173000, many paratypes (v) (2 each AM C.205270, MNHN Moll 21206, ZMA Moll. 4.07.001, remainder NMNZ M.172907). Type locality: northern New Zealand, NW of Cape Reinga, southern Norfolk Ridge, 33°22.61'S 170°12.70'E, dead, 514–540 m, RV *Tangaroa*, 01 Jun 2003.

**Extralimital material examined.** TASMAN SEA: Middleton Reef, 29°25'S 159°02'E, dead, 298 m (4 v, C.462545); Middleton Reef, 29°30'S 159°07'E, dead, 295 m (30 v, C.462544).

**Description.** Shell up to c. 7 mm high, subcircular, equivalve, almost equilateral, left valve distinctly more inflated than right valve, auricles dissimilar in shape, anterior



**Figure 6.** *A–D, F, K*, *Parvamussium araneum* Dijkstra, separate valves, AM C.165518, HMAS *Kimbla* stn 4, 18.5 ml E of North Reef, QLD, 23°11.5'S 152°14.5'E, 188 m; sculpture on centre of lv disc (A), rv anterior auricle exterior (B), rv exterior (C), lv anterior auricle exterior (D), lv exterior (F), lv interior (K). *E, G–J*, *Parvamussium cancellorum* Dijkstra & Marshall, separate valves, AM C.462544, Middleton Reef, Tasman Sea, 29°30'S 159°07'E, 295 m; lv interior (E), lv exterior (G), lv anterior auricle exterior (H), rv anterior auricle exterior (I), rv exterior (J). Scale bars represent 100  $\mu$ m (A), 0.5 mm (B, D, H, I), 2 mm (C, E–G, J, K).

auricle larger than posterior one, umbonal angle c. 100°, internal riblets present, 11–12 on left valve and 11 on right valve, translucent or opaque white. Prodissoconch c. 170 µm long, D-shaped, smooth, convex, rim flanged (Dijkstra & Marshall, 2008: figs 4D, F).

Early dissoconch of left valve disc and auricles smooth apart from commarginal growth lines. Disc sculptured with crisp commarginal lamellae (typically 9 or 10 per mm), closer and more numerous near adult ventral margin. Delicate interstitial radial riblets present. Auricular sculpture similar to that of disc.

Right valve sculptured with regularly spaced commarginal lamellae, more close-set near umbonal area, with interstitial scratches. Posterior auricle continuous with disc, sculptured with closely spaced commarginal lamellae and fine radial threads, anterior auricle with more prominent radial riblets overrun by commarginal lamellae. Byssal notch shallow, byssal fasciole separated from disc by sharply incised groove.

**Habitat.** Collected in the bathyal zone, free on soft sediment (so far empty shells only).

**Distribution.** West Norfolk Ridge and Norfolk Ridge, 442–774 m (Dijkstra & Marshall, 2008: 7). Present specimens from Australia (Middleton Reef, New South Wales) dead at 295–298 m.

**Remarks.** The present specimens from Middleton Reef have more delicate and somewhat more closely spaced commarginal sculpture on the left valve than the type specimens from the Norfolk Ridge, but other characters are similar.

*Parvamussium cancellorum* is a **new record** for Australia.

***Parvamussium conspectum*  
Dijkstra & Kastoro, 1997**

Figs 5, 7A–E

*Parvamussium* sp. cf. *texturatum* (Dautzenberg & Bavay).—  
Dijkstra, 1991: 17, figs 44–52.

*Parvamussium conspectum* Dijkstra & Kastoro, 1997: 258,  
figs 48–61.

**Type data.** Holotype (pr) MNHN Moll 21182. Paratypes (v) (2 HD, 2 POLIPI, 6 MNHN Moll 21183–4). Type locality: Indonesia, Kai Islands, 5°17'S 132°41'E, alive, 212–221 m (KARUBAR stn DW15).

**Additional material examined.** —AUSTRALIA: QLD, SE of Swain Reefs, 22°26'16"S 153°17'05"E, dead, 187 m (8 v, C.462542).

**Description.** Shell up to c. 5 mm high, fragile, elongate, inequivalve, slightly inequilateral, valves equally inflated, auricles dissimilar in size and shape, umbonal angle c. 90°. Internal riblets 9–10, commencing in early growth stage in most specimens (late in ontogeny in a few), plus 1 auricular riblet on each side. Left valve creamy orange, right valve whitish, interior of both valves glossy.

Left valve sculptured with c. 20 irregularly spaced primary and secondary radial riblets, c. 10 closely set commarginal lamellae in early growth stage (before pre-radial stage), widely spaced on central part of disc and more closely so towards ventral margin. Intersections strongly squamous. Anterior auricle with closely spaced, strongly developed commarginal lamellae, more prominent anteriorly.

Right valve sculptured with c. 20 widely spaced commarginal lirae. Sculpture of auricles similar to that of left valve. One radial lira on anterior auricle near byssal fasciole. Byssal notch shallow, byssal fasciole narrow.

**Habitat.** Living in the bathyal zone, free on soft sediment (sand and mud).

**Distribution.** Indonesia, 100–290 m (Dijkstra, 1991; Dijkstra & Kastoro, 1997). Maximum depth range of live-taken specimens is 212–290 m. Present specimens from eastern Australia dead in 187 m.

**Remarks.** This species is morphologically close to *Parvamussium texturatum* (Dautzenberg & Bavay, 1912), known from the Sulu Sea. *Parvamussium texturatum* is circular and *P. conspectum* more elongate in shape. Moreover, typical *P. texturatum* has more numerous internal riblets (15), *P. conspectum* fewer (9). The sculpture on the left valve of *P. texturatum* is somewhat weaker than that of *P. conspectum*.

The present specimens from the Great Barrier Reef are identical to the type specimens, apart from being somewhat more circular in shape, and some specimens have one more internal rib or one or two more rudimentary interstitial riblets. Moreover, typical specimens have somewhat more prominent commarginal lamellae in the early growth stage.

*Parvamussium conspectum* is a **new record** for Australia.

***Parvamussium lamprelli* sp. nov.**

Figs 5, 7F–J

**Holotype** (pr) (H 8.9 mm, L 9.4 mm, D 2.3 mm) QM MO.17961: QLD, 18°09'S 148°31'E, alive, 1103–1115 m, epibenthic sled, 08.V.1986 (James Cook University *Cidaris* I stn 11.3). **Paratypes** (pr): seven paratypes from the same locality, 6 QM MO.17734, 1 ZMA Moll. 409001.

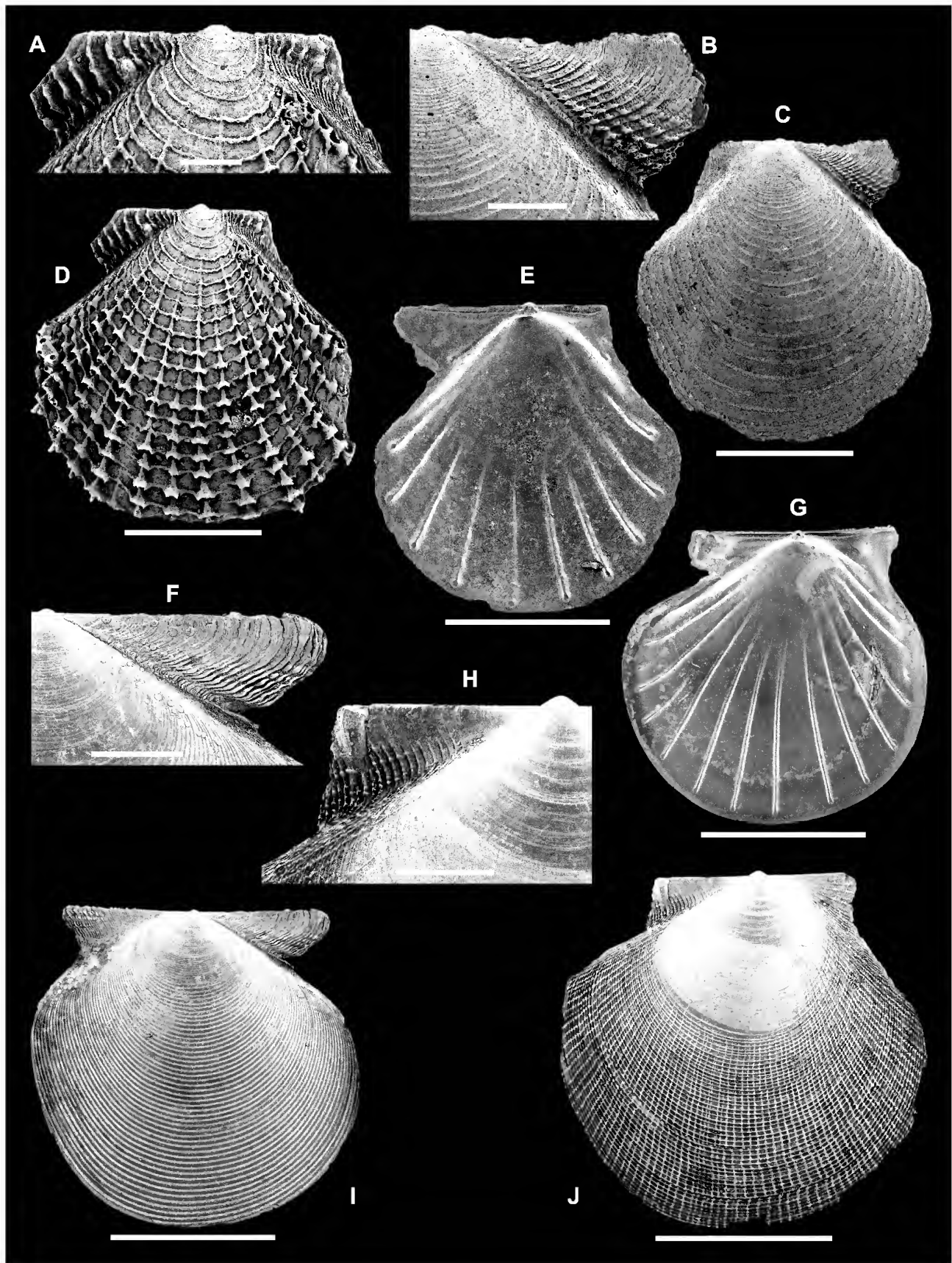
**Description.** Shell up to c. 9 mm high, fragile, circular, weakly inflated, almost equally convex, inequivalve, equilateral, auricles subequal, umbonal angle about 110°, hyaline, whitish.

Both valves with 12–13 narrow internal riblets, commencing 2 mm below umbo and extending to ventral margin, with narrow marginal apron 1 mm wide; 3–5 rudimentary interstitial riblets near margin, one auricular riblet on each auricle. External sculpture clearly visible from interior.

Left valve smooth, glossy, translucent in early growth stage to c. 4 mm high, later bearing latticed sculpture with numerous, very closely spaced, delicate commarginal and radial lirae extending to ventral margin. Auricles with fine, closely spaced commarginal lamellate riblets and a few very weak radial lirae (2 on anterior auricle and 4–5 on posterior).

Right valve smooth and translucent to c. 2 mm high, later with evenly spaced commarginal lirae, c. 8 per mm in central part of disc. Auricles with commarginal lamellae, more prominent on anterior and more closely spaced on posterior. Dorsal margin straight, with some scales, scales more prominent on anterior auricle. Byssal fasciole small, byssal notch present.

**Discussion.** *Parvamussium lamprelli* is morphologically closest to *P. multiliratum* Dijkstra, 1995, also recorded here from Queensland and known from the Coral Sea eastwards



**Figure 7.** *A–E*, *Parvamussium conspectum* Dijkstra & Kastoro, separate valves, AM C 462542, E of Swain Reefs, QLD, 22°26'16"S 153°17'05"E, 187 m, lv auricles exterior (A), rv anterior auricle exterior (B), rv exterior (C), lv exterior (D), rv interior (E). *F–J*, *Parvamussium lamprelli* sp. nov., 2 paratypes, QM MO17734, JCU *Cidaris I* stn 11.3, N QLD, 18°09'S 148°31'E, 1103–1115 m, rv anterior auricle exterior (F), rv interior (G), lv anterior auricle exterior (H), rv exterior (I), lv exterior (J). Scale bars represent 0.5 mm (A, B), 2 mm (C–E), 1 mm (F–H), 4 mm (I, J).

to Vanuatu. The two species are very similar in shape, size and internal riblets, and both have a smooth, glossy disc in the early growth stage and are similarly coloured, but differ strongly in sculpture of the left valve. *Parvamussium lamprelli* has fine latticed sculpture of closely spaced commarginal and radial lirae, whereas *P. multiliratum* has only widely spaced commarginal lirae. No specimens with intermediate sculpture have been observed.

Another similar-looking species is *Parvamussium cassium* Dijkstra, 1991, known from Indonesia. *Parvamussium cassium* is similar in size and shape, but differs from *P. lamprelli* in having more widely latticed sculpture on the left valve, a longer anterior auricle on the right valve, and in lacking fully developed internal riblets.

*Parvamussium retiaculum* Dijkstra, 1995, known from New Caledonia and Wallis and Futuna, differs from *P. lamprelli* in having more widely latticed sculpture on the left valve, a more oval shape, a larger anterior auricle, and broader internal riblets.

*Parvamussium retiolum* Dijkstra, 1995, known from the Chesterfield Islands, New Caledonia, Wallis and Futuna, and Vanuatu, also has fine latticed sculpture on the left valve, which is coarser than that of *P. lamprelli*, but these two species otherwise differ strongly in size (*P. retiolum* up to 16 mm high, *P. lamprelli* up to 9 mm), in shape (*P. retiolum* oval and oblique, *P. lamprelli* circular), and in the much larger anterior auricle and broader internal riblets that commence earlier in *P. retiolum* than in *P. lamprelli*.

**Habitat.** Present specimens live-taken from soft sediment in the bathyal zone.

**Distribution.** So far known only from the type locality.

**Etymology.** Named after the late Kevin Lamprell, in honour of his work on the Australian Bivalvia.

### *Parvamussium maorium* Dell, 1956

Figs 5, 8A–B,H–I,L

*Parvamussium maorium* Dell, 1956: 20, figs 30–31 (as *Parvamussium maoria* [sic]); Powell, 1979: 381, figs 93.1–2; Dijkstra & Marshall, 2008: 9, figs 6E–I, 7; Spencer *et al.*, 2009: 198; Huber, 2010: 224.

*Parvamussium maorum* [sic] Dell.–Dell, 1962: 75; Dell, 1963: 206.

**Type data.** Holotype (rv) NMNZ M.09171, 8 paratypes: 4 v NMNZ M.09169, 2 v NMNZ M.010737 and 2 v CMC AQ 169. Type locality: New Zealand, off Otago Peninsula, ENE of Taiaroa Head, Karitane Canyon, 45°37.5'S 171°06.0'E, 476–640 m (*Alert* stn 54-17).

**Additional material examined.** —AUSTRALIA: NEW SOUTH WALES: off Newcastle, 32°59'S 152°33.5'E, dead, 381–444 m (1 v, C.165531); 28 km E of Little Bay, 33°58.54'S 151°33.38'E, dead, 183–192 m (3 v, C.165526); 27.5 ml off Sydney, 33°83.3'S 151°81.7'E, dead, 549 m (7 v + 3 fragm., C.024344); off Sydney, 34°04.2'S 151°37.2'E, dead, 384 m (2 v, C.165527); off Kiama, 34°38'–34°33'S 151°16'–151°17'E, alive, 450–500 m (1 pr, C.165525); 44 km E of Nowra, 34°55.79'–34°56.06'S 151°08.06'–151°07.86'E, alive, 429–466 m (1 pr, VM F60167); off Jervis Bay, canyon, 35°08.3'S 151°10'E, dead, 400–1000 m (1 v, C.165532). VICTORIA: 30 ml S of Cape Everard, 38°18'S 149°17'E, dead, 366 m (11 v, C.165530); S of Point Hicks, 38°17.70'S 149°11.30'E, alive, 400 m (3 pr, VM F60150; 5 pr, VM F60153; 2 pr, VM F60161). TASMANIA: Bass Strait, between Cape Everard & Flinders Island, 38°59'S 148°34.1'E, dead, 426 m (4 v, C.165533); off Cape Naturaliste, 40°50.6'S 148°46.5'E, dead, 399 m (20 v, C.165528; 5 v, C.165529); off Freycinet Peninsula, 41°57.50'S 148°37.90'E, alive, 400 m (7 pr, VM F60152); off Freycinet Peninsula, 42°0.20'S 148°37.70'E, alive, 720 m (12 pr, VM F60151); 9.5 ml NE Tasman Island, 43°12.30'S 148°13.45'E, dead, 570.5 m (11 v, C.165534). TASMAN SEA: Lord Howe Rise, 29°42.06'S 159°48.31'E, alive, 2450 m (1 pr, C.165408).

**Description.** Shell up to c. 14 mm high, fragile, translucent to almost opaque, inequivalve, equilateral (juvenile), inequilateral (adult), higher than wide, left valve slightly more convex than right valve, auricles unequal in size, umbonal angle c. 90°. Whitish with fine dull white maculations on left valve.

Left valve acline to weakly posteriorly elongate (proscloine), weakly sculptured laterally with unevenly and closely spaced radial riblets, more prominent posteriorly. Central part of disc smooth. Antero-ventrally also with delicate, closely spaced commarginal lamellae. Anterior auricle with commarginal lamellae near disc flank and more dorsally with a few delicate antimarginal riblets, posterior auricle with a few weak antimarginal riblets. Dorsal margin straight.

Right valve sculptured with evenly spaced commarginal lamellae. Auricles somewhat raised dorsally, due to commarginal sculpture. Anterior auricle weakly commarginally sculptured, dorsally more prominent, with one antimarginal riblet near pseudo-fasciole, posterior auricle almost smooth. Byssal notch relatively deep.

Interior of both valves with 10–11 radial riblets, most specimens with 10 riblets, somewhat curved in posterior direction; with a small auricular riblet laterally.

**Habitat.** Living in the bathyal and abyssal zones, free on soft sediment (muddy sand or mud).

**Distribution.** New Zealand and Chatham Islands: many lots from throughout the New Zealand EEZ, from Three Kings Rise (31°30.7'S 172°49.8'E, 1216–1385 m; 1 v, NIWA U602) to off Campbell Island (53°29'S 169°48'E, 589–594 m; 1 v NMNZ M.39553), as shallow as 168 m in the Southland fiords, but in 349–1208 m elsewhere (Dijkstra & Marshall, 2008: 9, fig. 7). Now also Tasman Sea and southeastern Australia (New South Wales, Victoria and Tasmania). The live-taken specimen from the Tasman Sea is the only record from an abyssal depth (2450 m). Present specimens from Australia dead at 183–1000 m, alive at 400–720 m.

**Remarks.** The present specimens from south-eastern Australia are morphologically identical to the type specimens from New Zealand.

*Parvamussium maorium* is a **new record** for Australia.

### *Parvamussium multiliratum* Dijkstra, 1995

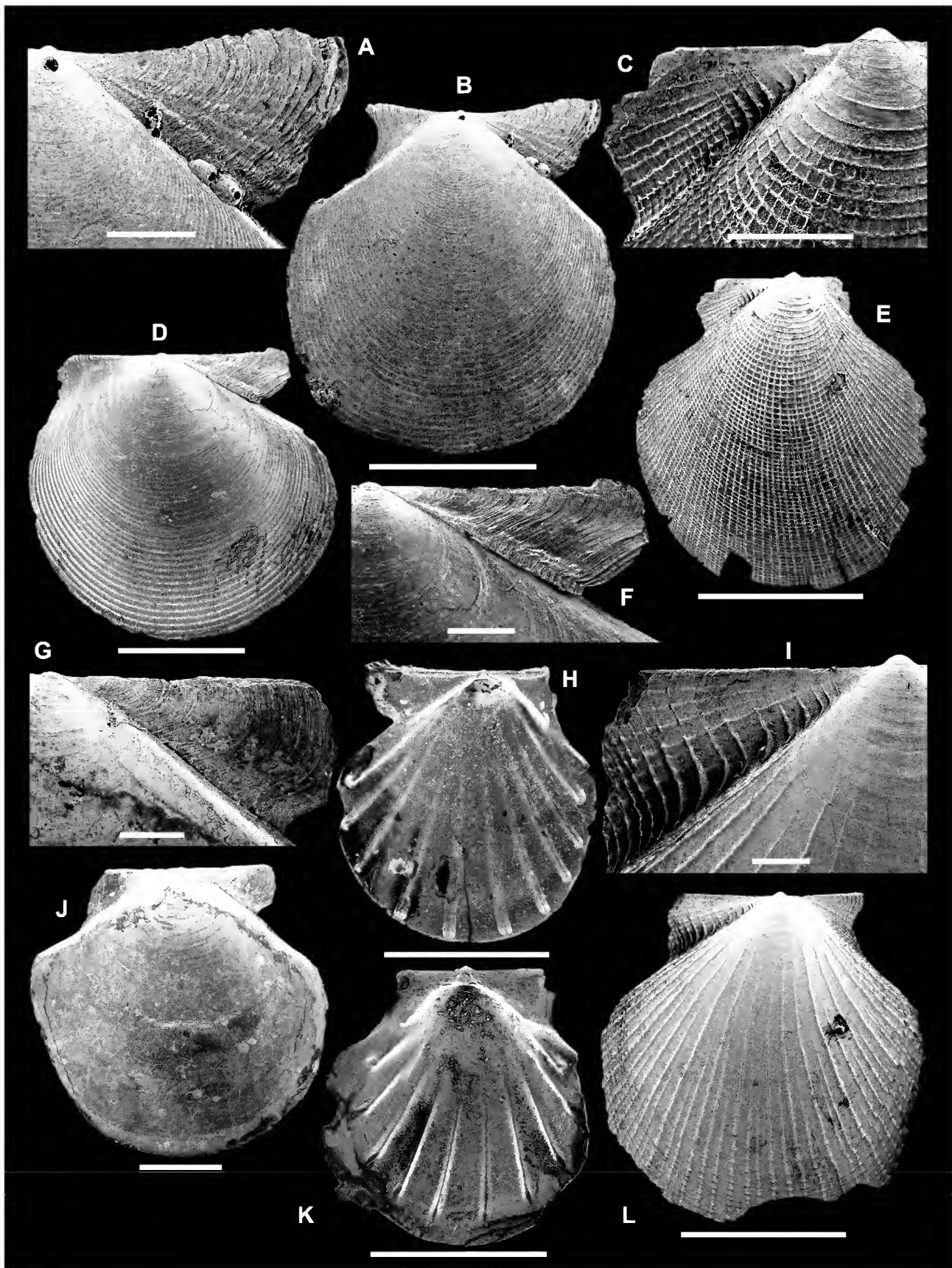
Figs 8D,F, 9

*Parvamussium multiliratum* Dijkstra, 1995b: 26; figs 31–34, 91–92; Dijkstra, 2001: 83; Dijkstra & Maestrati, 2008: 91; Dijkstra & Maestrati, 2010: 339.

**Type data.** Holotype (pr) MNHN Moll21173, 16 paratypes (13 MNHN Moll21174–21181, 1 AM C.201711, 1 ZMA Moll.395024, 1 USNM886343). Type locality: Southern New Caledonia, 22°10'S 167°33'E, alive, 2100–2110 m (BIOCAL stn CP 72).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: off Cairns, 16°02'–16°0'S 147°14.9'–147°13'E, dead, 1372 m (1 v, C.165480); off Cairns, 16°37'42"S 146°20'24"–146°18'42"E, dead, 658–685 m (1 v, C.374663); E of Lady Elliott Island, 24°0'S 153°06.5'E, dead, 476–531 m (3 v, C.165509); NE of Sandy Cape, 24°28.2'S 153°31.2'E, dead, 1330–1380 m (1 v, C.157674); E of Sandy Cape, 24°43.5'–24°08'S 153°33.4'–153°33.3'E, dead, 604 m (5 v, C.157675 [in part]). —SOLOMON ISLANDS: The Slot, 7°34.75'S 157°11.84'E, alive, 670–890 m (1 pr, C.157581). CORAL SEA: 11°31.09'S 145°22.31'E, alive, 1517–1611 m (many, C.165222); 11°35.61'S 145°29.42'E, alive, 1770–1863 m (4 pr, C.165220 [in part]); 11°40.98'S 145°36.85'E, alive, 2039–2052 m (2 pr, C.165221 [in part]); 11°56.72'S





**Figure 8.** *A, B, H, I, L*, *Parvamussium maorium* Dell, separate valves, AM C.165528, MT *Sprightly* stn S73-2051, off Cape Naturaliste, TAS, 40°50.6'S 148°46.5'E, 399 m; rv anterior auricle exterior (A), rv exterior (B), rv interior (H), lv anterior auricle exterior (I), lv exterior (L). *C, E, K*, *Parvamussium retiolum* Dijkstra, lv only, AM C.165535, HMAS *Kimbla* sta. 1, E of Lady Elliott Island, QLD, 24°0'S 153°06'E, 476–531 m; lv anterior auricle exterior (C), lv exterior (E), lv interior (K). *D, F*, *Parvamussium multiliratum* Dijkstra, rv only, AM C.374663, HMAS *Kimbla* sta. C.22, off Cairns, QLD, 16°37'42"S 146°20'24"–146°18'42"E, 658–685 m; rv exterior (D), rv anterior auricle exterior (F). *G, J*, *Parvamussium pauciliratum* (Smith), rv only, AM C.157659, HMAS *Kimbla* stn C.10, NE of Cairns, QLD, 16°33'54"–16°33'48"S 146°09'42"–146°09'36"E, 55 m; rv anterior auricle exterior (G), rv exterior (J). Scale bars represent 1 mm (A, C), 4 mm (B, E, H, K, L), 2 mm (D, J), 0.5 mm (F, G, I).

145°48.39'E, alive, 2510–2523 m (1 pr, C.165219). TASMAN SEA: Lord Howe Rise, 27°13.36'S 160°43.41'E, alive, 1989 m (2 pr, C.165412); Lord Howe Rise, 27°58.99'S 162°51.55'E, alive, 1250 m (3 pr, C.165409).

**Description.** Shell up to c. 9 mm high, fragile, circular, inequivalve, hyaline, whitish, left valve slightly more convex than right valve, auricles subequal, umbonal angle about 110°. Prodissoconch c. 220 µm in height.

Both valves with 14 internal riblets plus 2 rudimentary interstitial ones, one auricular riblet on each auricle. External sculpture clearly visible from interior.

Left valve sculptured with widely spaced commarginal lamellae commencing at 3 mm shell height and extending to ventral margin. Unevenly spaced, delicate radial riblets developed near ventral margin, a few commencing earlier. Umbonal region glossy with a few white spots, otherwise translucent and dull due to microscopic granules. Auricles with commarginal lamellate riblets, more closely spaced near lateral margins than elsewhere.

Right valve with evenly arranged commarginal lirae, somewhat interrupted near ventral margin region by a disturbance of growth. Auricles with commarginal lamellae, more prominent on anterior auricle and more closely spaced on posterior. Dorsal margin straight, with a few scales, more prominent on anterior auricle. Byssal fasciole small, byssal notch present.

**Habitat.** Living in the bathyal and abyssal zones, free on soft sediment (muddy sand or mud).

**Distribution.** New Caledonia, 2100–2110 m, and Loyalty Islands, 1615–2040 m; Wallis and Futuna Islands, 400–765 m (dead); Vanuatu, 748–775 m (Dijkstra, 1995b, 2001). Living records from the Coral Sea (1517–2523 m), Solomon Islands (670–890 m) and Tasman Sea (1250–1989 m); Fiji, 640–687 m; Tonga, 360–436 m (dead) (Dijkstra & Maestrati, 2008); Austral Islands, 600–620 m (Dijkstra & Maestrati, 2010). Maximum depth range of live-taken specimens is 600–2523 m. Present specimens from Australia (Queensland) are dead-taken only, at 476–1380 m.

**Remarks.** The present specimens are morphologically identical to the type specimens from New Caledonia.

*Parvamussium multiliratum* is a **new record** for Australia.

### *Parvamussium pauciliratum* (E.A. Smith, 1903)

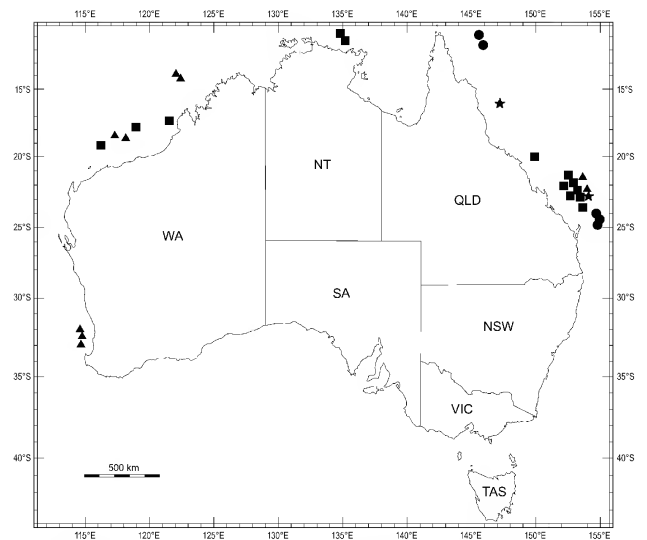
Figs 8G, J, 9

*Amussium paucilirata* [sic] Smith, 1903: 622, pl. 36, figs 23–24.

*Parvamussium pauciliratum* (Smith).—Dijkstra, 1991: 14, figs 33–34; Dijkstra, 1995b: 26, figs 107–110, 151–152; Dijkstra & Kastoro, 1997: 261, figs 73–74; Dijkstra, 1998a: 12, pl. 1, figs 1–2; Dijkstra & Maestrati, 2008: 92; Dijkstra & Moolenbeek, 2008: 16; Xu & Zhang, 2008: 78, fig. 215; Huber, 2010: 224; Dijkstra, 2011: 42, pl. 1016, figs 2, 3a–b, 4; Dijkstra, 2013: 19, pl. 3, figs 1–1d, pl. 4, fig. 9.

**Type data.** Lectotype (pr) designated by Dijkstra (1995b: 28) NHMUK1903.9.17.17, 2 paralectotypes (pr) NHMUK 1903.9.17.18/1–2. Type locality: Maldive Islands, S Nilandu Atoll, alive, 2–66 m.

**Comments on type data.** Although the original registration number indicated 4 specimens, only 3 types are now present in NHMUK.



**Figure 9.** Distribution of *Parvamussium multiliratum* Dijkstra (circles), *P. pauciliratum* (Smith) (stars), *P. retiolium* Dijkstra (triangles) and *P. scitulum* (Smith) (squares).

**Additional material examined.**—AUSTRALIA: QUEENSLAND: NE of Cairns, 16°33'54"–16°33'48"S 146°09'42"–146°09'36"E, dead, 55 m (3 v, C.157659; 2 v, C.157660, in part); SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (3 v, C.157661, in part).—INDONESIA: Ceram, Piru Bay, 3°10'S 128°08'E, (2 v, C.338458).—PAPUA NEW GUINEA: Port Moresby, Fairfax Harbour, 0.5 ml off Wharf, 9°26'S 147°06'E, dead, 15–18 m (1 v, C.165515); off Port Moresby, W end of Manubada Island, 9°31'S 147°10'E, alive, 18–22 m (many v, C.165513); off Port Moresby, on sheltered NW side of Manubada Island, 9°31'S 147°10'E, dead, 23 m (many v, C.165514); Rabaul Harbour, Matupi Island, 4°14'S 152°12'E, dead, beach grit (1 v, C.338459).

**Description.** Shell fragile, small, up to c. 8 mm high, hyaline or opaque, sub-orbicular, inequivalve, right valve more convex than left, slightly inequilateral, auricles almost equal, umbonal angle c. 105°, prodissoconch c. 200 µm in height. Left valve creamy-white stained with white dots, right valve uniform white.

Left valve glossy, with a few minute growth lines, covered with microscopic granules. Auricles smooth on most specimens; a few have delicate commarginal lirae near anterior margin.

Right valve also glossy, smooth apart from microscopic granules. Anterior auricle with minute commarginal lirae. Dorsal margin straight. Internal riblets rudimentary, 1 or 2, with a small auricular lira on each side in most specimens. Resilifer triangular. Byssal notch very narrow.

**Habitat.** Living as shallow as 2 m in the littoral zone and on the continental shelf, free on soft sediment (sand and coral rubble, muddy sand or mud).

**Distribution.** Maldive Islands, 2–66 m (Smith, 1903); Indonesia, 34–467 m (dead) (Dijkstra, 1991; Dijkstra & Kastoro, 1997); Philippines, 32–82 m (Dijkstra, 2011, 2013); Papua New Guinea, 48–125 m (Dijkstra, 1998a); Chesterfield Islands, Coral Sea, 150–225 m (dead); New Caledonia, 27–45 m (Dijkstra, 1995b); Solomon Islands, 509–522 m (Dijkstra & Maestrati, 2008). Present material taken alive from southern Papua New Guinea at 18–22 m. Maximum depth range of live-taken specimens is 2–522 m. Present material from Australia (Queensland) taken only dead at 55–100 m.

**Remarks.** The present specimens are identical to the type specimens from the Maldive Islands (Indian Ocean).

*Parvamussium pauciliratum* is a **new record** for Australia.

***Parvamussium retiolum* Dijkstra, 1995**

Figs 8C,E,K, 9

*Parvamussium retiolum* Dijkstra, 1995b: 29, figs 39–42, 97; Dijkstra, 2001: 85; Dijkstra & Marshall, 2008: 10, figs 8A–G, 9; Dijkstra & Maestrati, 2008: 93; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2013b: 473.

**Type data.** Holotype (pr) MNHN Moll21171. Paratypes (39pr+6v): 35 MNHN Moll21172, 2 C.201713, 2 ZMA Moll.395026, 2 NMNZ M.268537, 2 NSMT-Mo70541, 2 USNM890860. Type locality: Coral Sea, Chesterfield Is., 19°47'S 158°44'E, alive, 685–700 m (MUSORSTOM 5 stn CP 363).

**Additional material examined.**—AUSTRALIA: QUEENSLAND: SE of Swain Reefs, 22°20'09"–22°26'16"S 153°17'05"E, dead, 187 m (1 v, C.165543); E of Lady Elliott Island, 24°0'S 153°06'E, dead, 476–531 m (4 v, C.165535). WESTERN AUSTRALIA: SW of Cape Naturaliste, 33°44.5'S 114°26.1'E, dead, 183–238 m (3 v, C.165545); W of Garden Island, 32°15'S 115°03'E, dead, 250–258 m (1 v, C.165550); W of Rottne Island, 31°0'S 114°51'E, dead (1 v, C.165548); 80 n.ml NNE of Port Hedland, 19°03.6'–19°04'S 119°03.4'–119°05'E, dead, 82 m (3 v, C.157711); N of Port Hedland, 18°40'S 117°55'E, dead, 150 m (1 v, C.157679); c. 240 ml NE of Broome, 14°37'S 123°40'E, dead, 80 m (19 v, C.165494 [in part]); c. 140 ml N of Cape Leveque, 14°29'S 123°03'E, dead, 124 m (many v [atypical]), C.165493). CORAL SEA: Elizabeth Reef, 29°53.82'S 159°01.65'E, alive, 420 m (1 pr, C.165246).—NEW CALEDONIA: S of Ile des Pins, 22°50'S 167°34'E, dead, 274 m (many v, C.165441; 4 v, C.165439); 4 ml S of Ile des Pins, 22°50'S 167°34'E, dead, 275 m (16 v, C.165443 [in part]; 1 v, C.165442 [in part]; 5 v, C.165444).

**Description.** Shell up to c. 16 mm high, fragile, inequivalve, inequilateral, left valve slightly more convex than right, translucent white, auricles unequal, umbonal angle c. 95°. Inner surface with 10 riblets, plus 1 posterior auricular riblet and 4 rudimentary auricular riblets on left valve and 3 on right, ends of riblets somewhat nodose.

Left valve sculptured with delicate commarginal lamellae crossing closely spaced radial riblets, somewhat coarser near umbonal area than elsewhere, more delicate near ventral margin. Auricles with fine radial riblets crossed near margin by fine commarginal lamellae.

Right valve with regular commarginal lirae, closely spaced near umbonal area, more widely spaced near ventral margin. Microscopic interstitial radial scratches near margins. Auricles with commarginal lamellae, more prominent anteriorly. Strongly developed scales on anterodorsal margin. Byssal notch narrow.

**Habitat.** Living on the continental shelf and in the bathyal zone, free amongst soft sediment.

**Distribution.** Chesterfield Islands, Coral Sea, 620–700; New Caledonia, 720–800 m (Dijkstra, 1995b, 2001); New Zealand: many lots listed by Dijkstra & Marshall (2008: 10, fig. 9) from the Norfolk Ridge N of Norfolk Island (26°25.2'S 167°11.2'E, 714–756 m, 11 v, NMNZ M.171056) to South Ritchie Trough, off Mahia Peninsula, central E North Island (39°58.59'S 178°14.18'E, alive, 990 m, 2 pr, NIWA V466), in 316–1000 m (Dijkstra & Marshall, 2008: 11, fig. 9); Fiji, 310–699 m; Tonga, 391–510 m (dead) (Dijkstra & Maestrati, 2008). Now also Queensland and Western Australia. Maximum depth range of live-taken specimens is 310–1000 m. Present specimens in 82–531 m, alive in 420 m.

**Remarks.** *Parvamussium retiolum* is closely similar to *P. maorium*, but differs in the sculpture of the left valve (*P. maorium* is smooth on the central part of the disc and radially sculptured laterally, *P. retiolum* commarginally and radially sculptured throughout). Other morphological characters are very similar.

*Parvamussium retiolum* is a **new record** for Australia.

***Parvamussium scitulum* (E. A. Smith, 1885)**

Figs 9, 10A–D,F

*Amussium scitulum* Smith, 1885: 312, pl. 23, figs 4–4b.  
*Amusium* (*Propeamussium*) [sic] *scitulum* var.? *cmadoritinctum* Kuroda, 1931: 77, figs 81–82.  
*Ctenamussium* (*Ctenamussium*) *cmadoritinctum* (Kuroda).—Oyama, 1951: 80, pl. 13, figs 3–4.  
*Ctenamussium* [sic] *cmadoritinctum* (Kuroda).—Habe, 1964b: 173, pl. 53, fig. 4.  
*Ctenamussium* [sic] *scitulum* (Smith).—Koyama *et al.*, 1981: 63.  
*Propeamussium cmadoritinctum* (Kuroda).—Hayami, 1988a: 479, figs 2–1, 2.  
*Propeamussium* (*Parvamussium*) *scitulum* (Smith).—Dijkstra, 1990a: 3.  
*Parvamussium scitulum* (Smith).—Dijkstra, 1991: 16, figs 35–43; Dijkstra, 1995b: 31, figs 43–46, 153–154; Dijkstra, 1998a: 14, pl. 1, figs 3–6; Lamprell & Whitehead, 1992: [16], 179; Dijkstra & Kastoro, 1997: 261, figs 75–78; Hayami, 2000: 913, pl. 454, fig. 7; Dijkstra, 2001: 86; Dijkstra & Maestrati, 2008: 94; Xu & Zhang, 2008: 78, fig. 217; Dijkstra & Maestrati, 2010: 339; Huber, 2010: 224; Dijkstra, 2011: 42, pl. 1016, figs 5–8b; Dijkstra, 2013: 21, pl. 3, figs 2a–d, pl. 4, fig. 10; Dijkstra & Janssen, 2013: 192, figs 40–42; Dijkstra & Maestrati, 2013b: 474; Dijkstra & Maestrati, 2015: 605, figs 4A–C.

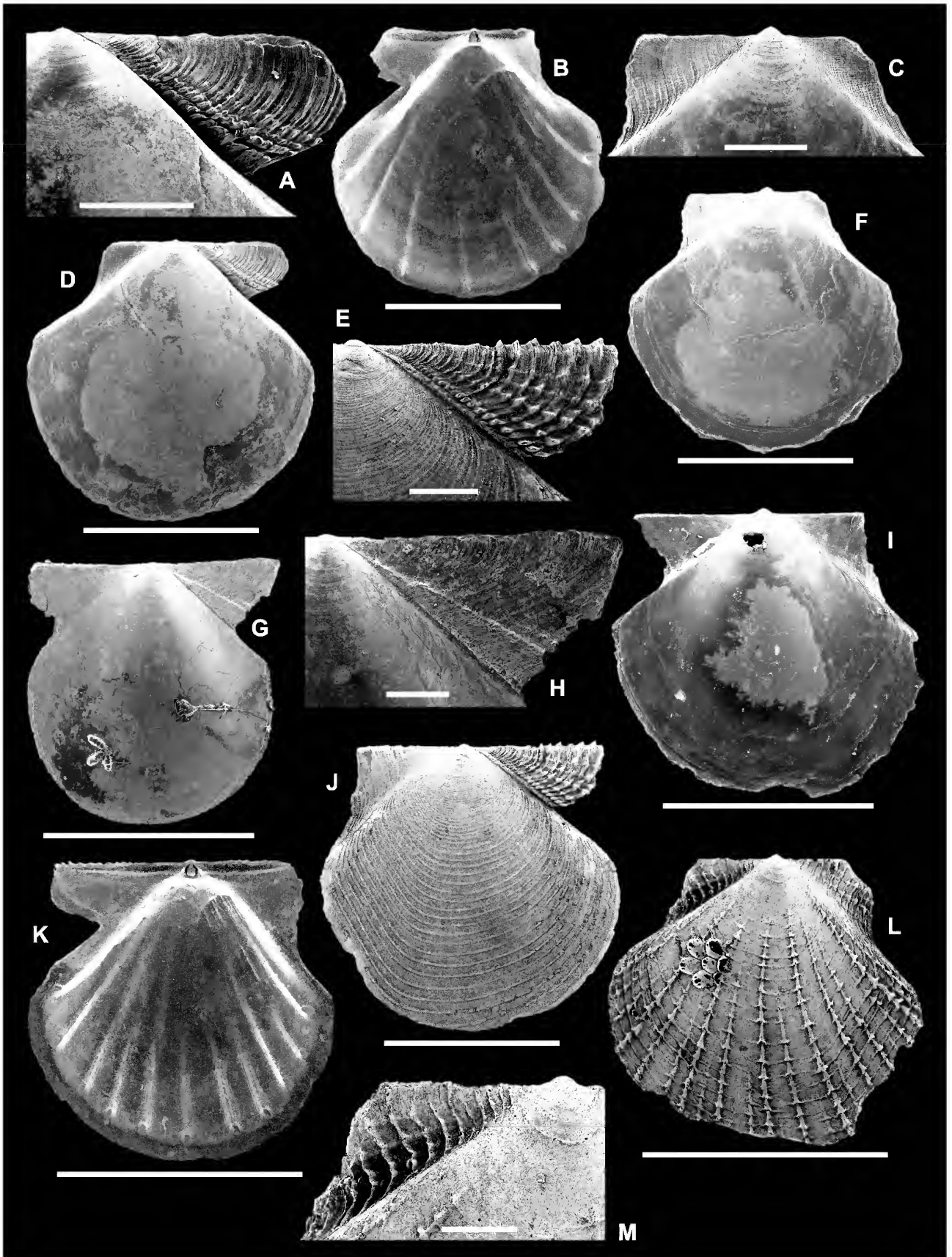
**Comments on synonymy.** Kuroda (1931: 77) described a possible new variation of the present species from Japan, *Amusium scitulum* var. *cmadoritinctum*, which is more colourful and much larger in size than the type material of *Parvamussium scitulum*. Smith (1885: 312) suggested that the type specimens from New Guinea are possibly juveniles. The present specimens are indeed larger than the type material and the colour is highly variable, so we agree with Kuroda (1931) that the larger, coloured specimens are part of the variation of *P. scitulum*.

**Type data.** *Amussium scitulum* Smith: lectotype (lv) designated by Dijkstra (1995b: 31) NHMUK1887.2.9.3319/1; 6 paralectotypes (v) NHMUK1887.2.9.3319/2–7. Type locality: S of New Guinea, 9°59'S 139°42'E, dead, 51 m (*Challenger* stn 188).

*Amusium scitulum* var. *cmadoritinctum* Kuroda: holotype (lv) and paratype (rv), figured in Kuroda (1931: 72, fig. 81 [holotype] and fig. 82 [paratype]), Kikuchi Shell Museum, Kuroda collection, now Nishinomiya Shell Museum (not seen). Type locality: Japan, Kyushu, Kagoshima Prefecture, Yakushima Island.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: N Gulf of Carpentaria, 10°05.2'S 139°28.5'E, dead, 37 m (8 v, C.165156); off Bowen, 19°48'S 148°53'E, dead, 62 m (many v, C.165485); GBR, Swain Reefs, 3 km NE of W side of Gillett Cay, 21°70'S 152°43.3'E, dead, 64–73 m (many v, C.165488; many v, C.165489; many v, C.165519, in part); SE of Swain Reefs, 22°20'09"–22°26'16"S 153°17'05"E, dead, 187 m (many v, C.462540); SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (1 v, C.157661, in part; 13 v, C.157662); SE of Swain Reefs, 22°32.4'S 152°33.9'E, dead, 92 m (2 v, C.338461); 4 ml E of North Reef, 23°09'S 151°58'E, dead, 64 m (1 v, C.165157); Capricorn Group, One tree Island, 23°30'S 152°05'E, dead, 55 m (14 v, C.165486; 2 v, C.165158); E of Lady Musgrave Island, 23°50.1'S 152°32.1'E, dead, 132 m (6 v, C.157665); E of Lady Musgrave Island, 23°51.2'S 152°34.5'E, dead, 175–200 m (12 v, C.338460); off S end of Fraser Island, 25°48'S 153°46'E, dead, 73 m (21 v, C.165490). WESTERN AUSTRALIA: W of Broome, approx. 17°58'S 122°14'E, dead, 90 m (many v, WAM474.91; many v, WAM420.91); N of Broome, approx. 17°58'S 122°14'E, dead, 56 m (13 v, WAM421.91); 94 n.ml NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m (many v, C.157691); NNW of Dampier, c. 19°34'S 116°08'E, dead, c. 101 m (13 v, WAM489.91). NORTHERN TERRITORY: Arafura Sea, c. 245 ml NE of Croker Island, 8°36'S 135°08'E, dead, 82 m (1 v, C.157726; 2 v, C.157725); Arafura Sea, c. 330 km NW of Wessel Islands, 8°26'S 135°22'E, dead, 75 m (11 v, C.157727; 12 v, C.157728); Arafura Sea, 180 ml NW of Wessel Islands, 8°56'S 135°25'E, dead, 73 m





**Figure 10.** *A–D, F, Parvamussium scitulum* (Smith), separate valves, AM C.165490, HMAS *Kimbla* stn Q11, off S end of Frazer Island, QLD, 25°48'S 153°46'E, 73 m; rv anterior auricle exterior (A), rv interior (B), lv auricles exterior (C), rv exterior (D), lv exterior (F). *E, J–M, Parvamussium squalidulum* Dijkstra, separate valves, AM C.462546, Lord Howe Island shelf, 31°36'S 159°09'E, 35 m; rv anterior auricle exterior (E), rv exterior (J), rv interior (K), lv exterior (L), lv anterior auricle exterior (M). *G–I, Parvamussium slacksmithae* sp. nov., paratype (G, H) AM C.209769 and holotype (I), AM C.157685, FRV *Soela* stn 26-18, 72 nautical miles NNW of Dampier, WA, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, 110 m; rv exterior (G), rv anterior auricle exterior (H), lv exterior (I). Scale bars represent 1 mm (A, C), 4 mm (B, D, F, I, K), 0.5 mm (E, H, M), 5 mm (G, J, L).

(8 v, C.157724); NW Gulf of Carpentaria, 8°48'S 137°01'E, dead (1 v, C.338462); 125 km N of Goulburn Island, 10°23'S 133°36'E, dead, 62 m (20 v, C.165483); 41 km NE of Goulburn Island, 11°10.5'S 133°43'E, dead, 47 m (many v, C.165482); 84 km NE of Goulburn Island, 10°48.5'S 133°48'E, dead, 60 m (17 v, C.165484). TASMAN SEA: Middleton Reef, 29°24'S 159°04'E, dead, 273.5 m (many v, C.461378); Middleton Reef, 29°29'S 159°05'E, dead, 117.5 m (many v, C.461379); Middleton Reef, 29°24'S 159°06'E, dead, 121 m (13 v, C.461388); Middleton Reef, 29°25'S 159°02'E, dead, 298 m (many v, C.461382); Middleton Reef, 29°25'S 159°05'E, dead, 167 m (12 v, C.461389; 25 v, C.461395); Middleton Reef, 29°30'S 159°03'E, dead, 254 m (many v, C.461384); Middleton Reef, 29°30'S 159°07'E, dead, 295 m (29 v, C.461381 [in part]); Lord Howe Shelf, 31°25'S 159°02'E, dead, 58.5 m (2 v, C.461411); Lord Howe Shelf, 31°25'S 159°03'E, dead, 64 m (4 v, C.461405); Lord Howe Shelf, 31°26'S 159°07'E, dead, 96 m (many v, C.461380; 1 v, C.461398); Lord Howe Shelf, 31°27'S 159°08'E, dead, 57.5 m (5 v, C.461406); Lord Howe Shelf, 31°30'S 159°05'E, dead, 48 m (1 v, C.461403); Lord Howe Shelf, 31°31'S 159°07'E, dead, 51.5 m (1 v, C.461397); Lord Howe Shelf, 31°36'S 159°09'E, dead, 35 m (27 v, C.462546); Lord Howe Shelf, 31°43'S 159°04'E, dead, 98 m (11 v, C.461391); Lord Howe Shelf, 31°44'S 159°04'E, dead, 117.5 m (9 v, C.462547); Lord Howe Island, Balls Pyramid, 31°44'S 159°11'E, dead, 53.5 m (3 v, C.461408); Lord Howe Island, Balls Pyramid, 31°44'S 159°18'E, dead, 78 m (1 v, C.461404); Lord Howe Island, Balls Pyramid, 31°46'S 159°09'E, dead, 157.5 m (8 v, C.461386 [in part]); off Lord Howe Island, 31°34.95'S 159°0.3'E, dead, 73 m (many v, C.165487).

**Description.** Shell fragile, small, up to c. 12 mm high, subcircular, compressed, inequivalve, inequilateral, right valve more convex than left, auricles rather small and unequal, umbonal angle c. 120°, prodissoconch c. 210 µm in height. Left valve stained, opaque, right valve semi-translucent white.

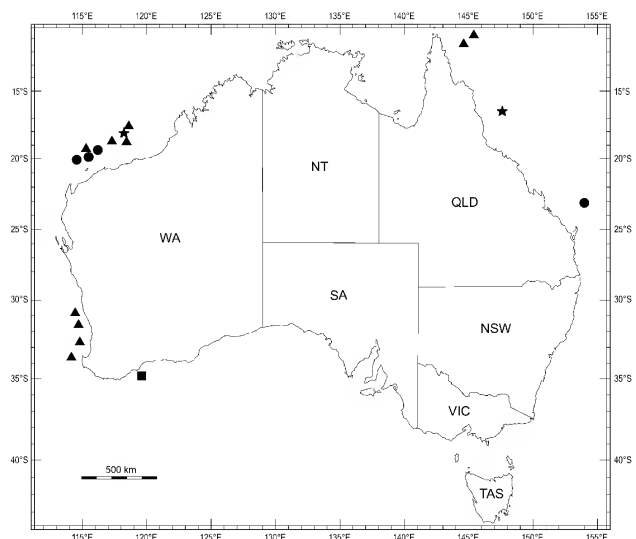
Left valve very weakly inflated, weakly sculptured with delicate, variable radial striations, somewhat stronger near posterior margin than elsewhere. Microscopic close-set commarginal striae developed on disc of some specimens, somewhat more widely spaced near umbonal area. Anterior auricle with prominent 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. Dorsal margin straight. Byssal notch narrow.

**Habitat.** Living in the sublittoral and bathyal zones, free on soft sediment (sand, muddy sand or mud with coral rubble or gravel).

**Distribution.** Japan to tropical western Pacific, 40–500 m (?alive) (Hayami, 2000); Indonesia, 50–385 m (dead) (Dijkstra, 1990a, 1991; Dijkstra & Kastoro, 1997); Papua New Guinea, 60–125 m; Chesterfield Islands, Coral Sea, 300 m; New Caledonia, 250–350 m; Loyalty Islands, 70–200 m; Wallis and Futuna Islands, 200–240 m (dead) (Dijkstra, 1995b, 1998a, 2001; Dijkstra & Maestrati, 2008); Fiji, 80–120 m; Tonga, 327–360 m (dead) (Dijkstra & Maestrati, 2008); Austral Islands, 200–620 m (dead) (Dijkstra & Maestrati, 2010). Now also extended westwards into the Indian Ocean from the Mozambique Channel, northwestern and southern Madagascar and northeastern South Africa, in 53–112 m (Dijkstra & Maestrati, 2015). Maximum depth range of live-taken specimens is 60–350 m. Lamprell & Whitehead (1992: [16], 179) recorded this species from deep water off Australia, but without any locality data. The present material from Australia taken only dead at 37–200 m.

**Remarks.** The present material from Australia is somewhat more variable in sculpture (smooth or almost smooth to typically striate) than the type specimens from eastern Indonesia.



**Figure 11.** Distribution of *Parvamussium slacksmithae* sp. nov. (circles), *P. squalidulum* Dijkstra (stars), *P. torresi* (Smith) (triangles) and *P. whissoni* sp. nov. (square).

### *Parvamussium slacksmithae* sp. nov.

Figs 10G–I, 11

**Holotype** (lv) AM C.157685, Western Australia, 72 n.ml NNW of Dampier, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, dead, 110 m, coll. B. W. Jenkins, 26.X.1983 (FRV *Soela* stn 26-18), (H 5.1 mm, L 6.0 mm). **Paratypes** (64, lv + rv): 50 AM C.209769, 14 ZMA Moll.409002; paratypes from the same locality. Largest paratype (lv): H 5.9 mm, L 6.5 mm.

**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: 85 n.ml NNW of Port Hedland, 19°00.4'–19°03'S 118°01'E, dead, 116–120 m, sand & gravel, FRV *Soela* stn 29-26, coll. B.W. Jenkins, 29.X.1983 (1 v, C.157713); 94 n.ml NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m, FRV *Soela* stn 23-06, coll. B. W. Jenkins, 23.X.1983 (10 v, C.157658). QUEENSLAND: SE of Swain Reefs, 22°20'09"–22°26'16"S 153°17'05"E, dead, 187 m, HMAS *Kimbla* stn 7, coll. P. H. Colman, VI.2008 (5 v, C.462541).

**Description.** Shell small, up to c. 6 mm high, fragile, translucent, left and right valves equally convex, almost circular, inequivalve, equilateral, auricles almost equal in size, umbonal angle c. 90°. Left valve with small milky white maculations, right valve with milky white dot umbonally.

Both valves smooth and glossy, with traces of commarginal growth lines on left valve, some specimens with weak, closely spaced commarginal lamellae and rudimentary radial sculpture on anterior and posterior ends of disc. Anterior auricle of left valve smooth, some specimens with weak commarginal sculpture near periphery. Anterior auricle of right valve with one radial riblet near pseudo-fasciole, posterior auricle smooth. Dorsal margin straight. Byssal notch shallow. Interior surface with rudimentary short riblets, two anteriorly and two posteriorly.

**Discussion.** *Parvamussium slacksmithae* sp. nov. is somewhat similar to *P. torresi* (E. A. Smith, 1885) from northeastern Australia, but differs in size (*P. slacksmithae* is c. 6 mm high, *P. torresi* is larger, up to c. 9 mm high), in external sculpture (right valve of *P. slacksmithae* is smooth, right valve of *P. torresi* has weak commarginal lamellae) and internal sculpture (*P. slacksmithae* has a few rudimentary riblets, *P. torresi* has 10 prominent, well-developed radial

riblets). *Parvamussium vesiculatum* Dijkstra, 1995 from New Caledonia also has rudimentary internal riblets, somewhat similar to the present species, but differs strongly externally (*P. slacksmithae* is almost smooth, *P. vesiculatum* is prominently sculptured) (Dijkstra, 1995b: 39).

**Habitat.** The present specimens are so far only dead-taken on the continental shelf on soft sediment.

**Distribution.** Northwestern Australia near Port Hedland from 18°48'–19°29'S, and 116°29'–119°0'E, also from Queensland, taken dead at 92–187 m.

**Remarks.** It is possible that the present species was collected alive at the type locality. Specimens are very fresh and soft parts are often lacking after sorting the material, as the valves become separated easily due to the weak external ligament. Specimens from Queensland have more prominent commarginal sculpture near the disc flank, but other characters are similar to the type material.

**Etymology.** Named after Mrs Shirley Slack-Smith, formerly curator of the Mollusca Section of the WAM, who generously supported this project and assisted in many ways.

### *Parvamussium squalidulum* Dijkstra, 1995

Figs 10E, J–M, 11

*Parvamussium squalidulum* Dijkstra, 1995b: 32, figs 47–50; Dijkstra & Kastoro, 1997: 262, figs 79–82; Dijkstra & Marshall, 1997: 81, pl. 4, figs 5–10; Dijkstra & Marshall, 2008: 12, figs 10A–E, 11; Dijkstra & Maestrati, 2008: 94; Xu & Zhang, 2008: 78, fig. 216; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2010: 339; Dijkstra, 2011: 42, pl. 1016, figs 1a–b; Dijkstra & Maestrati, 2013b: 474.

**Type data.** Holotype (pr) MNHN Moll21169. Paratypes (3 pr + 10 v): 2 AM C.201714, 3 ZMA Moll.395027, 6 MNHN Moll21170, 2 USNM 886342. Type locality: Lord Howe Rise, Kelso Bank, 24°11'S 159°35'E, alive, 270 m (MUSORSTOM 5 stn DW 277).

**Additional material examined.**—AUSTRALIA: QUEENSLAND: E of GBR, 17°22'S 146°48'E, alive, 296–303 m (9 pr [smooth var.], QM MO.17747; 7 pr [smooth var.], QM MO.17943). WESTERN AUSTRALIA: S of Rowley Shoals, approx. 17°35'S 118°56'E, dead, 260 m (1 v, WAM418.91).—NEW CALEDONIA: 4 ml S of Ile des Pins, 22°50'S 167°34'E, dead, 275 m (2 v, C.165443 [in part]). TASMAN SEA: Lord Howe Shelf, 31°36'S 159°09'E, dead, 35 m (15 v, C.461383 [in part]); Lord Howe Shelf, 31°43'S 159°04'E, dead, 98 m (3 v, C.463023); Lord Howe Shelf, 31°44'S 159°04'E, alive, 117.5 m (1 pr, 13 v, C.463024); Lord Howe Island, Balls Pyramid, 31°46'S 159°09'E, dead, 157.5 m (12 v, C.463025).

**Description.** Shell up to c. 11 mm high, fragile, semi-translucent, almost circular, inequivalve, inequilateral, left valve slightly more convex than right, auricles unequal in size, umbonal angle c. 125°. Inner surface of both valves with 10 radial riblets, with a few interstitial rudimentary riblets in some specimens. One auricular riblet on posterior auricle, absent on anterior. Left valve cream, with white and orange-brown maculations, right valve semi-translucent white, glossy.

Left valve sculptured with numerous unevenly spaced scaly radial riblets, increasing in number towards ventral margin, with delicate intercostal commarginal lamellae, more closely spaced near ventral margin than elsewhere. Both auricles with commarginal lamellae, anterior auricle with 3 very weak radial riblets, absent from posterior. Dorsal margin straight.

Right valve with minute commarginal lirae near lateral

margins, absent from central part of disc. Delicate, closely spaced commarginal lamellae near ventral margin. Anterior auricle with 5 radial riblets crossed by commarginal lamellae, posterior auricle with delicate lamellae near disc flank. Byssal notch narrow.

**Habitat.** Living on the outer continental shelf and in the bathyal zone, free on soft sediment (sand and mud).

**Distribution.** Eastern Indonesia, 124–850 m (dead) (Dijkstra & Kastoro, 1997);

Chesterfield Islands, Coral Sea, 270 m; Loyalty Islands, 380 m (dead); Vanuatu, 325–400 m; Wallis and Futuna Islands, 210–330 m (dead) (Dijkstra, 1995b, 2001); Kermadec Islands, 302 m (Dijkstra & Marshall, 1997; Dijkstra & Marshall, 2008: 12, fig. 11); Fiji, 280–296 m; Tonga, 523–806 m (Dijkstra & Maestrati, 2008); Austral Islands, 112–121 m (Dijkstra & Maestrati, 2010). Maximum depth range of live-taken specimens is 112–806 m. Present specimen from Queensland (296–303 m, alive), New South Wales (117.5 m, alive), and Western Australia (dead in 260 m).

**Remarks.** The present specimens from Western Australia are identical to the type specimens.

*Parvamussium squalidulum* is a **new record** for Australia.

### *Parvamussium thetidis* (Hedley, 1902)

Figs 12, 13

*Amusium thetidis* Hedley, 1902: 304, fig. 49; Hedley & Petterd, 1906, 223, pl. 38, figs 18–19.

*Amussium* [sic] *thetidis* Hedley.–Pritchard & Gatliff, 1904a: 266.

*Pecten* (*Amussium*) *crisatum* [sic] Bavay, 1905a: 187, pl. 17, figs 2a–c (junior primary homonym of *Pecten crisatus* Bronn, 1828).

*Amussium cristatellum* Dautzenberg & Bavay, 1912: 36, pl. 28, figs 5–8 (replacement name for *Pecten* (*Amussium*) *crisatum* Bavay, 1905).

*Ctenamusium salacon* Iredale, 1929: 164; Iredale & McMichael, 1962: 11.

*Ctenamusium thetidis* (Hedley).–Iredale, 1929: 164, 188; Cotton & Godfrey, 1938: 98, fig. 84; Macpherson & Chapple, 1951: 145; Cotton, 1961: 102, fig. 88; Iredale & McMichael, 1962: 11.

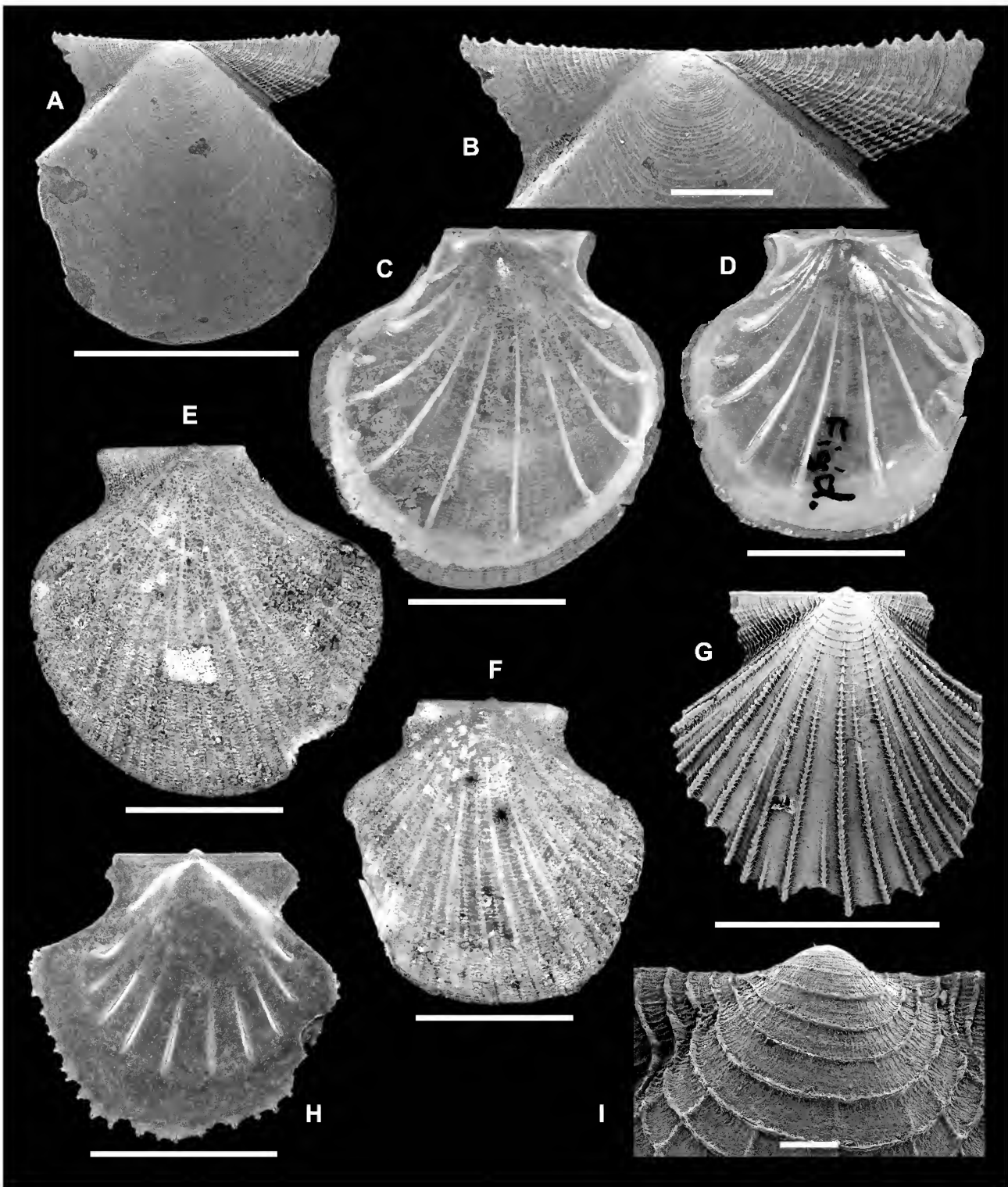
*Amusium texturatum* Dautzenberg & Bavay.–Barnard, 1964: 432 (misidentification).

*Propeamusium* (*Parvamussium*) *crisatellum* (Dautzenberg & Bavay).–Dijkstra, 1990a: 9.

*Parvamussium cristatellum* (Dautzenberg & Bavay).–Dijkstra, 1991: 13, figs 28–32; Rombouts, 1991: 67; Dijkstra & Marshall, 1997: 80, pl. 3, figs 4–8, pl. 4, figs 1–2; Dijkstra & Kastoro, 1997: 261, figs 62–72; Dijkstra, 2001: 83; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2010: 336; Dijkstra, 2011: 40, pl. 1015, figs 2–3b; Dijkstra, 2013: 18, pl. 2, figs 4a–5b, pl. 4, figs 7a–b.

*Parvamussium thetidis* (Hedley).–Dijkstra, 1991: 14; Dijkstra, 1995b: 35, figs 99–102; Lamprell & Whitehead, 1992: [16], pl. 6, fig. 35; Dijkstra & Kastoro, 1997: 262, figs 83–89; Dijkstra & Maestrati, 2008: 95.

**Type data.** *Amusium thetidis* Hedley: holotype (rv) AM C.013210, 5 paratypes (v) AM C.171634. Type locality: Australia, New South Wales, 5–8 miles [8–13 km] off Port Kembla, 34°28'S 151°06'–151°03'E, dead, 115–137 m (*Thetis* stn 49).



**Figure 12.** A–I, *Parvamussium thetidis* (Hedley), (A, B, G–I) separate valves, AM C.165516, c. 210 miles NE of Croker Island, Arafura Sea, NT, 08°18'S 133°58'E, 132 m; (C–F) syntypes of *Ctenamussium salacon* Iredale, AM C.024345, 27 miles [43 km] E of Sydney Heads, NSW, 549 m (2 lv, light photos, copyright Australian Museum); rv exterior (A), rv auricles exterior (B), lv interiors (C, D, H), lv exteriors (E–G), sculpture of lv umbonal area (I). Scale bars represent 4 mm (A, H), 1 mm (B), 5 mm (C–G), 200  $\mu$ m (I).

*Amussium cristatum* Bavay: lectotype (lv, Bavay, 1905a: pl. 17, fig. 2a) designated by Dijkstra & Kastoro (1997: 261) ZSI M3360/1; 2 paralectotypes (lv + rv, Bavay, 1905: pl. 17 figs 2b–c) ZSI M3360/2–3. Type locality: “Masandam insulam” [= Andaman Islands, India], depth unknown.

*Ctenamussium salacon* Iredale: figured syntype (lv) AM C.024345, with a second syntype lv (Fig. 12C–F). Type locality: Australia, New South Wales, 27 miles [43 km] E of Sydney Heads, dead, 549 m.



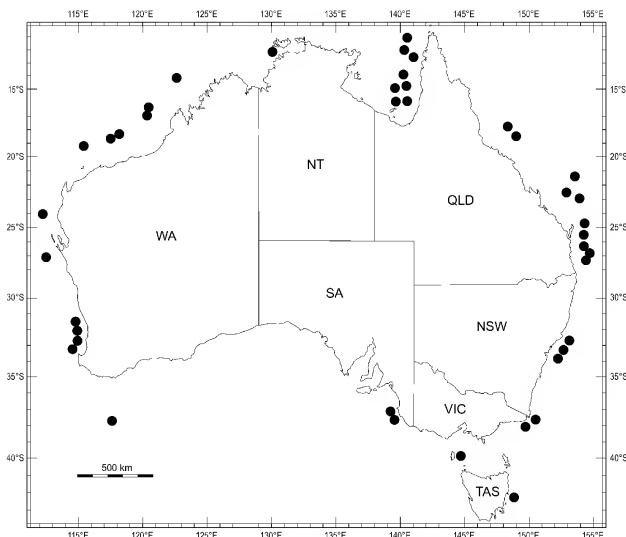


Figure 13. Distribution of *Parvamussium thetidis* (Hedley).

#### Additional material examined

—AUSTRALIA: QUEENSLAND: N Gulf of Carpentaria, 9°34'S 138°30'E, dead (4 v, C.338122); N Gulf of Carpentaria, 9°34'S 139°02'E, dead (2 v, C.338111); N Gulf of Carpentaria, 9°34'S 139°26'E, dead, 38 m (7 v, C.338123); N Gulf of Carpentaria, 10°35'S 140°28'E, dead, 46 m (8 v, C.338128); N Gulf of Carpentaria, 10°36'S 139°32'E, dead, 55 m (3 v, C.338124); N Gulf of Carpentaria, 10°51'S 139°32'E, dead, 55 m (6 v, C.338112); N Gulf of Carpentaria, 11°08'S 140°56'E, dead (1 v, C.338115); N Gulf of Carpentaria, 11°15'S 140°29'E, dead (3 v, C.338127); N Gulf of Carpentaria, 12°09'S 141°02'E, dead (2 v, C.338116); NE Gulf of Carpentaria, 12°09'S 141°02'E, dead, 50 m (3 v, C.338114); E Gulf of Carpentaria, 12°47'S 141°00'E, dead, 54 m (3 v, C.338113); E Gulf of Carpentaria, 13°10'S 140°35'E, dead, 64 m (9 v, C.338118); E Gulf of Carpentaria, 14°20'S 140°34'E, dead, 59 m (5 v, C.338119); S Gulf of Carpentaria, 14°29'S 139°32'E, dead, 66 m (1 v, C.338125); mid Gulf of Carpentaria, 14°51'S 139°47'E, dead, 66 m (1 v, C.338121); E Gulf of Carpentaria, 15°26'S 140°52'E, dead, 53 m (4 v, C.338120); S Gulf of Carpentaria, 15°29'S 139°31'E, dead, 49 m (1 v, C.338126); GBR, off Cairns, 16°34'S 146°15'–146°13.6'E, dead, 192 m (10 v, C.338151); off Cairns, 16°36'–16°35'S 146°15'–146°14.3'E, dead, 110–201 m (1 v, C.338136); off Cairns, 16°36'–16°35'S 146°14'–146°13.8'E, dead, 172–197 m (18 v, C.338137); off Cairns, 17°09'–17°07.4'S 146°42'–146°42.8'E, dead, 243–253 m (1 v, C.157658); off Cairns, 17°09'–17°09.5'S 146°42'–146°41.8'E, dead, 311–329 m (2 v, C.338132); off Cairns, 17°11'–17°12'S 146°38'–146°37.7'E, dead, 143–150 m (1 v, C.338150); off Cairns, 17°13'S 146°48'E, alive, 1161 m (1 pr, C.338131); off Cairns, 17°14'–17°13'S 146°40'–146°38.7'E, dead, 150–176 m (10 v, C.157657); c. 200 ml W of Roebuck Bay, 18°33'S 119°08'E, dead, 128 m (3 v, C.165566); off Townsville, 18°49'S 146°58'E, dead, 34–35 m (1 v, C.157577); Swain Reefs, Bylund (Gillett) Cay, 21°43'S 152°25'E, dead, 27–37 m (many v, C.338155); SE of Swain Reefs, 22°26'–22°20'S 153°17'–152°17.6'E, alive, 187 m (1 pr, C.338135; 10 pr, many v, C.461377 [in part]); SE of Swain Reefs, 22°31'S 152°42'E, dead, 78 m (3 v, C.338170); SE of Swain Reefs, 22°32'S 152°33'E, dead, 92 m (2 v, C.157668; 3 v, C.157670); off Yeppoon, 22°42'S 151°37'E, dead, 68 m (4 v, C.338154); NE of Rockhampton, 22°50'S 151°39'E, dead, 64 m (1 v, C.338157); Capricorn Channel, 16.8 mls NE of North Reef, 23°08'S 152°12'E, dead, 115 m (many v, C.338109); Capricorn Channel, 23°08'S 152°16'E, alive, 155 m (2 pr + 12 v, C.338110); 18.5 ml E of North Reef, 23°11.5'S 152°14.5'E, alive, 188 m (1 pr + 2 v, C.165518 [in part]); Capricorn Channel, E of North West Island, 23°15'S 152°24'E, dead, 284 m (6 v, C.338146); Capricorn Group, North West Island, 23°18'S 151°42'E, dead, 18–36 m (5 v, C.338153); E of North West Island, 23°19'S 152°35'E, dead, 320 m (22 v, C.338145); near Heron Island, 23°23'S 151°56'E, dead, 40 m (1 v, C.338156); 24.5 mls E of Lady Musgrave Island, 23°33'S 152°37'E, dead, 339–348 m (18 v, C.338147); NE of Lady Musgrave Island, 23°38'S 152°45'E, dead, 365 m (15 v, C.338143); c. 25 mls E of Lady Musgrave Island, 23°44'S 152°49'E, dead, 348–357 m (many v, C.338148); E of Lady Musgrave Island, 23°51'S 152°34'E, dead, 175–200 m (3 v, C.157672; 14 v, C.157673); E of Lady Musgrave Island, 23°52'–23°51'S 152°42'–152°41.7'E, dead, 296 m (many v, C.155799; 10 v, C.338134; many v, C.165563); Capricorn Channel, E of Lady Elliot Island, 24°0'S 153°06'E, alive, 476–531 m (1 pr + 22 v, C.338149); NE of Lady Elliot Island, 24°03'S 152°49'E, alive, 150 m (10 pr, C.157676); 20 mls N of Frazer Island, 24°22'S 153°17'E, dead, 192–229 m (1 v, C.338144); 20 mls N of Frazer Island, 24°23'S 153°17'E, dead, 100–128 m (1 v, C.338142); off Frazer Island, 24°57'S 153°37'E, dead, 210 m (many v, C.338141); off Maryborough, 25°47'S 153°33'E, dead, 64 m, 10 v (10 v, C.338152); off S end Frazer Island, 25°57'S 153°34'E, dead, 58–60 m (1 v, C.338140); off S end Frazer Island, 25°58'S 153°51'E, dead, 210–219 m (24 v, C.338138; 12 v, C.165560); off S end of Frazer Island, 26°0'S 154°0'E, dead, 732 m (1 v, C.338139); ESE of Noosa Heads, 26°34'S 153°40'E, dead, 128 m (15 v, C.338163); off Maroochyedore, 26°41'S 153°38'E, dead, 200 m (11 v, C.338160); off Caloundra, 26°47'S 153°35'E, dead, 128 m (9 v, C.338164); NNE of Cape Moreton, 26°50'–26°55'S 153°36'E, alive, 183 m (many, C.338165); NE of Cape Moreton Light, 26°54'–26°57'S 153°32'–153°35'E, dead, 115–119 m (many v, C.338166); NE of Cape Moreton, 26°55'S 153°33'E, dead, 124 m (4 v, C.308694); NE of Cape Moreton, 26°55'S 153°33'E, dead, 115–119 m (3 v, C.338158); NE of Cape Moreton, 26°55'S 153°33'E, alive, 115–124 m (many, C.338159; many, C.338169); E of Moreton Bay, 26°55'S 153°33'E, dead, 115–176 m (3 v,

C.338168); off Cape Moreton, 27°0'S 153°35'E, alive, 128–183 m (many, C.338167); off N end of Moreton Bay, 27°01'S 153°36'E, dead, 128 m (10 v, C.338161); off Moreton Bay, 27°27'S 153°39'E, dead, 77 m (1 v, C.338162); off S end Frazer Island, 27°57'S 153°51'E, alive, 201 m (many v, C.338117; many v, C.165359). **NEW SOUTH WALES:** 12.5 mls E of Cape Byron, 28°38'S 153°52'E, dead, 203 m (1 v, C.019806); 24 km E of Ballina, 28°49'S 153°51'E, dead, 185 m (20 v, C.338197); N of Coffs Harbour, 29°40'S 153°30'E, dead, 71 m (1 v, C.338178); off Korogoro Point, 31°11'S 153°13'E, dead, 220 m (2 v, C.338196); 38 km E of Forster, 32°22'S 152°57'E, dead, 247 m (2 v, C.338195); off Newcastle, 32°53'S 152°35'E, dead, 146–175 m (1 v, C.338181); off Newcastle, 32°58'S 152°41'E, dead, 951–1150 m, 3 v, dead (3 v, C.155843); E of Cape Three Points, 33°28'–33°29'S 152°04'–152°03'E, alive, 457–476 m (1 pr + 5 v, C.155817); off Broken Bay, 33°34'S 151°31'E, dead, 82–137 m (1 v, C.338189); off Botany Bay, 33°41'S 151°53'E, dead, 366 m (8 v, C.155806); 22 mls [35 km] E of Narraben, N of Sydney, 33°42'S 151°43'E, dead, 146 m (5 v, C.026071); off Sydney, 33°42'–33°39'S 151°52'–151°54'E, dead, 457 m (many v, C.155802); off Broken Bay, 33°43'S 151°50'E, dead, 270 m (6 v, C.155838); off Broken Bay, 33°43'S 151°40'E, dead, 143 m (8 v, C.338180); off Broken Bay, 33°44'S 151°48'E, dead, 263 m (11 v, C.155811); off Sydney, 33°46'S 151°43'E, alive, 176 m (6 pr + 12 v, C.155829); off Sydney, 33°46'S 151°43'E, dead, 176 m (14 v, C.155836); E of Sydney, 33°48'S 151°52'E, dead, 549 m (8 v, C.155826); 27.5 mls [44 km] E of Sydney Heads, 33°50'S 151°49'E, dead, 457–459 m (1 v, C.024345; 5 v, C.338199); Sydney, 37 km E of South Head, 33°51'S 151°41'E, dead, 457 m (2 v, C.338198); off Sydney, 33°52'S 151°40'E, dead, 200 m (2 v, C.338194); off Sydney, 33°58'S 151°29'E, dead, 150 m (10 v, C.338186); Sydney, Malabar, c. 30 km E of Little Bay, 33°58'S 151°34'E, dead, 192–203 m (many v, C.338183); Sydney, 28 km E of Little Bay, 33°58'S 151°33'E, dead, 183–192 m (10 v, C.338184); off Sydney, 33°58'–33°52'S 151°29'–151°22'E, dead, 75–150 m (7 v, C.338185); Sydney S, off Cronulla, 34°03'S 151°09'E, dead (3 v, C.338190); E of Sydney, 34°03'S 151°37'E, dead, 295 m (4 v, C.338191); off Sydney, 34°04'S 151°37'E, dead, 384 m (12 v, C.338192); off Sydney, 34°04'S 151°37'E, dead, 393 m (10 v, C.338182); off Watomolla, S of Sydney, 34°08'S 151°25'E, dead, 155 m (1 v, C.338188); S of Port Hacking, 34°09'S 151°26'E, dead, 205 m (1 v, C.338193); S of Sydney, 34°11'S 151°26'E, alive, 191–198 m (5 pr, C.343925); S of Sydney, 34°13'–34°15.8'S 151°29'–151°26.6'E, alive, 381–395 m (3 pr, C.343926); off Wollongong, 34°19'S 151°22'E, dead, 282 m (2 v, C.155825); off Port Kembla, 34°20'S 151°18'E, dead, 161 m (2 v, C.155835); 26 km E of Wollongong, 34°25'S 151°15'E, dead, 183 m (2 v, C.018135); 8–13 km off Port Kembla, 34°27'–34°30'S 151°04'–151°09'E, dead, 115–137 m (1 v, C.013210); 8–13 km off Port Kembla, 34°27'–34°30'S 151°04'–151°09'E, dead, 115–137 m (5 v, C.171634); off Nowra, 34°50'S 151°13'E, dead, 550 m (1 v, C.155821); off Nowra, 34°50'S 151°15'E, dead, 786–841 m (1 v, C.338179); 44 km E of Nowra, 34°55.79'–34°56.06'S 151°08.06'–151°07.86'E, alive, 429–466 m (13 pr [juv.], VM F.60249); off Jervis Bay, 35°05'S 151°02'–151°10'E, dead, 400–1000 m (1 v, C.338187); **VICTORIA:** off Gabo Island, 37°39'–37°36'S 150°16'E, alive, 439 m (1 pr, C.343924); 53 km S of Cape Conran, Bass Canyon, 38°18'S 148°39'E, dead, 750 m (1 v, C.338200). **TASMANIA:** Bass Strait, King Island, E of Grassy, 40°11'–40°35'S 144°39'–143°28'E, dead, 58–77 m (5 v, C.338354); off Cape Naturaliste, 40°50'S 148°46'E, dead, 399 m (1 v, C.338356); Maria Island, 12 mls E Cape Mistaken, 42°42'S 148°17'E, dead, 695 m (2 v, C.338355). **SOUTH AUSTRALIA:** off Beachport, dead, 366 m (2 v, SAM D19023); Cape Jaffa, dead, 238 m (2 v, SAM D19024). **WESTERN AUSTRALIA:** W of Bluff Point, 37°40'S 113°12'E, dead, 174 m (1 v, WAM454.91); Recherche Archipelago, 34°09'S 121°27'E, dead, 81 m (3 v, C.338389); SW of Cape Naturaliste, 33°44'S 114°26'E, dead, 183–238 m (1 v, C.338386); SW of Cape Naturaliste, 33°35'S 114°31'E, dead, 176–183 m (6 v, C.338382); NW of Bunbury, 33°15'S 114°37'E, dead, 155 m (3 v, C.338407); NW of Bunbury, 33°15'S 114°32'E, dead, 201–228 m (many v, WAM427.91); W of Bunbury, 33°03'S 114°44'E, dead, 156 m (7 v, C.338378); off Bunbury, 33°0'S 114°41'E, dead, 170 m (3 v, C.338406); NW of Bunbury, 33°0'S 114°38'E, dead, 230–256 m (14 v, C.338411); NW of Bunbury, 33°0'S 114°37'E, dead, 200–221 m (many v, C.338410); SW of Mandurah, 32°45'S 114°47'E, dead, 220 m (8 v, C.338405); SW of Mandurah, 32°41'S 114°51'E, dead, 146–150 m (1 v, C.338408; 1 v, C.165551); W of Garden Island, 32°15'S 115°07'E, dead, 210–212 m (11 v, C.338388); W of Garden Island, 32°15'S 115°03'E, dead, 250–258 m (14 v, C.338409); W of Garden Island, 32°15'S 115°06'E, dead, 176–182 m (12 v, C.338387); W of Rottnest Island, 32°0'S 115°15'E, dead, 146–150 m (4 v, C.338401); W of Rottnest Island, 31°59'S 115°13'E, dead, 201–214 m (13 v, C.338395); W of Rottnest Island, 31°50'S 115°03'E, dead, 256–320 m (7 v, C.338414); NW of Rottnest Island, 31°45'S 115°09'E, dead, 144–150 m (5 v, C.338396); NW of Rottnest Island, 31°45'S 115°02'E, dead, 265–276 m (6 v, C.338390; 1 v, C.165554; 1 v, C.165555); off Rottnest Island, Direction Bank, 31°44'S 115°12'E, dead, 138 m (2 v, C.338397); NW of Rottnest Island, 31°44'S 115°03'E, dead, 183–192 m (4 v, C.338391); off Rottnest Island, 31°42'S 115°08'E, dead, 150 m (2 v, C.338419); off Rottnest Island, 31°41'S 115°05'E, dead, 164 m (2 v, C.338418); off Rottnest Island, 31°38'S 115°08'E, dead, 140 m (2 v, C.338420); W of Guiderton, 31°34'S 115°03'E, dead, 135 m (3 v, C.338403); W of Rottnest Island, 31°0'S 114°52'E, dead, 256 m (2 v, C.338413); W of Rottnest Island, 31°0'S 114°51'E, dead, 256 m (7 v, C.338416); W of Rottnest Island, 31°0'S 114°51'E, dead, 283–320 m (11 v, C.338415); W of Rottnest Island, 30°59'S 114°51'E, dead, 229 m (9 v, C.338412); WNW of Lancelin, 30°58'S 114°53'E, dead, 154 m (12 v, C.338392); WNW of Lancelin, 30°58'S 114°47'E, dead, 289 m (2 v, C.338394); NW of Green Head, 30°37'S 114°38'E, dead, 128–140 m (1 v, C.338404); W of Cervantes Island, 30°33'S 114°40'E, dead, 192–196 m (14 v, C.338398); W of Cervantes, 30°33'S 114°32'E, dead, 154 m (7 v, C.338400); off Cervantes Island, 30°32'S 114°41'E, dead, 238–247 m (9 v, C.338399); NW of Cervantes, 30°19'S 114°30'E, dead, 192–256 m (15 v, C.338381); W of Jurien Bay, 30°19'S 114°37'E, dead, 148 m (1 v, C.338359); off Jurien Bay, 30°08'S 114°30'E, dead, 223–245 m (13 v, C.338417); NW of Green Head, 29°58'S 114°27'E, dead, 197–219 m (3 v, C.338402); SW of Dongara, 29°49'S 114°24'E, dead, 135 m (1 v, WAM455.91); NW of Beagle Island, 29°43'S 114°20'E, dead, 183 m (3 v, C.338421); W of Beagle Island, 29°35'–29°36'S 114°17'E–114°20'E, dead, 163 m (2 v, C.338380); WSW of Dongara, 29°30'S 114°12'E, dead, 146–155 m (1 v, WAM436.91); off Pelsaert Bank, 29°28'S 114°11'–114°11.2'E, dead, 183 m (2 v, C.338379); W of Dongara, 29°20.8'S 114°05.7'E, dead, 192–219 m

(2 v, WAM497.91); Rottneest Shelf, 28°10.62'S 113°23.17'E, dead, 154 m (1 v, WAM12523; 1 v, WAM12524); NW of Bluff Point, 27°40'S 113°03'E, alive, 128 m (1 pr, WAM453.91); W of Carnarvon, 24°59'S 112°27'E, alive, 130 m (1 pr, WAM477.91; 3 v, WAM478.91); NNW of Dampier, 19°34'S 116°08'E, dead, 101 m (2 v, WAM490.91); North West Shelf, c. 170 mls W of Port Hedland, 19°29'S 116°01'E, dead, 137 m (8 v, C.338358); 72 n.ml NNW of Dampier, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, alive, 110 m (4 pr + many v, C.157686); North West Shelf, 115 mls NW of Port Hedland, 19°26'S 117°14'E, dead, 91 m (8 v, C.338375); North West Shelf, c. 190 mls NW of Port Hedland, 19°25'S 115°51'E, dead, 256 m (4 v, C.338376); North West Shelf, c. 190 mls NW of Port Hedland, 19°24'S 115°52'E, dead, 238 m (8 v, C.338377); North West Shelf, c. 90 mls N of Port Hedland, 19°07'S 118°15'E, dead, 88 m (3 v, C.338372); 78 n.ml NNE of Port Hedland, 19°04.6'–19°03'S 118°47.4'–118°06'E, dead, 82 m (1 v, C.157714); 85 n.ml NNW of Port Hedland, 19°00.8'S 118°01.3'E, dead, 112 m (many v, C.157688; many v, C.157687); 85 n.ml NNW of Port Hedland, 19°00.4'–19°00.3'S 118°01.0'–118°01.1'E, dead, 116–120 m (2 v, C.165204 [in part]); North West Shelf, c. 120 mls NW of Port Hedland, 18°54'S 117°27'E, dead, 183 m (2 v, C.338374); 94 n.ml NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m (many v, C.157690); 100 n.ml NW of Port Hedland, 18°47'S 117°58'E, dead, 154 m (15 v, WAM458.91; 12 v, WAM459.91); North West Shelf, 110 mls N of Port Hedland, 18°46'S 119°17'E, dead, 106 m (3 v, C.338369); North West Shelf, c. 140 mls W of Broome, 18°42'S 120°06'E, dead, 90 m (2 v, C.338373); North West Shelf, c. 120 mls N of Port Hedland, 18°40'S 119°23'E, dead, 117 m (17 v, C.338367; 2 v, C.165564); N of Port Hedland, 18°40'S 117°55'E, dead, 150 m (3 v, C.157678; 25 v, C.157680); North West Shelf, c. 200 mls W of Roebuck Bay, 18°33'S 119°08'E, dead, 128 m (12 v, C.338370); North West Shelf, c. 180 mls W of Broome, 18°25'S 119°50'E, dead, 115 m (1 v, C.338366); 114 n. mls N of Port Hedland, 18°25'S 118°22'E (4 v, WAM463.91); North West Shelf, 130 mls N of Port Hedland, 18°13'S 118°37'E, dead, 229 m (4 v, C.338371); S of Rowley Shoals, dead, 266 m (6 v, WAM 469.91; 2 v [atypical], WAM471.91); North West Shelf, c. 230 mls W of Broome, 18°0'S 118°56'E, dead, 261 m (6 v, C.338368; 5 v, C.157716); North West Shelf, c. 135 mls NW of Roebuck Bay, 17°34'S 120°22'E, dead, 188 m (2 v, C.338365); North West Shelf, c. 100 mls NW of Broome, 16°58'S 120°47'E, dead, 194 m (16 v, C.338357; 4 v, C.165568); North West Shelf, c. 150 mls W of Cape Leveque, 16°16'S 120°45'E, dead, 330 m (5 v, C.338364); North West Shelf, c. 110 mls NW of Cape Leveque, 15°53'S 121°28'E, dead, 95 m (1 v, C.338363); North West Shelf, c. 170 mls N of Broome, 15°27'S 121°31'E, dead, 210 m (3 v, C.338362); c. 210 mls N of Broome, 14°50'S 121°49'E, dead, 230 m (2 v, C.338361); N of Cape Leveque, 14°07'S 122°52'E, dead, 256 m (12 v, C.338360). **NORTHERN TERRITORY:** Arafura Sea, 386 km N of Goulburn Island, 8°02'S 133°50'E, dead, 108 m (6 v, C.338090); Arafura Sea, c. 210 ml NE of Croker Island, 8°18'S 133°58'E, dead, 132 m (many v, C.165516); Arafura Sea, 8°09'S 134°50'E, alive, 115 m (1 pr, C.165228); Arafura Sea, c. 250 mls NE of Croker Island, 8°09'S 134°50'E, dead, 115 m (5 v, C.338083); Arafura Sea, N of Wessel Islands, 8°36'S 135°08'E, dead, 82 m (1 v, C.338082; 1 v, C.338129); Arafura Sea, 230 km N of Goulburn Island, 8°39'S 133°34'E, dead, 192 m (3 v, C.338089); Arafura Sea, c. 200 mls NW of Wessel Islands, 8°39'S 135°21'E, dead, 65 m (3 v, C.338085); Arafura Sea, 365 km N of Milingimbi Island, 8°48'S 134°58'E, dead, 100 m (8 v, C.338086); Arafura Sea, c. 180 mls NW of Wessel Islands, 8°56'S 135°25'E, dead, 73 m (2 v, C.338084); Arafura Sea, c. 250 mls NE of Croker Island, 9°11'S 135°43'E, dead, 60 m (9 v, C.338130); Arafura Sea, 230 km N of Goulburn Island, 9°18'S 133°38'E, dead, 135 m (8 v, C.338088); Arafura Sea, 200 km N of Melville Island, 9°23'S 131°22'E, dead, 215 m (8 v, C.338095); Arafura Sea, 180 km N of Croker Island, 9°24'S 133°02'E, dead, 125 m (5 v, C.338092); N of Arnhem Land, 9°30'S 135°50'E, dead (10 v, C.338099); Arafura Sea, 160 km N of Melville Island, 9°45'S 131°19'E, dead, 124 m (1 v, C.338096); Arafura Sea, c. 110 ml N of Melville Island, 9°34'S 131°22'E, dead, 135 m (9 v, C.165562); Arafura Sea, 150 km N of Cobourg Peninsula, 9°45'S 132°04'E, dead, 108 m (4 v, C.338094); Arafura Sea, 150 km NW of Melville Island, 9°53'S 130°02'E, dead, 205 m (21 v, C.338097); Arafura Sea, c. 100 ml N of Croker Island, 9°30'S 132°34'E, 124 m (many v, C.165537); Darwin, 32 km off Point Charles, 12°10'S 130°22'E, dead, 22 m (1 v, C.338103); N of Arnhem Land, 10°01'S 135°48'E, dead (5 v, C.338100); Arafura Sea, 67 km NE of Croker Island, 10°36'S 132°56'E, dead, 62 m (1 v, C.338093); 68 km NE of Croker Island, 10°39'S 133°05'E, dead, 62 m (17 v, C.338091); 91 km N of Goulburn Island, 10°42'S 133°36'E, dead, 58 m (4 v, C.338087); N of Arnhem Land, 10°48'S 136°30'E, dead, 50 m (1 v, C.338101); SW Gulf of Carpentaria, 13°59'S 137°31'E, dead, 55 m (1 v, C.338098); W Gulf of Carpentaria, 13°57'S 137°48'E, dead, 59 m (2 v, C.338102). —INDONESIA: Ceram, Piru Bay, 3°10'S 128°08'E, dead (10 v, C.165538). —SOLOMON ISLANDS: W coast Malaita Island, off Laulesi, 8°53'S 160°45'E, dead, c. 366 m (1 v, C.165434). CORAL SEA: North East Herald Cay, 16°56'S 149°11'E, dead, 5–7 m (4 v, C.338457). —NEW CALEDONIA: S of Ile des Pins, 22°50'S 167°34'E, dead, 274 m (1 v, C.165440). TASMAN SEA: Lord Howe Rise, 31°37'S 159°13'E, dead, 51–55 m (1 v, C.338456).

**Description.** Shell fragile, small, up to c. 10 mm high, opaque, inequivalve, inequilateral, left valve slightly more convex than right, auricles unequal in size, umbonal angle c. 95°, prodissoconch c. 210 µm high. Left valve cream, some specimens with white spots; right valve uniform whitish. Internal riblets 8–10, most specimens with 10, some specimens with rudimentary interstitial riblets, plus 1 or in a few specimens 2 auricular riblets. Riblets fine at first, becoming more prominent distally near ventral marginal.

Left valve sculptured with unevenly spaced radial riblets, commencing at c. 1 mm shell height, enlarging to ventral margin. Commarginal lamellae rather delicate, variable, close-set to more widely spaced, traversing radial riblets.

Auricles with fine, closely spaced commarginal lamellae, somewhat weaker on posterior than anterior auricle. Dorsal margin straight.

Right valve with regular, rather widely spaced commarginal lirae. Anterior auricle with closely spaced commarginal lamellae and 1–3 weakly developed radial riblets near byssal fasciole, posterior auricle with commarginal lamellae only. Dorsal margin slightly raised at ends, with small scales along margin. Resilifer triangular. Byssal notch narrow.

**Habitat.** Living on the continental shelf and in the bathyal zone, free on soft sediment (sand, muddy sand or sandy mud).

**Distribution.** Philippines, 80–150 m [as *Parvamussium cristatellum*] (Dijkstra, 2011); Eastern Indonesia, 230–467 m [as *P. cristatellum*] (Dijkstra, 1991; Dijkstra & Kastoro, 1997); Chesterfield Islands, Coral Sea, 500–540 m; Norfolk Ridge, 573–650 m; Loyalty Islands, 310–350 m (dead); Vanuatu, 450–550 m (dead) [as *P. cristatellum*] (Dijkstra, 1995b); Kermadec Islands, 256–549 m (dead) [as *P. cristatellum*] (Dijkstra & Marshall, 1997); Norfolk Ridge, 569–616 m; Fiji, 390–410 m; Tonga, 351–450 m (dead) (Dijkstra & Maestrati, 2008); Austral Islands, 140–750 m (dead) [as *P. cristatellum*] (Dijkstra & Maestrati, 2010). Maximum depth range of live-taken specimens is 230–650 m, from Australia 110–1161 m.

**Remarks.** The external sculpture of the left valve of *Parvamussium thetidis* is extremely variable. The primary radial riblets vary in prominence from strongly developed to very weakly developed or even lacking on the central part of the disc and are unevenly spaced. The commarginal lamellae also vary in spacing from very closely to more widely set. All these variations are observed in the abundant material from around Australia. This includes material indistinguishable from the specimens previously identified as *P. cristatellum* (Dautzenberg & Bavay, 1912) and *Ctenamussium salacon* Iredale, 1929, which we therefore regard as a synonyms of *P. thetidis*.

The northwestern Indian Ocean species *Parvamussium siebenrocki* (Sturany, 1901) and *Parvamussium formosum* (Melvill in Melvill & Standen, 1907) are very closely similar to the present species (see Dijkstra & Marshall, 1997: 80) and could be morphs or even synonyms of the one species, in which case the earliest name for this species would be *P. siebenrocki*. However, the distribution and range of variation require further study before this is accepted.

### *Parvamussium torresi* (E. A. Smith, 1885)

Figs 11, 14A–B, D–E, J

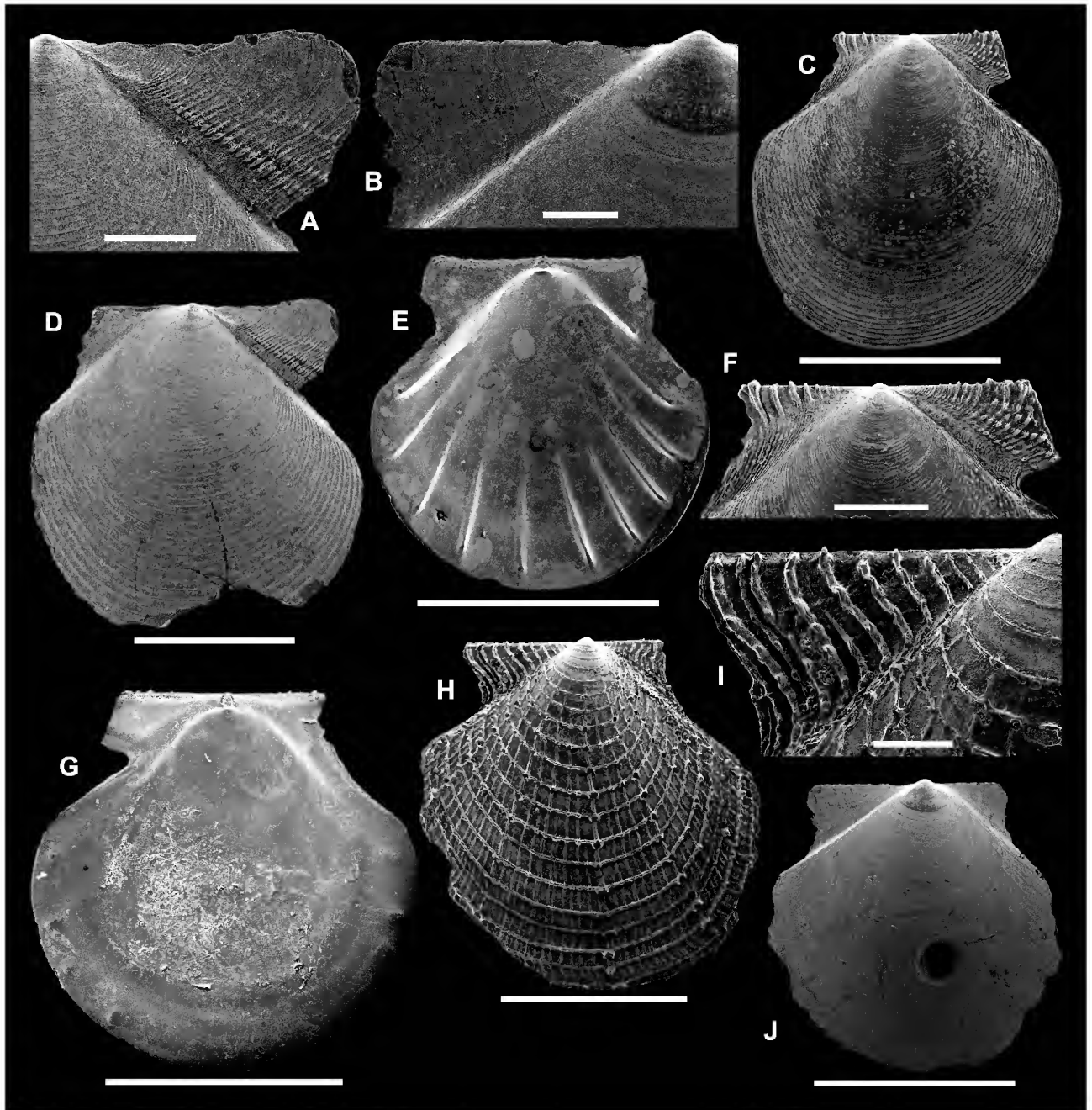
*Amussium torresi* Smith, 1885: 311, pl. 23, figs 3–3b.

*Glyptamussium torresi* (Smith).—Iredale, 1939: 370.

*Propeamussium* (*Parvamussium*) *torresi* (Smith).—Dijkstra, 1990a: 3.

*Parvamussium torresi* (Smith).—Dijkstra, 1995b: 36, figs 51–54, 125–128; Dijkstra & Kastoro, 1997: 262, figs 90–94; Dijkstra & Maestrati, 2008: 95; Dijkstra & Maestrati, 2015: 612, figs 5A–C.

**Type data.** Lectotype (pr) designated by Dijkstra (1995b: 36, figs 125–128) NHMUK1887.2.9.3316, 5 paralectotypes (v) NHMUK1887.2.9.3317/1–5. Type locality: Australia, QLD, E of Cape York, 11°38'15"S 143°59'38"E, alive, 285 m (*Challenger* stn 185B).



**Figure 14.** *A, B, D, E, J*, *Parvamussium torresi* (Smith), separate valves, AM C.165565, MV *Espirito Santo* stn E68/660, 200 miles [322 km] WNW of Port Hedland, WA, 19°29'S 115°38'E, 320 m, rv anterior auricle exterior (A), lv anterior auricle exterior (B), rv exterior (D), lv interior (E), lv exterior (J). *C, F, G-I*, *Parvamussium vesiculatum* Dijkstra, separate valves, AM C.165414, ORV *Franklin* stn 89-40, Gifford Guyot, Coral Sea, 26°45.27'S 159°30.59'E, 315–360 m; rv exterior (C), rv auricles exterior (F), rv interior (G), lv exterior (H), lv anterior auricle exterior (I). Scale bars represent 0.5 mm (A, B, I), 4 mm (C–E, H, J), 1 mm (F), 3 mm (G).

**Comments on type data.** The size of the lectotype (H 7.8 mm, L 7.9 mm) is somewhat different from Smith's measurements, due to damage near the ventral margin of the left valve, and the marginal apron of the right valve is broken off.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: ENE of Cape York Peninsula, 10°29'S 144°0'E, alive, 495–534 m (1 pr, C.166583). WESTERN AUSTRALIA: Recherche Archipelago, 34°09'S 121°27'E, dead, 81 m (1 v, C.165557); SW of Cape Naturaliste, 33°44.5'S 114°26.1'E, dead, 183–238 m (22 v, C.165544; many v, C.165543); NW of Bunbury, 33°15'S 114°32'E, dead, 201–228 m (many v, WAM426.91); W of Bunbury, 33°03'S 114°44'E, dead, 156 m (18 v, C.165561); NW of Bunbury, 33°05'S 114°41'E, dead, 183 m (37 v, WAM431.91; 27 v, WAM432.91); W of Garden Island, 32°15'S 115°03'E, dead, 250–258 m (12 v, C.165549); SW of Rottnest Island, 32°05'S 115°04'E, alive, 583 m (1 pr, WAM456.91); W of Rottnest Island, 31°59.5'S 114°13'E, dead, 201–214 m (8 v, C.165552); W of

Rottnest Island, 31°59'S 115°14'E, dead, 182 m (27 v, C.165541; 17 v, C.165542); NW of Rottnest Island, 31°45'S 115°02'E, dead, 265–276 m (5 v, C.165553); off Rottnest Island, 31°39.8'S 115°07.1'E, dead, 150 m (5 v, C.165556); N of Lancelin, 31°16'S 114°54'E, dead, 274 m (26 v, WAM441.91); NW of Rottnest Island, 31°44'S 115°03'E, dead, 183–192 m (4 v, C.165539); W of Rottnest Island, 30°59'S 114°51'E, dead, 125 m (5 v, WAM444.91); WNW of Lancelin, 30°58'S 114°51'E, dead, 183 m (many v, WAM428.91; 28 v, WAM429.91); WNW of Lancelin, 30°58'S 114°49'E, dead, 212–215 m (many v, WAM430.91); off Cervantes Island, 30°32'S 114°41'E, dead, 238–247 m (8 v, C.165540); NW of Beagle Island, 29°43'S 114°17'E, dead, 174–283 m (4 v, C.165547); 200 ml WNW of Port Hedland, 19°29'S 115°38'E, dead, 320 m (12 v, C.165565); 100 n.ml NW of Port Hedland, 18°47'S 117°58'E, dead, 154 m (2 v, WAM460.91; 23 v, WAM461.91; 1 v, WAM462.91); 230 ml W of Roebuck Bay, 18°30'S 118°03'E, dead, 238 m (15 v, C.165567); S of Rowley Shoals, approx. 17°35'S 118°56'E, dead, 300 m, dead (9 v, WAM416.91; 1 v, WAM417.91); S of Rowley Shoals, approx. 17°35'S 118°56'E, dead, 266 m (1 v, WAM419.91; many v, WAM468.91; many v, WAM470.91; 1 v, WAM473.91); S of Rowley Shoals, approx. 17°35'S 118°56'E, dead, 260 m (many v, WAM423.91).

**Description.** Shell fragile, small, up to c. 9 mm high, subcircular, inequivalve, left valve slightly more convex than right valve, auricles unequal in size, umbonal angle c. 100°, prodissoconch c. 200 µm in height. Internal riblets 10 in most specimens, some with 1 or 2 rudimentary interstitial riblets, plus 1 small auricular riblet on each side. Left valve translucent white, some specimens with white spots, right valve semi-translucent white.

Left valve glossy, very weakly sculptured with unevenly spaced commarginal growth lines; some specimens with minute, close-set commarginal lamellae near ventral margin. Auricles smooth; anterior auricle considerable larger than posterior. Dorsal margin 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. Dorsal margin somewhat raised towards ends due to prominent lamellae on antero- and postero-dorsal margins. Resilifer triangular. Byssal notch narrow.

**Habitat.** Living on the continental shelf and in the bathyal zone, free on soft sediment (sand, muddy sand or mud).

**Distribution.** 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; Vanuatu, 260–300 m; Wallis and Futuna Islands, 250–330 m, dead (Dijkstra, 1995b, 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 into the Indian Ocean from the Mozambique Channel, in 180–264 m. Maximum depth range of live-taken specimens is 170–583 m. Present material from Australia taken in 81–320 m (dead) and 495–583 m (alive).

**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* more convex). The right valve of *Parvamussium torresi* is sculptured with weak commarginal lirae, which are lacking from most specimens of *P. scitulum*. The present material from Australia is morphologically identical to the type specimens from Torres Strait (NE Queensland).

### *Parvamussium vesiculatum* Dijkstra, 1995

Figs 14C,F–I

*Parvamussium vesiculatum* Dijkstra, 1995b: 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; Spencer *et al.*, 2009: 198; Dijkstra, 2011: 44, pl. 1017, figs 1a–b; Dijkstra & Maestrati, 2015: 613, figs 5G–I.

**Type data.** Holotype (pr) MNHN Moll21167; paratypes (36 pr + 27 v): 2 AM C.201715, 12 ZMA Moll.395030, 43 MNHN Moll21168, 2 NMNZ M.268538, 2 NSMT-Mo70542, 2 USNM890874. Type locality: SE New Caledonia, 22°47'S 167°14'E, alive, 440–450 m (BIOCAL stn DW 44).

**Extralimital material examined.** —NEW CALEDONIA: 4 ml S of Isle des Pins, 22°50'S 167°34'E, alive, 275 m (1 pr, C.165236; 1 pr, C.165442 [in part]). CORAL SEA: Gifford Guyot, 26°45.27'S 159°30.59'E, alive, 315–360 m (2 pr, C.165414; 1 pr, C.165415). TASMAN SEA: Derwent Hunter Seamount, 30°48.18'S 156°13.27'E, alive, 288 m (1 pr, C.165244); Taupo Seamount, 33°16.85'S 156°09.15'E, alive, 244 m (1 pr, C.165242).

**Description.** Shell up to c. 8.6 mm high, fragile, semi-translucent white, almost circular, inequivalve, inequilateral, left valve slightly more convex than right, auricles unequal in size, umbonal angle c. 95°. Inner surface with rudimentary riblets anteriorly and posteriorly, also weak on auricles.

Left valve sculptured with widely spaced commarginal lirae with strongly developed, radially arranged nodules or hollow scales. Unevenly spaced radial riblets between commarginal lirae. Auricles with commarginal lamellae, prominent on anterior, slightly closer on posterior. Dorsal margin 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.

**Habitat.** Living in the upper bathyal zone, free on soft sediment (sand and mud).

**Distribution.** Taiwan, 442 m (Dijkstra & Maestrati, 2009: 43); Philippines, 280 m (Dijkstra, 2011); Eastern Indonesia, 205–212 m (Dijkstra & Kastoro, 1997); New Caledonia, 260–650 m; Norfolk Ridge, 470 m; Loyalty Islands, 310 m, dead; Wallis and Futuna Islands, 400–600 m; and Vanuatu, 291–300 m (Dijkstra, 1995b; 2001); Norfolk Ridge, 470 m (Dijkstra & Marshall, 1997); New Zealand: 5 lots from Wanganella Bank, W Norfolk Ridge (32°10.5'S 167°21.2'E, 442–449 m, 12 v, NIWA P13) to Kermadec Ridge, W of Cape Reinga and Three Kings Trough, NW of Three Kings Islands (34°0'S 171°55'E, 805 m, 1 v, NMNZ M.107605), 205–650 m (Dijkstra & Marshall, 2008: 12, fig. 11); Fiji, 327–420 m (dead); Tonga, 327–418 m (dead); Solomon Islands, 396–411 m, dead (Dijkstra & Maestrati, 2008). Now also extended westwards into the Indian Ocean from northwestern and southern Madagascar, 200–220 m (Dijkstra & Maestrati, 2015). The maximum depth range of live-taken specimens is 205–650 m. Now also from the Coral Sea (315–360 m) and Tasman Sea (244–288 m).

**Remarks.** *Parvamussium vesiculatum* is not recorded from the continental shelf of Australia, but lives in the Coral Sea and Tasman Sea.

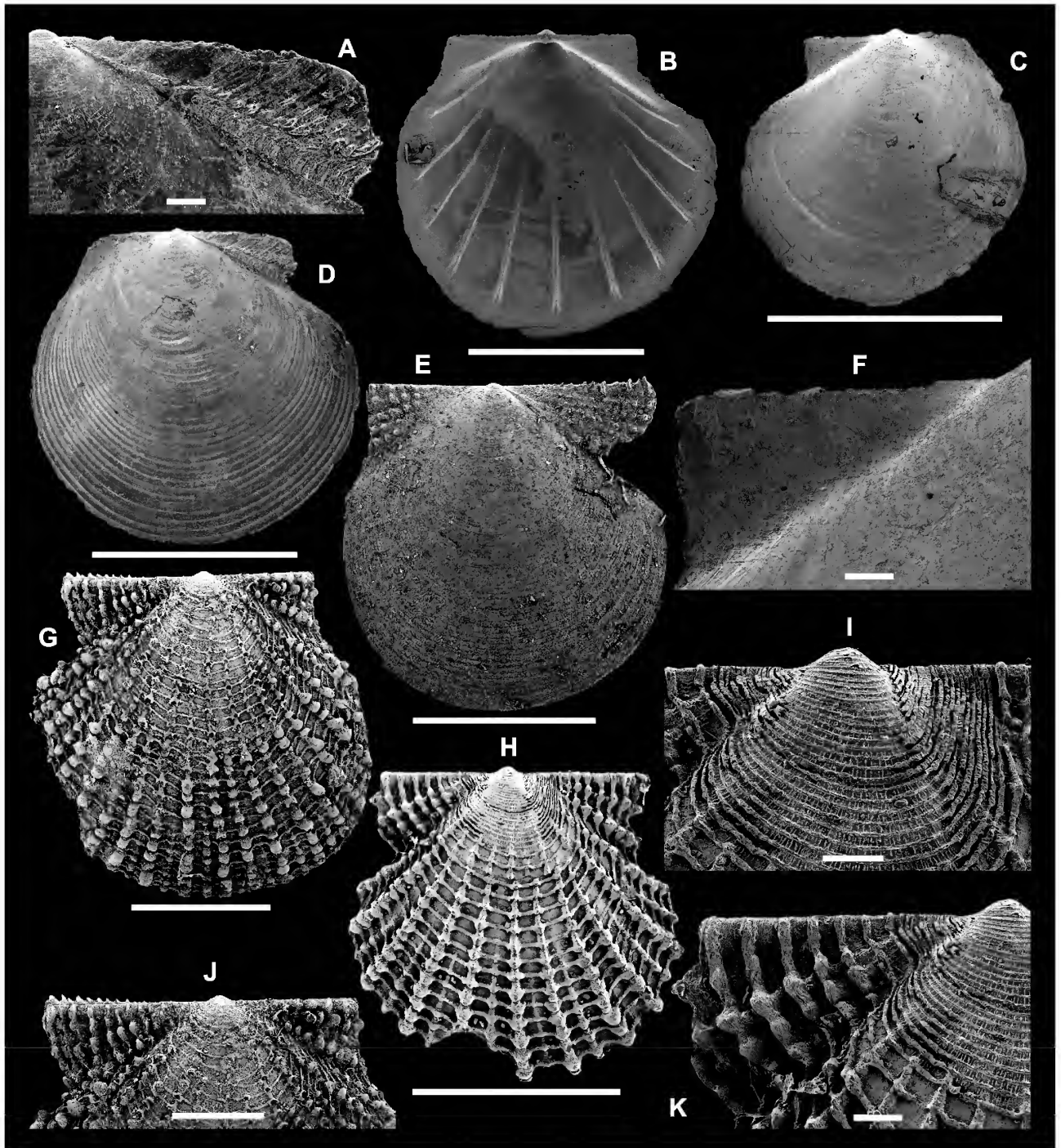
### *Parvamussium whissoni* sp. nov.

Figs 11, 15A–D,F

**Holotype** (lv) (H 5.3 mm, L 5.2 mm) WAM S77663: southern Western Australia, off Albany, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, dead, 748–776 m, hard substrate, leg. C. S. Whisson & J. Fromont, 23 Nov 2005 (CSIRO RV *Southern Surveyor* stn SS 1005/023). **Paratypes** (19: 13 lv + 6 rv): 12 lv + 5 rv, WAM S77664; 1 lv + 1 rv, ZMA Moll.4.12.001. Paratypes from the same locality. Largest paratype (rv): H 6.0 mm, L 6.1 mm.

**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: off Albany, 35°25'03"–35°25'58"S 118°22'26"–118°21'58"E, dead, 1019–1031 m, soft substrate, leg. C. S. Whisson & J. Fromont, 26 Nov 2005, CSIRO RV *Southern Survey* stn SS 1005/043 (3 v, WAM S77659).





**Figure 15.** *A–D, F, Parvamussium whissoni* sp. nov., paratypes, WAM S77664, CSIRO RV *Southern Surveyor* stn SS1005/023, off Albany, southern WA, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, 748–776 m; rv anterior auricle exterior (A), lv interior (B), lv exterior (C), rv exterior (D), lv anterior auricle exterior (F). *E, G, J, Cyclopecten horridus* Dijkstra, AM C.165232, pair, HMAS *Kimbla* stn 4, Capricorn Channel, QLD, 23°11.5'S 152°14.5'E, 188 m; rv exterior (E), lv exterior (G), rv auricles exterior (J). *H, I, K, Cyclopecten cancellus* Dijkstra, lv only, AM C.374666, beach, N side of Margaret River, Kilcarnup, WA, 33°57'S 114°59'E; lv exterior (H), lv umbonal sculpture (I), lv anterior auricle exterior (K). Scale bars represent 200  $\mu$ m (A, F, I, K), 3 mm (B, D), 4 mm (C), 2 mm (E, G, H), 1 mm (J).

**Description.** Shell small, up to c. 6 mm high, fragile, semi-translucent to opaque, left slightly more convex than right valve, almost circular, inequivalve, equilateral, slightly anteriorly elongate, auricles dissimilar in shape, anterior auricle somewhat larger in size than posterior one, umbonal angle c. 95°. Left valve with small white longitudinal maculations, umbonal top whitish opaque, right valve whitish translucent.

Disc and auricles of left valve completely smooth and glossy, with traces of commarginal growth lines. Right valve with widely spaced commarginal lirae (7–8 per mm on central part of disc). Anterior auricle of right valve with weak commarginal lamellae and one radial riblet near pseudo-fasciole, posterior auricle smooth and continuous with disc. Dorsal margin straight. Byssal notch shallow. Left valve with 11 interior riblets (plus one rudimentary in holotype), and

one auricular on each side. Right valve with 11–13 riblets and one auricular posteriorly. Riblets commence after c. 2 mm and extend almost to ventral margin.

**Discussion.** *Parvamussium multiliratum* Dijkstra, 1995 is a closely similar bathyal and abyssal species, known from New Caledonia (Dijkstra, 1995b: 26), Wallis and Futuna and Vanuatu (Dijkstra, 2001: 83), Fiji and Tonga (Dijkstra & Maestrati, 2008: 91), and herein from the Solomon Islands, Coral Sea, Queensland, and Tasman Sea. *Parvamussium whissoni* and *P. multiliratum* are similar in shape (almost circular), but differ somewhat in size (*P. whissoni* up to c. 6 mm high, *P. multiliratum* up to c. 9 mm high), and can be further differentiated by the following characters: *P. whissoni* lacks sculpture on disc and auricles, whereas *P. multiliratum* has commarginal lamellae and some specimens have very weak radial threads interstitially; *P. whissoni* lacks sculpture on the posterior auricle of the right valve, whereas *P. multiliratum* has delicate, closely spaced commarginal lamellae. The internal riblets of the two species are equally developed, but differ in number (*P. whissoni* has 11–13, *P. multiliratum* 14+).

A somewhat similar-looking smooth new congener from Western Australia is *Parvamussium slacksmithae*, which is similar in size, but differs in shape, having larger auricles and the posterior auricle demarcated from the disc (continuous with disc in *P. whissoni*), by lacking commarginal sculpture on the right valve (present in *P. whissoni*), and by rudimentary internal riblets, two anteriorly and two posteriorly (11–13 well-developed in *P. whissoni*).

**Habitat.** The present specimens are so far only dead-taken in the bathyal zone on hard and soft sediment.

**Distribution.** Southern Western Australia, so far from 35°S and 118°E at 748–1031 m (single valves only).

**Etymology.** Named after Corey S. Whisson, technical officer of the Mollusca Section, Department of Aquatic Zoology (WAM).

### *Cyclopecten* Verrill, 1897

*Cyclopecten* Verrill, 1897: 70. Type species (by subsequent designation, Sykes et al., 1898): *Pecten pustulosus* Verrill (1873: 14); Recent, near Georges Bank, off Newfoundland, Canada, 274 m.

*Xenamussium* Oyama, 1944: 244 (proposed as a subgenus of *Propeamussium*). Type species (by original designation): *Pecten hoskynsi* Forbes (1844: 146, 192); Recent, “Asia minor” [= off Turkey].

**Diagnosis.** Shell equivalve, small, circular in most species, laterally compressed, prodissococonch smooth, weakly inflated; left valve of most species sculptured with radial and/or commarginal costellae or striae, right valve with commarginal lamellae; auricles unequal; byssal notch well-developed; without internal radial riblets.

**Distribution.** Paleocene?, Oligocene–Recent (Waller, 2011). Cosmopolitan, subtidal to hadal (Hayami & Kase, 1993: 59). Most representative *Cyclopecten* species from the Indo-West Pacific region, however, live in deep water (Habe, 1977; Bernard, 1983; HHD, unpubl. data).

**Discussion.** Verrill (1897: 70) mentioned in his description “few pectinidial teeth [= ctenolium], byssus and byssal threads”, which are based on “*Cyclopecten*” *circularis* (G. B.

### Key to species of *Cyclopecten* from Australia

- 1 Shell c. 3 mm high, circular, opaque, whitish or creamy, lv with coarse reticulate sculpture with scaly intersections, rv with closely spaced commarginal lamellae, with rudimentary internal riblets in some specimens ..... *C. cancellus*
- Shell small, circular, lv commarginally sculptured with erect hollow spines, internal riblets lacking ..... 2
- 2 Shell c. 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*
- Shell small, subcircular, lv with weak reticulate sculpture in early stage ..... 3
- 3 Shell c. 7.5 mm high, translucent white, lv with weak reticulate sculpture in early ontogeny, other parts of disc smooth, rv with commarginal lamellae transformed into rounded lirae, no internal riblets ..... *C. powelli*
- Shell small, circular, lv with delicate reticulate sculpture, no internal riblets ..... 4
- 4 Shell c. 6 mm high, opaque, whitish, lv with delicate, closely spaced radial and commarginal sculpture, rv with commarginal lamellae ..... *C. kapalae*
- Shell small, circular, lv with radial and commarginal sculpture, in central part reticulate, no internal riblets ..... 5
- 5 Shell c. 10 mm high, semi-translucent, whitish, lv with prominent commarginal lamellae and weaker radial riblets, rv with delicate commarginal lirae ..... *C. reticulatus*

Sowerby I, 1835) [= *Lissochlamys exotica* (Dillwyn, 1817), a pectinid species mistakenly included by Verrill]. A ctenolium and byssus are not present in *Cyclopecten*. Many *Cyclopecten* species have been described and placed in different genera, for example *Delectopecten* (a pectinid genus) (Hertlein, 1969; Knudsen, 1970; Habe, 1977; Bernard, 1978; Rombouts, 1991) or *Palliolium* (a pectinid genus) (Abbott, 1974, in part). Several described "*Cyclopecten*" species from the subantarctic region belong in *Cyclochlamys* (see below) (Dijkstra, unpubl. data).

The morphological characters of *Cyclopecten* are closest to those of *Parvamussium*, although *Cyclopecten* species are easily distinguished by their lack of internal riblets. As Hayami & Kase (1993: 59) suggested, *Cyclopecten* possibly was derived from *Parvamussium* through paedomorphosis.

The shell characters of *Xenamussium* are identical to those of *Cyclopecten*, and in our opinion these names are synonyms.

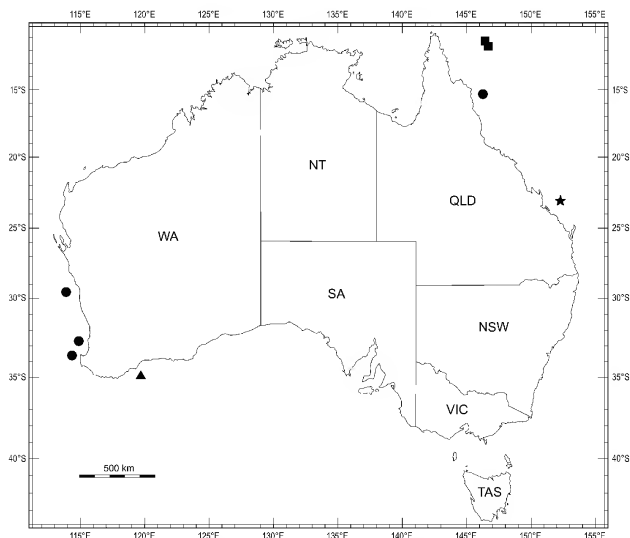
### *Cyclopecten cancellus* Dijkstra, 1991

Figs 15H–I, K, 16

*Cyclopecten cancellus* Dijkstra, 1991: 21, figs 66–70; Dijkstra, 2001: 90, figs 33–35; Dijkstra & Moolenbeek, 2008: 18; Dijkstra & Maestrati, 2008: 97; Dijkstra & Maestrati, 2013b: 474.

**Type data.** Holotype (lv) RMNH56560, 14 paratypes (v) RMNH56561–56566. Type locality: Indonesia, Flores Sea, off SW Salayer, 6°22.4'S 120°26.3'E, dead, 130–155 m (SNELLIUS-II stn 4.153).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: off Cairns, 16°36'12"–16°35'54"S 146°15'24"–146°14'18"E, dead, 110–201 m (1 v, C.165464). WESTERN AUSTRALIA: S of Cowaramup Bay, near mouth of Margaret River, 33°57'S 114°59'E, dead (2 v, C.165468); Kilcarnup, N side of Margaret River, 33°57'S 114°59'E, dead, beach (1 v, C.374666); Ellensbrook, 33°55'S 115°0'E, dead, beach (2 v, WAM S12952); Cowaramup, 33°52'S 115°0'E, dead (2 v [rudimentary internal riblets], WAM S12559; 1 v, WAM S12535); Rottnest Island, 32°0'S 115°30'E, dead, beach (9 v, WAM415.91); Rottnest Island, Bathurst Point, 32°0'S 115°30'E, dead, beach (1 v, WAM414.91); Rottnest Island, Ricey Beach, 32°0'S 115°30'E, dead, beach (3 v, WAM413.91; 1 v, C.165465); Cottesloe, Cable Station, 33°0'S 115°45'E, dead (1 v, WAM481.91); NW of Beagle Island, 29°43'S 114°17'E, dead, 274–283 m (1 v, C.165466). —NEW CALEDONIA: off New Caledonia, 20°16'S 169°51'E, alive, 85–100 m (2 pr, C.165234).



**Figure 16.** Distribution of *Cyclopecten cancellus* Dijkstra (circles), *C. horridus* Dijkstra (star), *C. powelli* Dell (triangle) and *C. reticulatus* sp. nov. (squares).

**Description.** Shell small, up to c. 3 mm high, convex, subcircular, opaque, whitish to cream, wider than high, inequivalve, almost equilateral, left valve slightly more convex than right, auricles almost equal in size, umbonal angle c. 100°.

Left valve with coarse reticulate sculpture with scaly intersections, radial riblets (c. 10) more prominent than commarginal lamellae, both widely spaced, commencing at 0.5 mm shell height and increasing in prominence ventrally, with secondary interstitial radial riblets. Auricles with 1–2 radial riblets crossed by prominent commarginal lamellae.

Right valve with closely spaced commarginal lamellae. Anterior auricle with 2–4 weak radial riblets, posterior smooth. Dorsal margin straight. Byssal notch moderately deep, byssal fasciole narrow.

**Habitat.** Living in the sublittoral and bathyal zones amongst rubble on soft bottoms.

**Distribution.** Indonesia, 130–375 m, dead; Vanuatu, 140–175 m, dead (Dijkstra, 1991, 2001); Fiji, 500–614 m, dead (Dijkstra & Maestrati, 2008). Now also from New Caledonia (85–100 m) and Australia (beach drift and 110–283 m, dead).

**Remarks.** The present species is similar to the type specimens from Indonesia, although some specimens from Western Australia have some rudimentary internal riblets, which are lacking in typical specimens.

*Cyclopecten cancellus* is a **new record** for Australia (empty shells only).

### *Cyclopecten horridus* Dijkstra, 1995

Figs 15E, G, J, 16

*Cyclopecten horridus* Dijkstra, 1995b: 41, figs 63–64, 98; Dijkstra & Marshall, 1997: 87, pl. 6, figs 1–6; Dijkstra & Marshall, 2008: 16, figs 12E–H, 13; Spencer et al. 2009: 198; Dijkstra & Maestrati, 2015: 617, figs 6H–I.

**Type data.** Holotype (pr) MNHN Moll21163, 7 paratypes (v) (5 MNHN Moll21164–21166, 2 ZMA Moll.395020). Type locality: Loyalty Islands, 20°29'S 166°43'E, alive, 600 m (MUSORSTOM 6 stn DW 420).

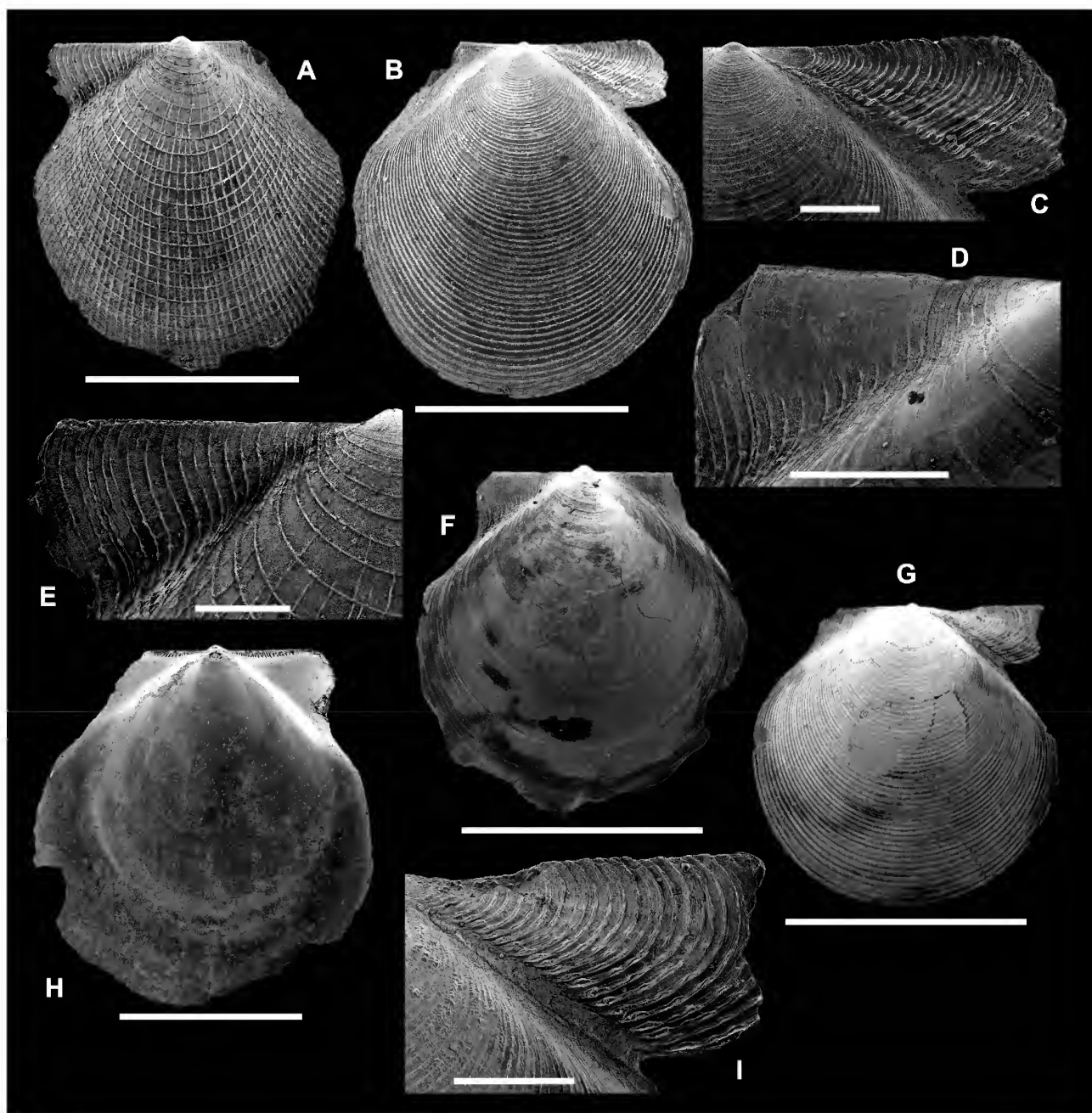
**Additional material examined.** —AUSTRALIA: QUEENSLAND: Capricorn Channel, 23°11.5'S 152°14.5'E, alive, 188 m (2 pr, C.165232). CORAL SEA: Britannia Guyot, 28°17.04'S 155°36.46'E, alive, 425 m, 5 pr, alive (5 pr, C.165416; 2 pr, C.165417). TASMAN SEA: Derwent Hunter Seamount, 30°48.18'S 156°13.27'E, alive, 288 m (1 pr, C.165245).

**Description.** Shell up to c. 6 mm high, almost circular, left valve more convex than right, inequivalve, equilateral, auricles almost equal in size, umbonal angle c. 125°, opaque whitish.

Left valve sculptured throughout with commarginal lamellae, present also on auricles, and closely spaced in early growth stage, enlarging ventrally. Erect hollow spines on lamellae. Interstitial microsculpture of antimarginal scratches in late growth stage.

Right valve with closely spaced, fine commarginal lamellae, more prominent near ventral margin. Anterior auricle with 3 radial riblets crossed by commarginal lamellae. Dorsal margin straight. Byssal notch moderately deep, byssal fasciole narrow.

**Habitat.** Living in the bathyal zone on soft sediment (sand and mud) amongst rubble.



**Figure 17.** *A–C, E, H, Cyclopecten kapalae* Dijkstra, paratypes, separate valves, AM C.165060, off Sydney, NSW, FRV *Kapala* Stn K80-20-08, 33°31'S–33°33'S 152°08'E–152°07'E, 907–914 m; lv exterior (A), rv exterior (B), rv anterior auricle exterior (C), lv anterior auricle exterior (E), lv interior (H). *D, F, G, I, Cyclopecten powelli* Dell, separate valves, WAM S77658, RV *Southern Surveyor* stn SS1005/043, off Albany, WA, 35°25'03"–35°25'58"S 118°22'26"–118°21'58"E, 1019–1031 m; lv anterior auricle exterior (D), lv exterior (F), rv exterior (G), rv anterior auricle exterior (I). Scale bars represent 3 mm (A, B, F–H), 0.5 mm (C–E, I).

**Distribution.** New Caledonia, 435–735 m, dead; Loyalty Islands, 600 m (Dijkstra, 1995b); Kermadec Islands, 350–538 m (Dijkstra & Marshall, 1997, 2008). Now also from Australia (Queensland), the Coral Sea and the Tasman Sea. Recently also recorded from off Transkei, South Africa, 150–200 m, dead (Dijkstra & Maestrati, 2015). Maximum depth range of live-taken specimens is 188–600 m.

**Remarks.** The present material from Australia is similar to the type specimens from the Loyalty Islands, although the sculpture of the left valve is somewhat more prominent.

*Cyclopecten horridus* is a **new record** for Australia.

### *Cyclopecten kapalae* Dijkstra, 1990

Figs 17A–C,E,H, 18

*Cyclopecten kapalae* Dijkstra, 1990c: 29–32, figs 1–5; Dijkstra & Marshall, 1997: 87, pl. 6, figs 7–12; Dijkstra & Marshall, 2008: 16, figs 14, 15A–F; Dijkstra & Maestrati, 2008: 97; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2015: 619, figs 7H–J.

**Type data.** Holotype (pr) AM C.155831.1; 47 paratypes (v) (AM C.155800, C.155813, C.155814, C.155822, C.155823, C.155831.2, C.155832, C.155837, C.165060). Type locality:

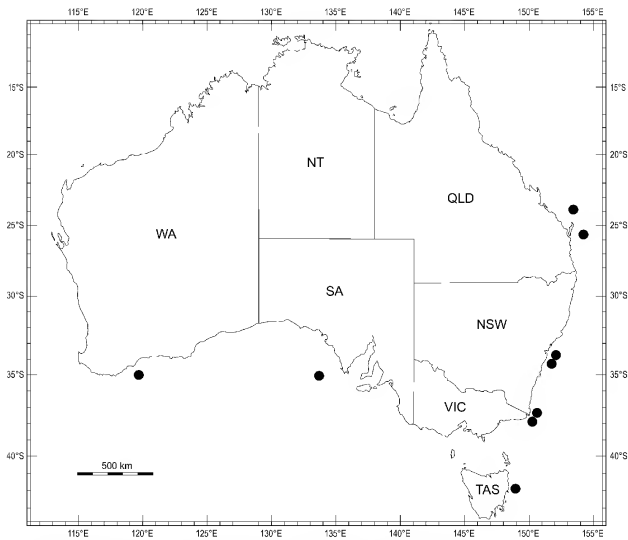


Figure 18. Distribution of *Cyclopecten kapalae* Dijkstra.

Australia, New South Wales, off Sydney, 33°31'–33°33'S 152°08'–152°07'E, alive, 907–914 m (FRV *Kapala* stn K80-20-08).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: NE of Sandy Cape, 24°25.2'–24°06'S 153°23.5'–153°22.4'E, dead, 830 m, 1 v, dead (1 v, C.165445); E of Sandy Cape, 24°43.5'–24°43.8'S 153°33.4'–153°33.3'E, dead, 604 m, 1 v, dead (1 v, C.165475; 3 v, C.157675); Frazer Island, off S end, c. 26°01'S 153°50'E, dead, 732 m (1 v, C.165472). NEW SOUTH WALES: E of Broken Bay, 33°26'S 152°11'E, alive, 822–877 m (1 pr, C.339127; 6 v, C.165470); off Sydney, 33°31'–33°33'S 152°08'–152°07'E, alive, 907–914 m (1 pr, C.155831; 7 pr + 10 v, C.165060); E of Broken Bay, 33°32'S 152°08'E, dead, 914 m (1 v, C.155813); E of Broken Bay, 33°32'S 152°08'E, dead, 914 m (1 v, C.155814); E of Sydney, 33°33'S 152°05'E, dead, 750 m (3 v, C.155800); off Sydney, 33°37'–33°39'S 152°04'–152°02'E, alive, 896–924 m (3 pr, C.339126); off Broken Bay, 33°38'S 152°06'E, dead, 1000 m (1 v, C.165471); NE of Sydney, 33°41'S 151°56'E, dead, 741 m (4 v, C.155837); off Broken Bay, 33°44'S 151°57'E, dead, 805 m (many v, C.155832); off Sydney, 34°05'S 151°43.6'E, dead, 750 m (many v, C.165469); off Nowra, 34°50'S 151°13'E, dead, 550 m (1 v, C.155822); off Nowra, 34°50'S 151°13'E, dead, 786–841 m (4 v, C.155823). VICTORIA: 35 ml S of Tamboon Inlet, Gippsland, 38°02'S 149°08'E, dead, 732 m (1 v, C.337235); S of Point Hicks, 38°19.60'S 149°24.30'E, alive, 930 m (4 pr, VM F60158); S of Point Hicks, 38°21.90'S 149°20'E, alive, 1000 m (4 pr, VM F60159); S of Point Hicks, 38°25.0'S 149°00.0'E, alive, 1500 m (2 pr, VM F60155); 76 km S of Point Hicks, 38°29.33'–38°26.81'S 149°19.98'–149°20.78'E, alive, 1750–1840 m (4 pr [juv.], VM F60250). TASMANIA: off Freycinet Peninsula, 42°00.20'S 148°37.70'E, alive, 720 m (13 pr, VM F60156); off Freycinet Peninsula, 42°02.20'S 148°38.70'E, alive, 800 m (7 pr, VM F60157); 12 ml E of Cape Mistaken, 42°42'10"S 148°17'25"E, dead, 695 m (3 v, C.165473). SOUTH AUSTRALIA: 160 km SSW of St. Francis Island, dead, 33°65'S 132°13'E, 635 m (3 v, C.165474). WESTERN AUSTRALIA: off Albany, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, alive, 748–776 m (1 pr WAM S77660, 15 v WAM S77666-9). KERMADEC ISLANDS: Raoul Island, SE of Chanter Island, alive, 512–549 m (NMNZ M225614). TASMANT SEA: Lord Howe Rise, 27°58.99'S 162°51.55'E, alive, 1250 m (3 pr [lv smooth], C.165410).

**Description.** Shell small, c. 6 mm in height, slightly higher than wide, sub-circular, inequivalve, left valve somewhat more convex than right, anterior and posterior auricles unequal, umbonal angle about 90°, dirty to milky white, some specimens translucent.

Left valve with reticulate sculpture of weak unevenly spaced radial costae and more prominent commarginal lamellae, interstices microscopically scratched. Radial ribbing commencing 1 mm below umbo; commarginal lamellae commence near umbo. Radial riblets and commarginal lamellae 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. Dorsal margin almost straight. Hinge dentition with strong irregular grooves. No internal riblets.

**Habitat.** Living in the bathyal zone, amongst rubble on soft sediment (sand and mud).

**Distribution.** Australia (New South Wales), 907–914 m (Dijkstra, 1990c: 29); Kermadec Islands, 512–549 m (Dijkstra & Marshall, 1997); New Zealand: Norfolk Ridge, from N of Norfolk Island (26°15.9'S 167°10.8'E, 750–774 m, 30 v, NMNZ M.172012) to the Chatham Rise, of E central South Island (43°56.8'S 178°01.7'E, 680–736 m, 1 v, NMNZ M.107607), alive in 512–914 m; the Solomon Islands, 611–1598 m, dead (Dijkstra & Maestrati, 2008). Now also from Queensland, Victoria, Tasmania and South Australia and the Tasman Sea. Recently also extended into the Indian Ocean from the Mozambique Channel and southern Madagascar, in 707–708 m (Dijkstra & Maestrati, 2015). Maximum depth range of live-taken specimens is 512–1840 m.

**Remarks.** A closely similar species from off California (USA), *Cyclopecten bistratus* (Dall, 1916), differs from *C. kapalae* in size (height and length of *C. bistratus* up to 7 mm) and in having more closely spaced radial riblets on the left valve. Okutani (1962: 18) reported *Cyclopecten bistratus* from Sagami Bay, Japan (710–1385 m). However, the reticulate sculpture is finer and weaker than that of both *Cyclopecten bistratus* from the eastern Pacific and *C. kapalae*, and the species reported by Okutani is unnamed.

*Cyclopecten thyrdeus* (Melvill in Melvill & Standen, 1907) from the Arabian Sea, *Cyclopecten secundus* Finlay, 1927 from New Zealand, *Cyclopecten cancellus* Dijkstra, 1991 from Indonesia, and *Cyclopecten ryukyuensis* Hayami & Kase, 1993 from southern Japan all differ from the present species by having more prominent reticulate sculpture and fewer radial costae on the left valve (Dijkstra, 1991: 22).

The present specimens from Western Australia are more weakly sculptured on the left valve than the type material of *Cyclopecten kapalae*, and some are even almost smooth.

### *Cyclopecten powelli* Dell, 1956

Figs 16, 17D,F–G,I

*Cyclopecten powelli* Dell, 1956: 23, pl. 4, figs 34–35; Powell, 1979: 380, figs 93.5–6; Dijkstra & Marshall, 2008: 19, figs 17A–B, D–F, 18; Spencer *et al.*, 2009: 198; Huber, 2010: 225.

**Type data.** Holotype (1v) ZMUC BIV-443, 4 paratypes (1 rv, ZMUC BIV-444; 1 lv + 2 rv, NMNZ M.5698). Type locality: New Zealand, SW of Cape Foulwind, 42°10'S 170°10'E, dead, 610 m, 20 Jan 1952 (RRS *Galathea* stn 626).

**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: off Albany, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, dead, 748–776 m, hard substrate, leg. Whisson & Fromont, 23 Nov 2005 (CSIRO RV *Southern Surveyor* stn SS 1005/023) (3 v, WAM S77670); off Albany, 35°25'03"–35°25'58"S 118°22'26"–118°21'58"E, dead, 1019–1031 m, soft substrate, leg. Whisson & Fromont, 26 Nov 2005 (CSIRO RV *Southern Surveyor* stn SS 1005/043) (5 v, WAM S77658).

**Description.** Shell up to c. 7.5 mm high, almost circular, left valve more convex than right valve, equivalve, almost equilateral, auricles dissimilar in shape, anterior auricle larger than posterior one, umbonal angle c. 105°, translucent



or opaque white. Prodissoconch c. 180 µm long, smooth and convex. Pre-radial dissoconch of left valve up to c. 2 mm height with granular microsculpture.

Left valve sculptured with weak radial threads and commarginal lamellae in early growth stage or completely smooth, other parts of disc smooth. Auricular sculpture similar to that of disc, with more closely spaced commarginal lamellae on posterior auricle.

Right valve with crisp, widely and regularly spaced commarginal lamellae, transformed into low, rounded, regularly spaced ridges. Posterior auricle continuous with disc, sculptured with closely spaced commarginal lamellae and finer radial threads and granules, anterior auricle and byssal fasciole separated from disc by sharply incized groove, sculptured with commarginal lamellae, and 3–5 radial threads on ventral half. Byssal notch shallow, byssal fasciole narrow. Interior riblets lacking.

**Habitat.** Living in the bathyal zone on soft sediment.

**Distribution.** Tasman Sea, 750–1463 m, alive (Dijkstra & Marshall, 2008, p. 19). Now also from Australia (Western Australia). Maximum depth range of present material is 748–1031 m (single valves only).

**Remarks.** The present material from Australia is similar to the type specimens from New Zealand, although the sculpture on the left valve is somewhat weaker, and some specimens have only traces of radial threads or are smooth.

*Cyclopecten powelli* is a **new record** for Australia.

### *Cyclopecten reticulatus* sp. nov.

Figs 16, 19A–D

**Holotype** (pr) (H 9.0 mm, W 9.9 mm, D 2.9 mm) AM C.572380, CORAL SEA, 11°35.61'S 145°29.42'E, alive, 1770–1863 m, benthic sled, leg. I. Loch, 22 Aug 1988 (ORV *Franklin* stn 14). **Paratypes** (5 pr): 2 same data as holotype, AM C.572395, C.165220; 3 paratypes (2 AM C.165221 [in part], 1 ZMA Moll.409003): 11°40.98'S 145°36.85'E, alive, 2039–2052 m, benthic sled, ORV *Franklin* stn 15, coll. I. Loch, 23 Aug 1988. Part of the ventral marginal region of the left valve of the holotype is broken off (height originally somewhat larger than 9.0 mm).

**Description.** Shell up to c. 10 mm high, fragile, semi-translucent white, almost circular, compressed, inequivalve, equilateral, left valve somewhat more convex than right, auricles unequal in shape and size, umbonal angle c. 110°, inner surface without riblets, smooth.

Left valve sculptured with prominent commarginal lamellae throughout, c. 5 per mm on central part of disc, somewhat more widely spaced in early growth stage and more narrowly near ventral margin, commencing at c. 1 mm shell height. Unevenly spaced radial riblets commence at c. 2 mm shell height and increase in number to ventral margin, c. 6 per mm on central part of disc. Commarginal sculpture coarse near ventral margin, radial sculpture weaker, near central part reticulate, near anterior margin intersections somewhat noduliferous, near ventral margin more lamellose. Auricles with closely spaced commarginal lamellae and 3–4 delicate radial riblets, anterior auricle larger than posterior. Dorsal margin straight.

Right valve with delicate commarginal lirae throughout, somewhat more closely spaced than on left valve. Anterior auricle with coarse commarginal lamellae, weaker and finer on posterior. Byssal notch relatively deep, byssal fasciole narrow.

**Discussion.** *Cyclopecten reticulatus* sp. nov. is most similar to *Cyclopecten kermadecensis* (E. A. Smith, 1885) from the Kermadec Islands, but differs in shape (*C. kermadecensis* more oblong) and is sculptured with more widely spaced commarginal lamellae (more closely spaced and more radially sculptured in *C. kermadecensis*) on the left valve. *Cyclopecten horridus* is smaller in size (c. 6 mm high) than the present species; both are almost circular in shape. *Cyclopecten horridus* has coarser radial sculpture on the left valve (weak on *C. reticulatus*) and weaker commarginal sculpture (more prominent on *C. reticulatus*) with hollow spines on the intersections (more noduliferous on *C. reticulatus*). *Cyclopecten pellucidulus* Dijkstra, 1995 is somewhat similar in shape, but smaller in size than *C. reticulatus* sp. nov. (up to c. 6 mm in height, *C. reticulatus* c. 10 mm in height) and lacks radial sculpture on the left valve. *Cyclopecten kapalae* is also smaller in size (up to c. 6 mm in height) and somewhat more oblong than *C. reticulatus*, with more delicate reticulate sculpture on the left valve.

**Habitat.** Living in the bathyal and abyssal zones on soft sediment (sand and mud).

**Distribution.** Coral Sea, 11°35.61'–40.98'S 145°29.42'–36.85'E. Present specimens alive in 1770–2052 m.

**Remarks.** The present species is not recorded from the Australian continental shelf.

**Etymology.** The specific name reflects the reticulate left valve (Latin, adj. *reticulatus* = a small net).

### *Similipecten* Winckworth, 1932

*Similipecten* Winckworth, 1932: 241, 250 (proposed as a subgenus of *Chlamys*). Type species (by original designation): *Pecten similis* Laskey, 1811; Recent, Firth of Forth, Scotland.

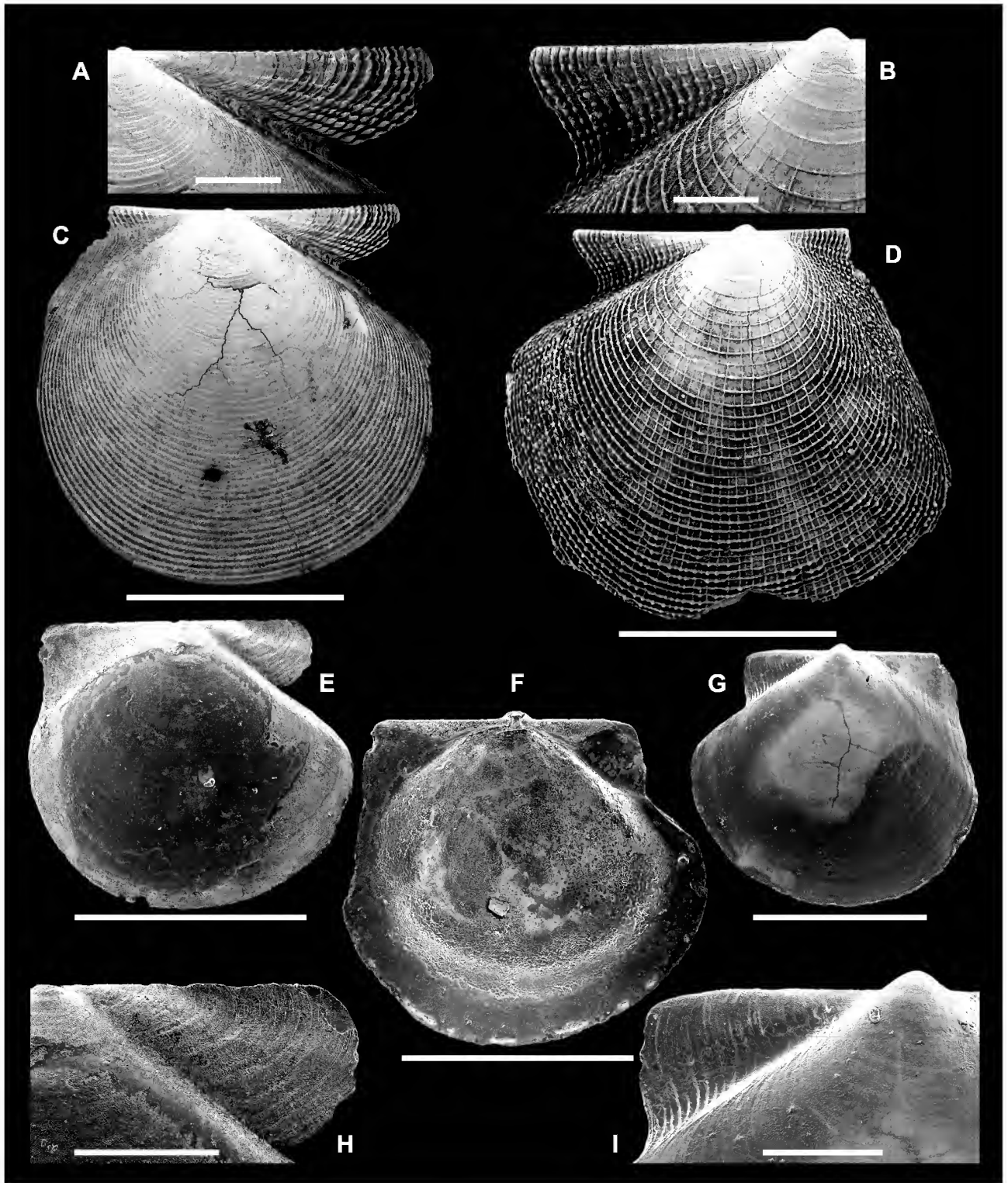
*Arctinula* Thiele, 1934: 806 (proposed as a section of *Palliohum*). Type species (by original designation): *Pecten greenlandicus* G. B. Sowerby II, 1842; Recent, Greenland.

**Diagnosis.** A byssally attached or free-living, small to medium-sized, flattened propeamussiid; shell (sub)circular, opaque or translucent, smooth or sculptured with minute commarginal growth lines or fine striae; auricles almost equal in size, anterior auricle of right valve demarcated from shell disc, other auricles less clearly demarcated; byssal gape moderately deep; ctenolium absent; hinge dentition rather broad.

**Distribution.** Early Oligocene–Recent (pers. comm. D. Jablonski, 2017). Arctic to tropical Atlantic, NW Indian Ocean eastwards to southwestern Pacific, littoral (Arctic and boreal region) to bathyal depths.

**Discussion.** *Similipecten* was proposed by Winckworth (1932: 241) as a subgenus of *Chlamys*. Hertlein (1969:





**Figure 19.** *A–D*, *Cyclopecten reticulatus* sp. nov., holotype, pair, AM C.165220, ORV *Franklin* stn 14, Coral Sea, 11°35.61'S 145°29.42'E, 1770–1863 m; rv anterior auricle exterior (A), lv anterior auricle exterior (B), rv exterior (C), lv exterior (D). *E–I*, *Similipecten colmani* sp. nov., holotype, AM C.165504 (G, I) and 2 paratypes, AM C.209771 (E, F, H), MV *San Pedro Sound* stn P69-1140, c. 45 miles N of Croker Island, Arafura Sea, NT, 10°17'S 132°38'E, 65 m; rv exterior (E), lv interior (F), lv exterior (G), rv anterior auricle exterior (H), lv anterior auricle exterior (I). Scale bars represent 1 mm (A, B), 5 mm (C, D), 2 mm (E–G), 0.5 mm (H, I).

N354), however, placed *Similipecten* in the *Eburneopecten* group as a synonym of *Palliolum* (*Delectopecten*) Stewart, 1930. *Similipecten* is now assigned to the Propeamussiidae (Waller, 1984: 213; Dijkstra, 1991: 23; Dijkstra, 2002: 42) or to Propeamussiinae (Schein, 1989: 95). The morphological

characters of *Arctinula* and *Similipecten* are identical (shell very fragile and subcircular, laterally flattened, hyaline to opaque, generally smooth, lacking internal riblets, byssal notch moderately developed, lacking a ctenolium) and we consider them to be synonyms.

Representative species of *Similipecten* are: *S. similis* (Laskey, 1811) from the Arctic to the tropical eastern Atlantic, *S. greenlandicus* (G. B. Sowerby II, 1842) from the Arctic and the boreal western Atlantic, *S. oskarssoni* Dijkstra, Warén & Gudmundsson, 2009 from the boreal to tropical eastern Atlantic, *S. nanus* (Verrill & Bush in Verrill, 1897) from the tropical western Atlantic, *S. eous* (Melvill in Melvill & Standen, 1907) from the Red Sea and Arabian Sea, and *S. colmani* sp. nov. from Indonesia (probably) and northern Australia.

### *Similipecten colmani* sp. nov.

Figs 19E–I, 20

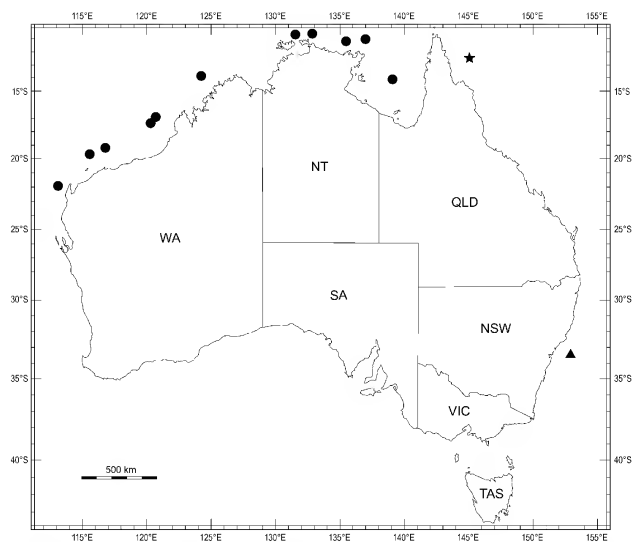
**Holotype** (lv) AM C.165504, Arafura Sea, Northern Territory, c. 45 ml N of Croker Island, 10°17'S 132°38'E, dead, 65 m, leg. P. H. Colman, 9 Nov 1969, MV *San Pedro Sound*; (H 3.0 mm, L 3.4 mm). **Paratypes** c. 100 (v), AM C.209771 (lv & rv), ZMA Moll.409004 (3 lv and 3 rv), same locality data as holotype.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: N Gulf of Carpentaria, 11°07'S 139°32'E, dead, 59 m (4 v, C.165497); NE Gulf of Carpentaria, 11°56'S 140°25'E, dead, 67 m (1 v, C.165495); Central Gulf of Carpentaria, 14°29.5'S 138°14'E, dead, 60 m (1 v, C.165496). WESTERN AUSTRALIA: off North West Cape, 22°51'S 113°41.2'E, dead, 78 m (2 v, C.165512); c. 190 ml NW of Port Hedland, 19°32'S 115°49'E, dead, 183 m (2 v, C.165491 [in part]); N of Port Hedland, 18°40'S 117°55'E, dead, 150 m (3 v, C.157678 [in part]); c. 135 ml NW of Roebuck Bay, 17°34'S 120°22'E, dead, 188 m (4 v, C.165508); c. 100 ml NW of Broome, 16°58'S 120°47'E, dead, 194 m, 5 v (5 v, C.165510; 4 v, C.165511); c. 240 ml NE of Broome, 14°37'S 123°40'E, dead, 80 m (1 v, C.165494 [in part]). NORTHERN TERRITORY: 100 km NE of Melville Island, 10°22.5'S 131°37'E, dead, 71 m (4 v, C.165506); 68 km NE of Croker Island, 10°39'S 133°05'E, dead, 62 m (4 v, C.165507); Arnhem Land, c. 60 ml NE of Goulburn Islands, 11°08'S 134°18.5'E, dead, 50 m (1 v, C.165501); Arnhem Land, 365 km N of Miinggimbi Island, 8°48'S 134°58'E, dead, 100 m (1 v, C.165502); c. 190 ml NW of Gove, 10°16'S 135°09'E, dead, 60 m (1 v, C.165505); Arnhem Land, c. 200 ml NW of Wessel Islands, 8°39'S 135°21'E, dead, 65 m (4 v, C.165499); Arnhem Land, N of Wessel Islands, 8°26'S 135°22'E, dead, 75 m, (1 v, C.165500); c. 250 ml NE of Croker Island, 9°11'S 135°43'E, dead, 70 m (1 v, C.165505); N of Arnhem Land, 10°50'S 137°10'E, dead, 59 m (1 v, C.165498).

**Description.** Shell small, fragile, hyaline or opaque, triangularly subcircular, somewhat wider than high, rather compressed, inequilateral, auricles unequal in size and proportions; posterior ones longer, taller, weakly differentiated from disc, with weakly concave posterior margin, anterior ones with obvious, narrow byssal notch (right valve) or shallow byssal sinus (left valve); umbonal angle c. 90°. Stained milky white.

Exterior of left valve disc sculptured with weak, closely spaced commarginal lirae towards ventral margin. Anterior auricle somewhat demarcated from shell disc, bearing c. 20 fine commarginal lamellae, prominent near disc flank. Antero-marginal area of anterior auricle somewhat curved, antero-dorsal area somewhat raised. Posterior auricle weakly demarcated from disc, bearing very weak, fine, close-set commarginal lirae; postero-dorsal margin straight.

Additional description (paratypes, rv). Shell up to c. 4 mm high, hyaline or opaque, dull milky white without maculations, slightly more convex than left valve, sculptured with closely spaced commarginal lamellae or lirae, also very weak or even absent. Anterior auricle sharply demarcated from disc, with semicircular anterior end, bearing very closely spaced fine lirae, absent from some specimens. Posterior auricle weakly demarcated from disc, bearing same sculpture as disc. Byssal notch narrow.



**Figure 20.** Distribution of *Similipecten colmani* sp. nov. (circles), *Catillopecten murrayi* (Smith) (star) and *C. tasmani* Dijkstra & Marshall (triangle).

**Discussion.** A similar-looking species, *Similipecten eous* (Melvill in Melvill & Standen, 1907), from the Red Sea and Arabian Sea, differs from the present species in its very weak sculpture of commarginal growth lines or a smooth shell surface on the left valve in early growth stages. The present species has more prominent sculpture of commarginal lirae on the left valve. The exterior surface of the right valve of *S. colmani* has commarginal lamellae or lirae, whereas it is smooth in *S. eous*.

*Similipecten similis* (Laskey, 1811) from the eastern Atlantic is larger (up to c. 6 mm in height), more brightly coloured on the left valve and most specimens have completely smooth discs on both valves.

**Habitat.** Dead specimens only collected so far, in the sublittoral and bathyal zones on soft sediment (sand and clay). The presence of an obvious notch indicates that *Similipecten colmani* sp. nov. lives byssally attached to hard objects. Ockelmann (1958: 68–72) described the byssal attachment of *Similipecten greenlandicus* [under *Propeamussium (Arctimula)*]: “Several adult animals were found with a bundle of exceedingly fine byssus threads, and possibly the species, when undisturbed, normally lives attached to objects on the sea bottom”.

**Distribution.** *Similipecten colmani* sp. nov. is distributed from off North West Cape (Western Australia) north-eastwards to the Arafura Sea in the Gulf of Carpentaria (Queensland). Probably also from the Flores Sea and Savu Sea (Indonesia) (see Remarks). So far only empty specimens have been collected, in a bathymetric range of 50–194 m.

**Remarks.** It is most likely that the specimens with abraded sculpture from Indonesia, identified as *Similipecten eous* by Dijkstra (1991: 23) are also this species.

**Etymology.** Named after Mr Phil H. Colman, senior technical officer in the Malacology Department of the Australian Museum, Sydney (now retired), who collected many pectinoids treated in this project and provided valuable ecological data from his field books.

**Catillopecten Iredale, 1939**

*Catillopecten* Iredale, 1939: 347, 370. Type species (by original designation): *Pecten murrayi* E. A. Smith, 1885; Recent, N QLD, E of Cape York, Coral Sea, 12°08'S 145°10'E, 1400 fathoms [2561 m].

*Bathypecten* Schein-Fatton, 1985: 491. Type species (by original designation): *Bathypecten vulcani* Schein-Fatton, 1985; Recent, eastern Pacific, 12°48'80"N 103°56'60"W, 2620 m.

**Diagnosis.** Propeamussiidae with a (sub)circular shape, shell hyaline or opaque, fragile, inequivalve, flattened, left valve slightly convex, right valve flat; exterior surface of disc weakly undulated or smooth, sculptured with commarginal lamellae and minute radial threads in some species. Auricles unequal, anterior auricle of right valve prominent and distinct, other auricles not delimited. Byssal notch deep, ctenolium absent. Shell microstructure of prismatic calcite layer on right valve and foliated calcite layer on left valve. Thin crossed-lamellar aragonite layer on interior shell surface near adductor scar.

**Distribution.** Oligocene–Recent (Oligocene Lincoln Creek Formation, cold-seep carbonate in Washington State, USA; Kiel, 2006: fig. 15.1–3). Atlantic Ocean, Indian Ocean, western and eastern Pacific, living in bathyal and abyssal depths.

**Discussion.** Schein-Fatton (1988) and Schein (1989, 2006) distinguished *Catillopecten* Iredale and *Bathypecten* Schein-Fatton by a few morphological characters. *Catillopecten* has commarginal sculpture, which is absent from *Bathypecten*. *Bathypecten* is slightly undulated in early ontogeny, whereas *Catillopecten* has a smoother shell disc. However, both morphological characters are very weak and highly variable, based on observed material (NHMUK, MNHN, ZMA, ZMUC). Both genera have a deep byssal notch throughout ontogeny (Waller, 1984: 214) and their prismatic microstructure throughout ontogeny on the right valve is identical. We consider them to be synonyms.

Included living species are *Catillopecten eucymatus* (Dall, 1898) from the Atlantic Ocean (1057–4829 m) (Schein, 1989: 101), *C. translucens* (Dautzenberg & Bavay, 1912) from Indonesia (1301 m), *C. murrayi* (E. A. Smith, 1885) from the northwestern Coral Sea (2561 m), *C. knudseni* (Bernard, 1978) from the northeastern Pacific (220–2900 m), *C. squamiformis* (Bernard, 1978) also from the northeastern Pacific (2030–2884), *C. graui* (Knudsen, 1970) from the tropical eastern Pacific (3270–3670 m), *C. vulcani* (Schein-Fatton, 1985) also from the tropical eastern Pacific (2620 m), and *C. tasmani* Dijkstra & Marshall, 2008 from the Tasman Sea (1097 m). Recently also from the northwestern Pacific (see Kamenev, 2018).

**Catillopecten murrayi (E. A. Smith, 1885)**

Figs 20, 21A,D

*Pecten murrayi* Smith, 1885: 303, pl. 22, figs 1–1a.

*Cyclopecten (Delectopecten) murrayi* (Smith).–Rombouts, 1991: 78.

*Catillopecten murrayi* (Smith).–Lamprell & Whitehead, 1992: [16]; Dijkstra & Marshall, 2008: 38, figs 31A–F, 33; Dijkstra & Maestrati, 2013b: 474.

**Type data.** Holotype (pr) NHMUK 1887.2.9.3281. Type locality: NW Coral Sea, E of Cape York (N QLD), 12°08'S 145°10'E, alive, 2561 m (*Challenger* stn 184).

**Comments on type data.** The holotype is an articulated specimen without soft parts. Probably these were removed during preservation. It is most likely that this specimen was collected alive, as dead-collected specimens always consist of separate valves because of their very weak ligament.

**Description.** Shell small, c. 15 mm high, fragile, almost circular, inequivalve, opaque, left valve somewhat more convex than right valve, auricles unequal, umbonal angle c. 95°.

Left valve sculptured with closely spaced commarginal lamellae, less prominent on right valve, more closely spaced near ventral margin. Auricles delimited from shell disc. Microsculpture of weak interstitial antimarginal threads.

Right valve almost flat, with minute commarginal lamellae. Posterior auricle delimited; anterior auricle distinct from shell disc, with deep byssal notch. Dorsal margin straight.

**Distribution.** The only other material recorded to date is that by Dijkstra & Marshall (2008: 39, fig. 33) from the Lord Howe Rise (34°31.5'S 166°21'E, 2928–2930 m; 2 v, NMNZ M.274123; 2 v, NIWA U195). The known distribution is therefore the Coral Sea and Lord Howe Rise, in 2561–2930 m.

**Remarks.** Specimens from the Lord Howe Rise are smaller than the holotype (height c. 10.5 mm versus c. 14.5 mm) but are otherwise identical.

**Catillopecten tasmani Dijkstra & Marshall, 2008**

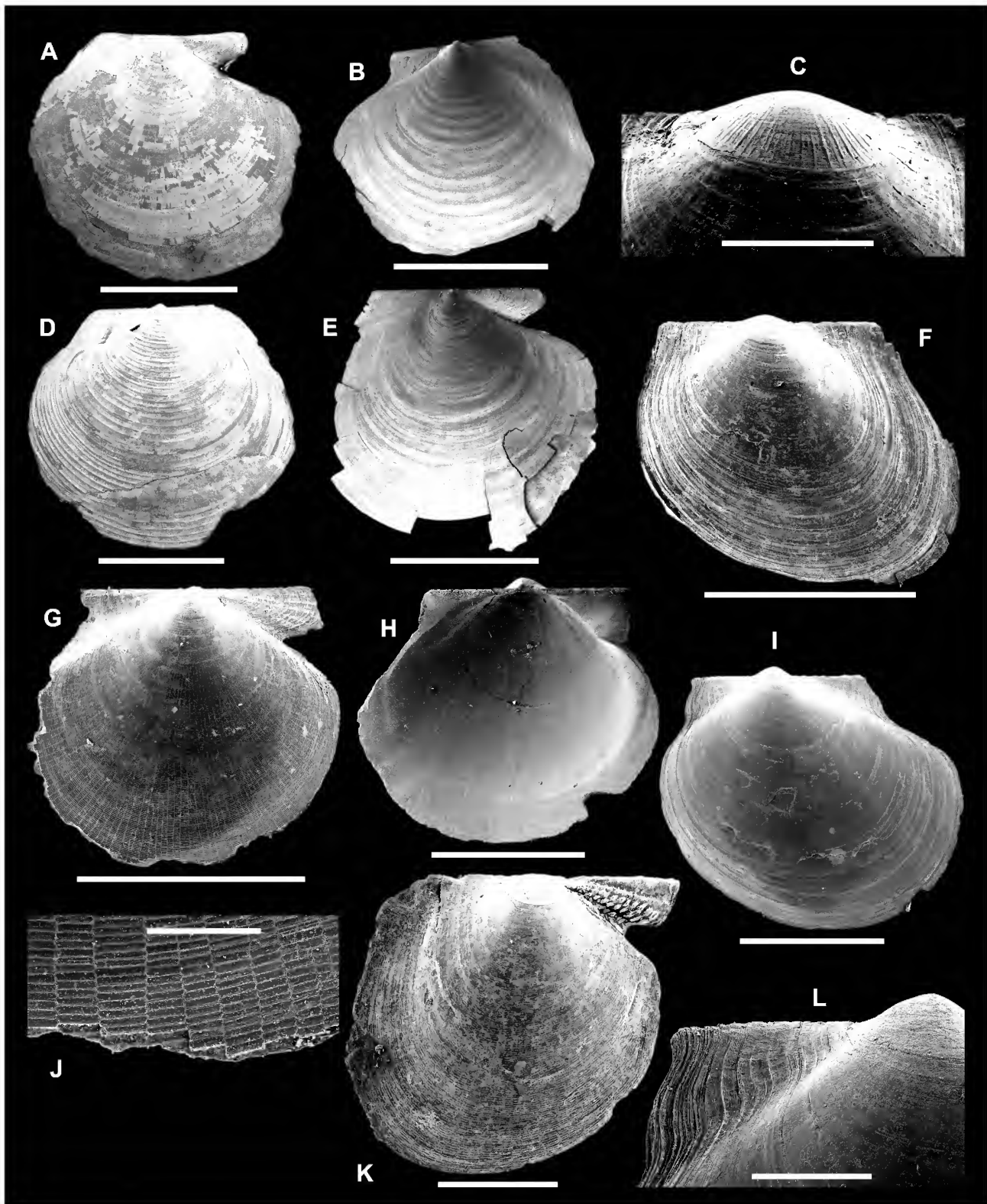
Figs 20, 21B,E

*Catillopecten tasmani* Dijkstra & Marshall, 2008: 39, figs 32A–F, 33; Spencer *et al.*, 2009: 198.

**Type data.** Holotype (lv) NIWA S151, Bounty Trough, southern New Zealand, 45°48.8'S 174°30.5'E, alive, 1586 m, 26 Oct 1979, RV *Tangaroa*; with paratypes (6 v, NMNZ M158279; 1 pr & 28 v NIWA; 1 pr & 4 v, ZMA Moll.4.02.013); other paratypes: Challenger Plateau, W New

**Key to species of *Catillopecten* from Australia**

- 1 Shell c. 15 mm high, opaque, whitish, discs with closely spaced commarginal sculpture, coarse on lv and weak on rv, posterior auricle continuous with shell disc ..... *C. murrayi*
- Shell small, valves weakly undulated commarginally ..... 2
- 2 Shell c. 6 mm high, translucent, whitish, valves smooth, weakly commarginally undulated, auricles of lv continuous with disc ..... *C. tasmani*



**Figure 21** *A, D*, *Catillopecten murrayi* (Smith), pair, NIWA U195, illustrated by Dijkstra & Marshall (2008: 39, fig. 33), Lord Howe Rise, 34°31.5'S 166°21'E, 2928–2930 m, rv exterior (A), lv exterior (D) (NMNZ photos courtesy of B. A. Marshall). *B, E*, *Catillopecten tasmani* Dijkstra & Marshall, holotype, pair, NIWA S151, illustrated by Dijkstra & Marshall (2008: 39, fig. 32), RV *Tangaroa*, Bounty Trough, southern New Zealand, 45°48.8'S 174°30.5'E, 1586 m, lv exterior (B), rv exterior (E) (NMNZ photos courtesy of B. A. Marshall). *C, F–L*, *Chlamydeella favus* (Hedley) (C, F, K) separate valves, AM C.269876, in sample with *C. nepeanensis* (Pritchard & Gatliff) (AM C.165517, specimens in Fig. 23C, F, H–J), Euston Reef, off Cairns, SW side of reef, 16°41'S 146°15'E, 21 m; (H, I, L) separate valves, AM C.013239, HMCS *Thetis* stn 49, 5–8 miles off Port Kembla, NSW, 34°27'–34°30'S 151°04'–151°0.9'E, 115–137 m; lv prodissoconch of specimen in Fig. 21F (C), lv exteriors (F, I), rv exteriors (G, K), lv interior (H), surface of rv exterior at lower margin of specimen in Fig. 21G (J), lv anterior auricle exterior (L). Scale bars represent 5 mm (A, B, D, E), 200  $\mu$ m (C, J), 1 mm (F), 2 mm (G–I), 0.5 mm (K, L).

Zealand, 41°15.2'S 167°07.2'E, alive, 1457–1463 m (3 pr, NIWA P941); Bounty Trough: 45°21.2'S 174°35.8'E, 1386 m (1 v, NIWA S153); 45°24.2'S 173°59.8'E, alive, 1373 m (1 pr & 2 v, NIWA S154); 45°52.3'S 174°04.9'E, alive, 1676 m (1 pr & 13 v, NIWA S152).

**Additional material examined.** —AUSTRALIA: NEW SOUTH WALES, off Sydney, 33°35'S 152°09'E, alive, 1097 m, FRV *Kapala* stn K79-20-07, coll. K. Graham, 4 Dec 1979 (1 pr, C.165239); off Sydney, 33°35'S–33°37'S 152°05'E, alive, 1106–1143 m, FRV *Kapala* stn K80-20-10, coll. P. H. Colman, B. Jenkins & R. Springthorpe, 10 Dec 1980 (1 pr, C.165238).

**Description.** Shell small, fragile, flattened, hyaline, up to c. 6 mm high, circular, inequivalve, left valve slightly more convex than right, auricles unequal, umbonal angle c. 90°.

Left valve smooth and weakly undulated commarginally, undulations commencing 2 mm below umbo and extending to ventral margin. Postero-marginal area of disc somewhat raised. Fine, closely spaced commarginal threads on anterior auricle, very weak on posterior auricle. Auricles not demarcated from shell disc.

Disc and posterior auricle of right valve also unsculptured. Anterior auricle distinct from shell disc, with fine, closely spaced commarginal threads, coarser near the anterodorsal margin. Dorsal margin straight. Resilifer triangular. Byssal gape rather deep.

**Habitat.** Living in the bathyal zone on soft sediment (sand, mud, foraminiferal ooze).

**Distribution.** Dijkstra & Marshall (2008: 40, fig. 33): Tasman Sea (Challenger Plateau) off W central New Zealand, and Bounty Trough, off SE New Zealand. Now also Australia (New South Wales). Maximum depth range of live-taken specimens 1097–1676 m.

**Remarks.** *Catillopecten murrayi* from the northwestern Coral Sea and Lord Howe Rise differs from the present species mainly in its larger size (height of *C. murrayi* c. 15 mm, of *C. tasmani* c. 6 mm), the presence or absence of undulations in the disc (*C. murrayi* is smooth, *C. tasmani* is undulated), and the presence or absence of commarginal lamellae on both valves (present on *C. murrayi*, absent from *C. tasmani*).

*Catillopecten tasmani* is a **new record** for Australia.

## Cyclochlamydidae Dijkstra & Maestrati, 2012

Cyclochlamydidae Dijkstra & Maestrati, 2012: 393.

**Diagnostic characters.** Very small Pectinoidea (c. 1.2 to 6 mm high) with a smooth or variously sculptured left valve with a flat, weakly to strongly inflated or even conical and pointed, sculptured prodissoconch, bordered in some species by a prominent flange-like commarginal lamella or rim; right valve with a flattened, sculptured prodissoconch; disc smooth in most species, antimarginally sculptured in a few, with a simple outer prismatic layer of commarginally elongate hexagonal microstructure; internal riblets lacking.

**Discussion.** This recently named family of micro-scallops includes three genera, two of which were formerly classified in Propeamussiidae: *Cyclochlamys* Finlay, 1926, *Chlamydella* Iredale, 1929, and *Micropecten* Dijkstra & Maestrati, 2012.

Cyclochlamydidae comprises c. 30 species living in the littoral to bathyal zones, mainly recorded from the southern hemisphere (Falkland Islands, southern Australia and New Zealand), but also from the Western Pacific (southern Japan and Indonesia), and the southwestern Indian Ocean (Rodrigues). It is absent from the Arctic, the Atlantic and the northern and eastern Pacific.

Cyclochlamydidae differs from Propeamussiidae by the following characters: (a) a sculptured prodissoconch in Cyclochlamydidae, smooth in Propeamussiidae; (b) an antimarginally sculptured right valve in some Cyclochlamydidae, smooth or weakly commarginally sculptured in Propeamussiidae; (d) a simple outer prismatic layer of commarginally elongate hexagonal microstructure on the right valve in Cyclochlamydidae, an outer layer of columnar calcite in Propeamussiidae; and (e) Cyclochlamydidae are small (1.2 mm to 6 mm high), Propeamussiidae larger, 5 mm to 120 mm high.

Huber (2015, p. 380) ranked Cyclochlamydidae as a subfamily of Propeamussiidae. Phylogenetic research on the monophyly of Cyclochlamydidae is in progress; its results will be published elsewhere.

### Key to genera of Cyclochlamydidae occurring in Australia

- |   |   |                     |
|---|---|---------------------|
| 1 | Shell small, triangular prodissoconch on lv, smooth or radially and/or commarginally sculptured on lv, rv with hexagonal microstructure ..... | <i>Cyclochlamys</i> |
| — | Shell small with a weakly inflated prodissoconch on lv .....  | 2                   |
| 2 | Shell smooth or radially and/or commarginally sculptured on lv, many specimens posteriorly oblique, rv with hexagonal microstructure .....    | <i>Chlamydella</i>  |



## *Cycloclamys* Finlay, 1926

*Cycloclamys* Finlay, 1926: 452. Type species (by original designation): *Pecten transemma* [sic] Suter, 1913; Recent, near the Snares Islands, New Zealand, 91 m; widespread around New Zealand.

**Diagnosis.** Shell inequivalve, minute, circular to posteriorly oblique; protruding conical to triangular prodissoconch on left valve, almost flat on right valve; left valve sculptured with radial and/or commarginal riblets or striae or smooth, right valve with commarginally elongate hexagonal (honeycomb-like) microstructure (simple calcitic prismatic outer layer); auricles unequal; byssal notch well-developed; no ctenolium; no internal lirae.

**Distribution.** Oligocene?; lower Miocene–Recent (Cotton, 1961: 104; Pastorino & Griffin, 2018: 2). Australia, New Zealand, subantarctic, Japan, 73–274 m. A species referred previously to *Cyclopecten* from the latest Eocene or earliest Oligocene (early Whaingaroan New Zealand Stage) Ototara Limestone in North Otago, New Zealand (Robinson & Lee, 2011, p. 138, fig. 3D–H) has a characteristic outer layer of elongate hexagonal calcite prisms on the right valve and is referred to *Cycloclamys*, although it also has weak commarginal ridges and possibly belongs in *Chlamydella*.

**Discussion.** *Cycloclamys* Finlay, 1926 was erroneously mentioned as a “nom. null.” by Hertlein (1969: N353), but is an available name, and is distinguishable from *Cyclopecten* Verrill by its pteriiform shell, its tall, conical prodissoconch on the left valve, and the commarginally elongate hexagonal (honeycomb-like) microsculpture of the right valve. The genus is known from New Zealand, southern Australia, the subantarctic region (Hayami & Kase, 1993), southern Japan (Hayami & Kase, 1993: 61), the Southwest Pacific (Dijkstra & Maestrati, 2012: 394), and southern Argentina (Pastorino & Griffin, 2018).

### *Cycloclamys nepeanensis* (Pritchard & Gatliff, 1904)

Figs 22, 23C,F,H–J

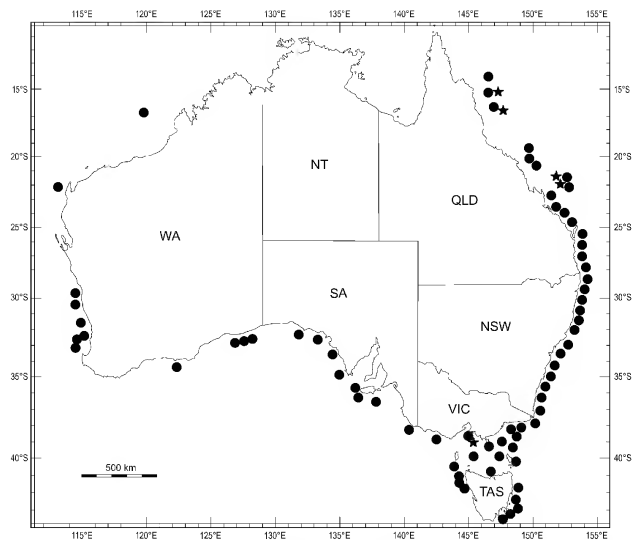
*Cyclopecten nepeanensis* Pritchard & Gatliff, 1904b: 338, pl. 20, fig. 5.

**Type data.** *Cyclopecten nepeanensis*: holotype (lv) NMV F.558, paratype (lv) NMV F.531. Type locality: Australia, Victoria, Point Nepean, Back Beach, dead.

**Comment on type locality.** “Back Beach” presumably refers to Sorrento Back Beach, an ocean beach a few kilometres east of Point Nepean, the eastern headland at the entrance to Port Phillip, Victoria. We have seen no other material from Victoria or New South Wales.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Endeavour Reef, 15°47'S 145°35'E, dead, 8–10 m (2 v, C.338079); off Cairns, outer GBR, Euston Reef, SW side of reef, 16°41'S 146°15'E, dead, 21 m (6 v, C.165517); GBR, Swain Reefs, NE of W side of Gillett Cay, 21°70'S 152°43.3'E, dead, 64–73 m (8 v, C.165454); Swain Reefs, Gillett Cay, inside reef, 21°43'S 152°25'E, dead, 27–37 m (5 v, C.338171). TASMAN SEA: Middleton Reef, 29°26'S 159°02'E, alive, 61.5 m (1 pr, C.461400); Middleton Reef, 29°26'S 159°05'E, dead, 32 m (1 v, C.461410); Lord Howe Shelf, 31°34'S 159°03'E, alive, 26 m (1 pr, 2 v, C.461399).

**Description.** Shell small, fragile, up to c. 2 mm high, hyaline or opaque, valves dissimilar in shape, size and sculpture; protruding conical prodissoconch of left valve with prominent reticulate sculpture. Prodissoconch 245–250 µm wide; of



**Figure 22.** Distribution of *Chlamydella favus* (Hedley) (circles) and *Cycloclamys nepeanensis* (Pritchard & Gatliff) (stars).

right valve c. 135 µm high, weakly convex, without central projection; of left valve with prominent, narrow, central projection with concave outlines, protruding c. 90 µm above surrounding prodissoconch margin.

Left valve slightly larger and more inflated than right valve, with prominent reticulate sculpture; auricles almost equal, weakly demarcated from disc, with some commarginal lines.

Right valve smooth apart from faint hexagonal microsculpture. Anterior auricle with closely spaced commarginal lamellae. Byssal notch well developed.

**Habitat.** Living in the sublittoral zone amongst rubble on soft sediment (sand and mud).

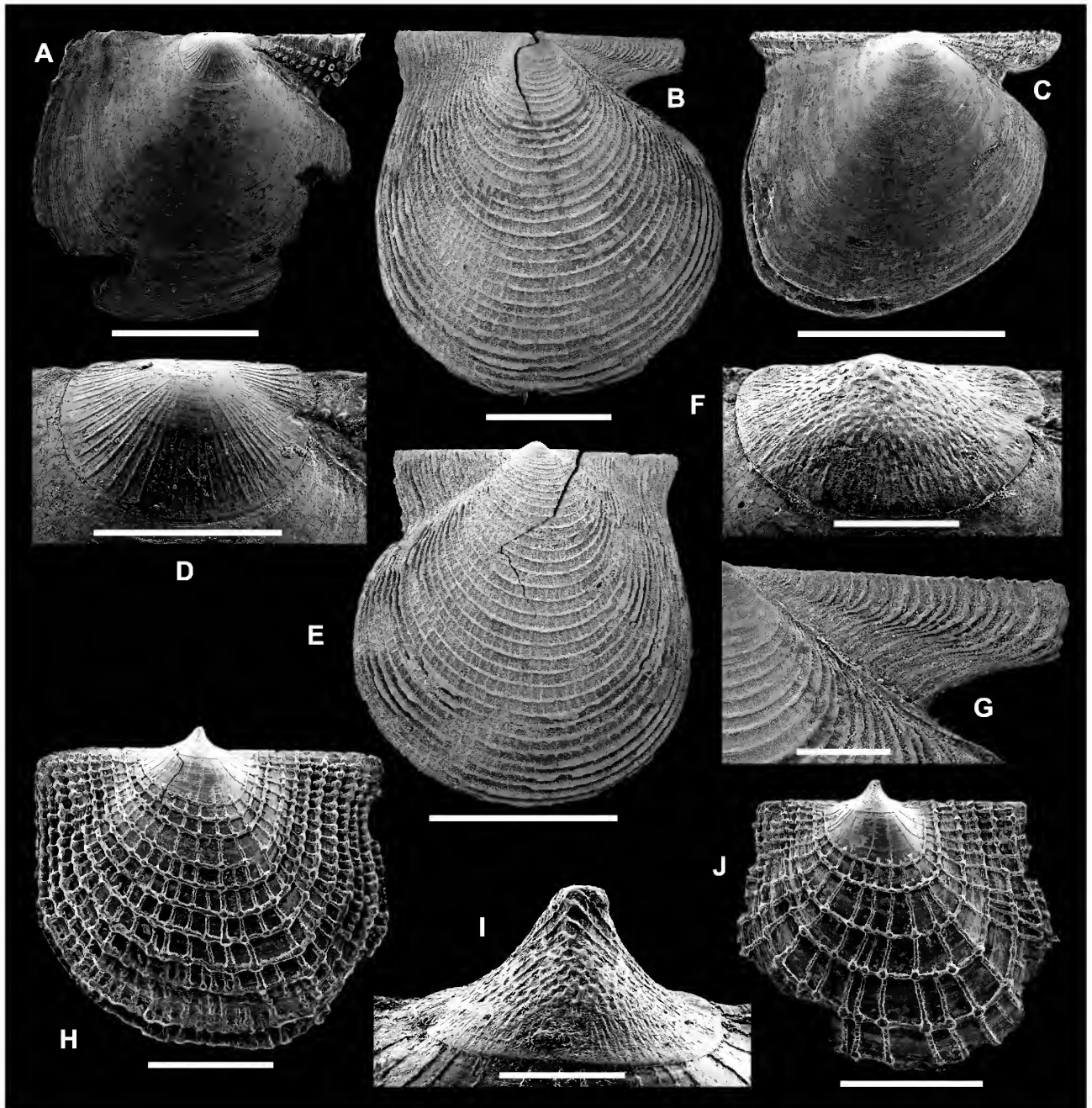
**Distribution.** Queensland, W Victoria and the Tasman Sea (Middleton Reef and Lord Howe Island; 26–61.5 m, alive). The sole record from the Australian mainland south of Queensland is the type material, two beach specimens from Point Nepean, Victoria.

**Remarks.** *Cycloclamys nepeanensis* is variable in shape (almost circular to slightly posteriorly oblique) with a variable reticulate sculpture on the left valve (weak to prominent). It was formerly synonymized with *Chlamydella favus* (Hedley, 1902) (as *Cycloclamys*; Dijkstra, 1995b: 40). However, the two species have different prodissoconchs on the left valve, i.e., conical in *Cycloclamys nepeanensis* and weakly inflated in *Chlamydella favus*, demonstrating that they belong in different genera.

## *Chlamydella* Iredale, 1929

*Chlamydella* Iredale, 1929: 164, 188. Type species (by original designation): *Cyclopecten favus* Hedley, 1902; Recent, off New South Wales, Australia, 75–91 m.

**Diagnosis.** Shell inequivalve, minute, up to c. 3 mm high, circular to posteriorly oblique; prodissoconch weakly inflated; left valve sculptured with radial and/or commarginal riblets or striae or smooth, right valve with commarginally elongate hexagonal (honeycomb-like) microstructure (simple calcitic prismatic outer layer); auricles unequal; byssal notch well-developed; no ctenolium; no internal lirae.



**Figure 23.** *A, D, ChlamydeUella favus* (Hedley), rv only, AM C.269876, same sample as Fig. 21C, F, K; rv exterior (A), prodissoconch of specimen in Fig. 23A (D). *B, E, G, Hyalopecten ponderi* sp. nov., holotype, pair, AM C.209770, ORV *Franklin* stn 15, Coral Sea, 11°40.98'S 145°36.85'E, 2039–2052 m; rv exterior (B), lv exterior (E), rv anterior auricle exterior (G). *C, F, H–J, Cyclochlomyis nepeanensis* (Pritchard & Gatliff), separate valves, AM C.165517, in sample with *ChlamydeUella favus* (Hedley) (AM C.269876, specimens in Fig. 21C, F–L), Euston Reef, off Cairns, SW side of reef, 16°41'S 146°15'E, 21 m; rv exterior (C); prodissoconch of specimen in Fig. 23C (F), lv exteriors (H, J), prodissoconch of specimen in Fig. 23J (I). Scale bars represent 0.5 mm (A, G, H), 2 mm (B), 1 mm (C, J), 200 µm (D), 3 m (E), 100 µm (F, I).

**Distribution.** Pleistocene–Recent. Australia, New Zealand, Japan, sublittoral to bathyal. *Cyclopecten* (*ChlamydeUella*) sp. from the early Miocene (Aquitian) Bhuban Formation, NE India (Mazumder & Tiwari 2012: 31, pl. 1, fig. 8) is based on an unidentifiable mould. This is the only published fossil record we are aware of, although D. Jablonski (pers. comm. 27 Jun 2017) reported an unpublished Pleistocene record from Henderson Island.

**Discussion.** Hayami & Kase (1993: 61) enumerated representative species of *ChlamydeUella* from Australia, subantarctic seas and Japan. They also suggested that *Cyclo-*

*chlamys* might be a senior synonym of *ChlamydeUella*. Although they placed both newly described species, i.e. *ChlamydeUella incubata* Hayami & Kase, 1993 and *ChlamydeUella tenuissima* Hayami & Kase, 1993 in the present genus, the figured prodissoconchs of the two species differ strongly (Hayami & Kase, 1993, fig. 204, lv prodissoconch of *C. incubata* conical, typical of *Cyclochlomyis*; figs 215–216, lv prodissoconch of *C. tenuissima* weakly inflated, typical of *ChlamydeUella*). Dijkstra & Marshall (2008: 22) synonymized the two genera, but Dijkstra & Maestrati (2012: 394) differentiated them, based mainly on their distinct prodissoconchs, and placed both genera in family Cyclochlomyidae.

*Chlamydella favus* (Hedley, 1902)

Figs 21C,F–L, 22, 23A,D

- Cyclopecten favus* Hedley, 1902: 305, fig. 50; Gatliff & Gabriel, 1911: 200; May, 1921: 11; Gabriel, 1956: 14.  
*Cyclopecten obliquus* Hedley, 1902: 306, fig. 51.  
*Chlamydella favus* (Hedley).—Iredale, 1929: 164; Macpherson & Chapple, 1951: 145; Iredale & McMichael, 1962: 11.  
*Chlamydella fava* [sic] (Hedley).—Cotton & Godfrey, 1938: 98, fig. 85 (after Hedley); Cotton, 1961: 103, fig. 89.  
*Chlamydella obliqua* (Hedley).—Iredale & McMichael, 1962: 11.  
*Cycloclamys favus* (Hedley).—Dijkstra, 1995b: 40, figs 87–90; Dijkstra, 2001: 88; Dijkstra & Maestrati, 2008: 101.

**Type data.** *Cyclopecten favus*: holotype (pr) AM C.013231, 20+ paratypes (v) AM C.171633. Type locality: Australia, New South Wales, 5.5–7.5 miles [9–12 km] NE of Cape Three Points, 33°28'S 151°33'E, alive, 75–91 m (*Thetis* stn 13).

*Cyclopecten obliquus*: holotype (lv) AM C.013234, 70+ paratypes (v) AM C.013232, C.013233. Type locality: Australia, New South Wales, 5–8 miles [8–13 km] off Port Kembla, 34°28'S 151°06'–03'E, dead, 115–137 m (*Thetis* stn 49).

**Additional material examined.**

—AUSTRALIA: QUEENSLAND: GBR, Lizard Island, South Island, SW reef face, 14°42'S 145°27'E, dead, 9–12 m (1 v, C.338077); off Cairns, outer Barrier Reef, Euston Reef, SW side of reef, 16°41'S 146°15'E, dead, 21 m (5 v, C.269876); GBR, Swain Reefs, 3 km NE of W side of Gillett Cay, 21°42'S 152°26'E, dead, 64–73 m (1 v, C.338078; 15 v, C.165519 [in part]); SE of Swain Reefs, 22°20'S 153°17'E, dead, 187 m (2 v [var. *obliqua*], C.461401; 19 v, C.463128); SE of Swain Reefs, 22°31.11'S 152°42.63'E, dead, 78 m (4 v, C.157671); Capricorn Group, Heron Island, 23°26'S 151°57'E, dead, 8 m (3 v, C.338074); E of Lady Musgrave Island, 23°50.1'S 152°32.1'E, dead, 132 m (6 v, C.157666; 9 v [var. *obliqua*], C.157667); Noosa Heads, 26°23'S 153°06'E, dead, beach (2 v, C.338073); off Maroochydore, 26°41.2'S 153°38.4'E, dead, c. 200 m (6 v, C.165520); Caloundra, 26°49'S 153°10'E, dead (2 v, C.338076); NNE of Cape Moreton, 26°50'–26°55'S 153°36'E, dead, 183 m (21 v, C.338069); NE of Cape Moreton, 26°55.5'S 153°33.5'E, alive, 115–124 m (1 pr + 14 v, C.338072); off Cape Moreton, 27°0'S 153°35'E, alive, 128–183 m (1 pr + 24 v, C.338068); off Moreton Bay, 27°27.37'S 153°39'E, alive, 77 m (4 pr + 2 v, C.338070); off Moreton Bay, 27°31'S 153°40'E, dead, 75–80 m (1 v, C.338071); off S end Frazer Island, 27°57.13'S 153°51.05'E, dead, 201 m (1 v, C.338075). NEW SOUTH WALES: 6 km E of Cudgen, S of Tweed Heads, 28°14'S 153°37'E, dead, 35 m (1 v, C.337218); 12.5 ml E of Cape Byron, 28°38'S 153°52'E, dead, 203 m (2 v, C.019805); off Ballina, 29°10'S 153°43'E, dead, 86 m (2 v, C.337219); E of Yamba, 29°30'S 153°22'E, dead, 13 m (3 v, C.157722); E of Yamba, 29°30'S 153°26'E, dead, 53 m (2 v, C.157721); 12 km E of Cakora Point, S of Yamba, 29°39'S 153°26'E, dead, 55 m (many v, C.337215); N of Coffs Harbour, 29°39'S 153°37'E, dead, 82 m (9 v, C.337217); N of Coffs Harbour, 29°40'S 153°30'E, dead, 71 m (6 v, C.157720); N of Coffs Harbour, 30°0'S 153°23'E, dead, 61 m (many v, C.337216); 9 ml NE of Coffs Harbour, 30°15'S 153°19'E, dead, 73–82 m (7 v, C.337220); NE of Port Macquarie, 31°23'S 153°12'E, dead, 183 m (2 v, C.037766); off Laurieton, 31°39'S 152°55'E, dead, 73 m (many v, C.337214); Port Stephens, near Hawks Nest, 32°41'S 152°10'E, dead, 5 m (6 v, C.337211); Port Stephens, near Soldiers Point, 32°42'S 152°04'E, dead, 7 m (1 v, C.337210); Port Stephens, near Soldiers Point, 32°42'S 152°04'E, dead, 5–9 m (5 v, C.337212); Port Stephens, 32°42'S 152°05'E, dead (3 v, C.012157; 3 v, C.012180; 14 v, C.337206); Port Stephens, 32°42'S 152°05'E, dead, 45–73 m (10 v, C.337213); Port Stephens, Fly Point, 32°43'S 152°09'E, alive, 18 m (5 pr, C.337204); Port Stephens, Fly Point, 32°43'S 152°09'E, alive, 8 m (many, C.339143); Port Stephens, Halifax Bay, between Shoal Bay & Nelson Bay, 32°43'S 152°09'E, dead (15 v, C.337207); Port Stephens, off Nelson Head, 32°43'S 152°10'E, alive, 15–24 m (4 pr, C.337203; 2 pr, C.337208; 2 v, C.337209); Port Stephens, off Nelson Bay, 32°43'S 152°15'E, dead, 46–73 m (many v, C.337205); Port Stephens, Fingal Bay, 32°45'S 152°10'E, dead (2 v, C.157583); off Newcastle, 32°53'S 152°35'E, dead, 146–175 m (4 v, C.157654); 18 km E of Newcastle, 32°55'S 151°58'E, dead, 70 m (2 v, C.337201); off Tuggerah Lake, 33°20'S 151°39'E, dead, 60 m (1 v, C.337202); off Sydney, 33°27'S 152°05'E, dead, 366 m (4 v, C.337187); 9–12 km NE of Cape Three Points, 33°32'–33°31'S 151°31'–151°34.9'E, alive, 75–91 m (1 pr, C.013231; many, C.013232; many v, C.171633; 1 pr, C.337200); Broken Bay, Patonga, 33°33'S 151°16'E, dead (1 v, C.337199); off Broken Bay, 33°34'S 151°31'E, dead, 82–137 m (1 v, C.337198); 22 ml E of Narrabeen, N of Sydney, 33°42'S 151°43'E, dead, 146 m (many v, C.026068; many v, C.026069); Collaroy Beach, N of Sydney, 33°44'S 151°18'E, dead (1 v, C.337181; many v, C.337182); Sydney, off Long Reef, 33°44'S 151°21'E, alive, 43 m (1 pr, C.339144); N of Sydney, 33°45'S 151°21'E, dead, 40 m (2 v, C.337189); off Sydney, 33°46'S 151°43'E, dead, 176 m (1 v, C.157578; 5 v, C.337186); Sydney, Port Jackson, North Harbour, 33°48'S 151°16'E, dead (many v, C.337172; 1 v, C.337173); Sydney, Middle Harbour, off Chinamans Beach, 33°48'S 151°14'E, dead, 3–7 m (4 v, C.337174); Sydney, Manly Beach, Ocean beach, 33°48'S 151°17'E, dead (15 v, C.337196; many v, C.337197); Sydney, Middle

Harbour, off Balmoral, 33°49'S 151°15'E, dead, 3–9 m (many v, C.337171); Sydney Harbour, Quarantine Bay, North Head, 33°49'S 151°17'E, dead, 27 m (9 v, C.337175); 44 km E of Sydney Heads, 33°50'S 151°49'E, dead, 549 m (many v, C.023436); Sydney Harbour, Watsons Bay, 33°50'S 151°16'E, dead (1 v, C.011600); Port Jackson, Watsons Point, off Green Point, 33°50'S 151°16'E, alive, 15 m (many, C.032207; 2 v, C.337162); Port Jackson, Western Channel, 33°50'S 151°16'E, dead, 27 m (1 v, C.337168); Sydney Harbour, Western Channel, off Sow & Pigs Reef, 33°50'S 151°16'E, alive, 11–16 m (2 v, C.337161; 1 pr, C.337169); Sydney Harbour, Nielson Park, Bottle & Glass Rocks, 33°50'S 151°16'E, dead, 11–17 m (8 v, C.337163; 9 v, C.337177); Sydney, off North Head, 33°50'S 151°18'E, dead, 33 m (1 v, C.337194); Port Jackson, Balmain, off Morts Dock, 33°51'S 151°11'E, dead, 7 m (7 v, C.337176); 50 km E of Sydney, 33°51'S 151°58'E, dead, 1463 m (many v, C.026642); off Sydney, 33°52'S 151°40'E, dead, 200 m (10 v, C.337188); Sydney, 33°53'S 151°13'E, dead (14 v, C.018530); Sydney, South Coogee, 33°55'S 151°15'E, dead, 10 m (1 v, C.337178); Sydney, 2 km E of Minstral Point, 33°56'S 151°16'E, dead, 38 m (5 v, C.337191); Sydney, 6 km E of Minstral Point, 33°56'S 151°19'E, dead, 61 m (many v, C.337192); Sydney, 2 km SE of Long Bay, 33°58'S 151°16'E, alive, 29 m (5 pr, C.337190); Sydney, 5 km E of Long Bay, dead, 77 m (1 v, C.337195); off Sydney, 33°58'–33°52'S 151°29'–151°22'E, dead, 75–150 m (many v, C.337183); off Sydney, 33°58'S 151°29'E, dead, 150 m (many v, C.337184); Sydney, 2.3 km E of Malabar, 33°59'S 151°16'E, dead, 66 m (1 v, C.337193); off Botany Bay, 33°59'S 151°33'E, dead, 194 m (4 v, C.337156); Botany Bay, Kurnell, 34°0'S 151°12'E, dead (1 v, C.337167); Sydney S, Bate Bay, Cronulla Beach, 34°02'S 151°10'E, dead (many v, C.337152); Sydney, N of Cronulla, Boat Harbour, 34°02'S 151°12'E, dead, 2 m (1 v, C.337160); Port Hacking, Gunnamatta Bay, 34°03'S 151°08'E, dead (3 v, C.337151; 1 v, C.337170); off Cronulla, 34°03'S 151°12'E, dead, 64 m (5 v, C.337155); E of Sydney, 34°03'S 151°37'E, dead, 295 m (3 v, C.337185); off Cronulla, 34°04'S 151°14'E, dead, 40–100 m (many v, C.337154); Port Hacking, 34°04'S 151°06'E, dead (10 v, C.337164); Port Hacking, Gunnamatta Bay, 34°04'S 151°08'E, channel at SW end, dead (4 v, C.337166); off Sydney, 34°04'S 151°37'E, dead, 384 m (6 v, C.337179); Port Hacking, off Jibbon, 34°05'S 151°13'E, dead, 70–85 m (3 v, C.337149; many v, C.337150; 7 v, C.337157); Port Hacking, off Jibbon (Hacking) Point, 34°05'S 151°14'E, dead, 70 m (1 v, C.337165); 32 km NE of Wollongong, 34°18'S 151°25'E, alive, 457 m (3 pr, C.155824); off Wollongong, 34°22'S 151°27'E, alive, 439–446 m (10 pr, C.339142); 16 ml E of Wollongong, 34°25'S 151°15'E, dead, 183 m (many v, C.018284); off Wollongong, 34°26'S 151°15'E, dead, 183 m (1 v, C.337144); 5–8 ml off Port Kembla, 34°27'–34°30'S 151°04'–151°09'E, dead, 115–137 m (many v, C.013233; 1 v, C.013234; many v, C.013239); Gerringong, Werri Beach, 34°44'S 150°50'E, dead (1 v, C.337158); off Crookhaven, 34°55'S 150°54'E, dead, 55–64 m (many v, C.337148); 44 km E of Nowra, 34°55.79'–34°56.06'S 151°08.06'–151°07.86'E, alive, 429–466 m (16 pr [smooth], VM F.60168); Beecroft Peninsula, Honeymoon Bay, 35°03'S 150°46'E, alive, 7 m (1 pr, C.339141); 8 km off Sussex Inlet, Wreck Bay, 35°12'S 150°36'E, alive, 37 m (13 v, C.022406); off Brush Island, 35°35'–35°37'S 150°40'–150°41'E, dead, 165 m (1 v, C.155818); Pebble Beach, 35°36'S 150°19'E, dead (1 v, C.337147); off Batemans Bay, 35°46'S 150°25'E, dead, 110 m (4 v, C.337139); off Montague Island, Narooma, 36°15'S 150°13'E, alive, 9–16 m (8 v, C.337137); off Montague Island, Narooma, 36°15'S 150°15'E, dead, 101 m (2 v, C.337145; 4 v, C.337146); Bermagui, Shelly Beach, 36°25'S 150°05'E, dead (4 v, C.337143); off Merimbula, 36°55'S 150°0'E, alive, 55–82 m (15 v, C.337153); Pambula, 36°56'S 149°55'E, dead (1 v, C.011772); off Eden, 37°00.60'S 150°20.70'E, alive, 363 m (7 pr [smooth], VM F.60165); Twofold Bay, 37°05'S 149°54'E, alive (6 v, C.337138); Twofold Bay, 37°05'S 149°57'E, dead, 37 m (1 v, C.337140); 15 ml off Twofold Bay, 37°22'S 150°02'E, dead, 75 m (9 v, C.337141); 20 ml SE of Twofold Bay, 37°26'S 150°15'E, dead, 149 m (5 v, C.337142). VICTORIA: Mallacoota, 37°34'S 149°56'E, dead (4 v, C.337225); SSE side of Gabo Island, 37°34'S 149°55'E, dead, 15–18 m (1 v, C.337226); off Mallacoota, 37°40'S 149°47'E, dead, 73 m (2 v, C.337227); 15 km S of Gabo Island, 37°43'S 149°57'E, dead, 95 m (1 v, C.337228); 12 km S of Ram Head, 37°50'S 149°37'E, dead, 119 m (1 v, C.157719); between Cape Howe & Lakes Entrance, 37°55'S 149°0'E, dead, 75–78 m (1 v, C.337223); 30 km SW of Cape Everard, 38°03'S 149°08'E, dead, 119 m (9 v, C.337236); Bass Strait, 36 km S of Cape Conran, 38°08'S 148°43'E, dead, 107 m (4 v, C.337238); Bass Strait, 44 km S of Mario, 38°12'S 148°35'E, dead, 146 m (2 v, C.337239); between Cape Howe & Lakes Entrance, 38°13'S 149°06'E, dead, 146–158 m (10 v, C.337222); Western Port Bay, Warneet Channel, 38°14'S 145°19'E, alive, 4 m (4 pr, C.337229); c. 43 km SE of Cape Everard, 38°15'S 149°12'E, dead, 165–274 m (2 v, C.337231); Western Port Bay, between Eagle & Crawfish Rock, NW arm, 38°16'S 145°17'E, alive, 3–5 m (3 pr + 8 v, C.337230); Bass Strait, SW of Lakes Entrance, 38°17'S 147°40'E, dead (2 v, C.337998); Bass Strait, c. 40 km S of Lakes Entrance, 38°31.7'S 149°01.7'E, dead, 60 m (7 v, C.338081); S of Point Hicks, 38°17.70'S 149°11.30'E, alive, 400 m (many, VM F.60164); Point Nepean, 38°18'S 144°39'E, dead (4 v, C.013537); Bass Canyon, 33 ml [53 km] S of Cape Conran, 38°18'S 148°39'E, dead, 750 m (7 v, C.337234); S of Point Hicks, 38°21.90'S 149°20'E, alive, 1000 m (1 pr [var. *obliqua*], VM F.60159); Western Port, 38°22'S 145°32'E, dead, 5–9 m (2 v, C.018663); Port Fairy, 38°23'S 142°14'E, dead (3 v, C.337233); 30 ml [48 km] S of Cape Everard, 38°30'S 149°30'E, dead, 366 m (2 v, C.337232); Bass Strait, c. 56 km S of Lakes Entrance, 38°50'S 147°91.7'E, dead, 63 m (1 v, C.338080). TASMANIA: Bass Strait, midway between Cape Everard & Flinders Island, 39°0'S 148°30'E, dead, 126 m (7 v, C.337997); Bass Strait, 25 ml S of Wilsons Promontory, 39°19'S 146°12'E, dead, 76 m (2 v, C.337224); Bass Strait, Erith (Deal) Island, 39°27'S 147°17'E, alive, 6 m (5 pr + 1 v, C.338026); Bass Strait, Murray Pass, Deal Island, 39°28'S 147°18'E, alive, 30–50 m (10 pr, C.338024; 13 pr, C.338025); Bass Strait, Deal Island, Little Squally Cove, 39°30'S 147°20'E, alive, 10–30 m (4 pr + 1 v, C.338031); Bass Strait, Deal Island, East Cove, 39°30'S 147°20'E, alive, 6–15 m (8 pr, C.339147); N of Hummock Island, 40°09'S 145°35'E, dead, 64 m (6 v, C.338006); N of Hummock Island, 40°09'S 145°11'E, dead, 51 m (3 v, C.338034); Bass Strait, S of King Island, 40°22'S 143°39'E, dead, 128 m (7 v, C.338005); S of King Island, 40°24'S 143°34'E, dead, 110 m (8 v, C.338004); off Cape Naturaliste, 40°48'S 148°27'E, dead, 51 m (3 v, C.338018); W of West Point, 41°01'S 144°21'E, dead, 80 m (1 v, C.338010); Tamar River mouth, Green's Beach, West Head, 41°05'S 146°45'E, dead (1 v, C.338030); S of West Point, 41°09'S 144°24'E, dead, 88 m (3 v, C.338009); off St. Helens Point, 41°20'S

148°30'E, dead, 110 m (2 v, C.338019); SW of Sandy Cape, 41°39'S 144°37'E, dead, 130 m (1 v, C.338008); off Freycinet Peninsula, 41°57.50'S 148°37.90'E, alive, 400 m (1 pr, VM F.60163); S of Cape Lodi, 42°0'S 148°18'E, dead, 28 m (1 v, C.338020); Great Oyster Bay, 42°20'S 148°13'E, dead, 45 m (3 v, C.338021); 2.5 ml NE Beaching Bay, Maria Island, 42°27.5'S 148°12'E, dead, 82.5 m (many v, C.338028); off Marion Bay, S of Maria Island, 42°50'S 147°59.8'E, alive, 58 m (1 pr + 7 v, C.337999); S of Maria Island, 42°50'S 148°07'E, dead, 84 m (15 v, C.338035); Pirates Bay, Eaglehawk Neck, 43°01'S 147°54'E, dead (1 v, C.338023); Tinderbox Bay, S of Hobart, 43°03'S 147°20'E, dead, 15 m (many v, C.338032); 9.5 ml NE of Tasman Island, 43°12'S 148°13'E, dead, 570 m (1 v, C.338027); off Port Davey, 43°13'S 145°36'E, dead, 132 m (15 v, C.338011); off Cape St. Vincent, 43°15'S 145°30'E, dead, 155 m (1 v, C.338003); W of Port Davey, 43°20'S 145°48'E, dead, 82 m (4 v, C.338012); S of Storm Bay, 43°20'S 147°37'E, dead, 97 m (11 v, C.338014); off Port Davey, 43°22'S 145°44'E, dead, 144 m (4 v, C.338002); D'Entrecasteaux Channel, Partridge Island, SE side, 43°23'S 147°06'E, dead, 16–20 m (1 v, C.338033); 11 ml SW of Cape Raoul, 43°25'S 147°45'E, alive, 117 m (many, C.338022); 2 ml S Tasman Head, S Bruny Island, 43°33'S 147°19'E, dead, 73 m (2 v, C.338029); S of Storm Bay, 43°35'S 147°32'E, dead, 121 m (2 v, C.338017); SE of South West Cape, 43°38'S 146°07'E, dead, 119 m (1 v, C.338013); S of D'Entrecasteaux Channel, 43°40'S 146°50'E, dead, 104 m (many v, C.338016); S of South East Cape, 43°49'S 146°33'E, dead, 159 m (4 v, C.338015); S of South East Cape, 43°55'S 146°51'E, dead, 168 m (3 v, C.338001); N of Macquarie Harbour, 44°19'S 144°51'E, dead, 170 m (1 v, C.338007). **SOUTH AUSTRALIA:** c. 35 ml [56 km] SW of Neptune Islands, dead, 190 m (2 v, SAM D19019); Cape Jaffa, dead, 165–238 m (2 v, SAM D19020); off Cape Borda, dead, 110 m (2 v, SAM D19021); off Beachport, dead, 73 m (2 v, SAM D19022); Beachport, off Cape Martin, 38°12.5'S 140°0'E, dead, 667 m (many v, C.165455); 80 km SE of Kangaroo Island, 37°0'S 138°33'E, dead, 77 m (1 v, C.338059); 64 km S of Cape Wiles, 35°39'S 136°40'E, dead, 174–183 m (many v, C.032058); N of Cape Borda, 35°20'–35°42'S 136°35'E, dead, 73 m (2 v, C.338058); SW of Cape Carnot, 35°15'S 134°32'E, dead, 150–178 m (3 v, C.338060); S of St. Francis Island, 33°0'–33°05'S 133°05'–133°10'E, dead, 64 m (2 v, C.338057); Great Australian Bight, SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (1 v, C.338061). **WESTERNAUSTRALIA:** Great Australian Bight, 33°20'S 128°45'E, dead, 140–147 m (2 v, C.338062); Great Australian Bight, 33°05'S 128°40'E, dead, 75 m (3 v, C.338056); Recherche Archipelago, 34°27.5'S 122°0.3'E, dead (1 v, C.165124); Recherche Archipelago, 34°19.5'S 121°27'E, dead, c. 80 m (1 v, C.165463); Great Australian Bight, between Eucla & Esperance, 33°08.3'–33°33.3'S 128°66.7'–128°75'E, dead, 79–147 m (7 v, C.165457); NW of Bunbury, 33°15'S 114°32'E, dead, 201–228 m (7 v, WAM424.91); W of Rottnest Island, 32°0'S 115°15'E, dead, 146–150 m (2 v, C.165458); W of Rottnest Island, 31°59'S 115°14'E, dead, 182 m (1 v, C.338066); off Rottnest Island, 31°42.2'S 115°08.2'E, dead, 150 m (3 v, C.338067); off Rottnest Island, 31°40'S 115°09.3'E, dead (3 v, C.338064); off Rottnest Island, 31°38'S 115°08'E, dead, 140 m (2 v, C.165461); W of Rottnest Island, 31°0'S 114°51'E, dead, 256 m (1 v, C.165460); W of Rottnest Island, 30°59'S 114°51'E, dead, 229 m (3 v, C.165459); W of Cervantes Island, 30°33.5'S 114°40.5'E, dead, 192–196 m (1 v, C.338065); NW of Beagle Island, 29°43'S 114°17'E, dead, 274–283 m (4 v, C.165462); off North West Cape, 22°15.5'S 113°47.6'E, dead, 70 m (1 v, C.338063); c. 370 km W of Broome, 18°0'S 118°56'E, dead, 261 m (2 v [var. *obliqua*], C.157715). **TASMAN SEA:** Lord Howe Shelf, 31°30'S 159°02'E, dead, 32.5 m (1 v, C.461409). **PAPUA NEW GUINEA:** Port Moresby, Ela Beach, 9°29'S 147°09'E, dead (14 v, C.165447); Amazon Bay, 10°18'S 149°20'E, dead (1 v, C.165448).

**Description.** Shell small, fragile, up to c. 3 mm high, hyaline or opaque, valves dissimilar in shape, size and sculpture; prodissoconch of both valves similar, c. 245 µm in width, 135 µm in height (Dijkstra, 1995b: figs 87–88; Figs 21C, 23A), evenly and weakly convex, sculptured with many low, narrow, weakly defined radial ridgelets; contrasting strongly with that of *Cycloclamys nepeanensis* in sculpture and in lack of central projection on left valve.

### Key to genera of Pectinidae occurring in Australia

- 1 Shell oblong, convex, commarginally undulated or corrugated, with radial macrosculpture, lacking antimarginal microsculpture, auricles unequal, byssal notch present, ctenolium weak or absent ..... *Hyalopecten*
- Shell circular, commarginally smooth, antimarginal microsculpture present ..... 2
- 2 Shell circular, convex, weakly commarginally undulated or smooth, with radial, commarginal or reticulate macrosculpture and antimarginal microsculpture, auricles unequal, byssal notch present, ctenolium strongly developed in most species ..... *Delectopecten*
- Shell of most specimens deformed, lv convex, right valve flat, with antimarginal microsculpture ..... 3
- 3 Shell circular, deformed, unequally convex, macrosculpture only on anterior auricle of rv, with antimarginal microsculpture, byssal notch deep, ctenolium strongly developed ..... *Hemipeecten*

Left valve slightly larger and more convex than right valve, smooth except for a few minute commarginal growth lines (typical var.) or with more prominent commarginal lirae (var. *obliqua*); auricles almost equal, with some commarginal lines. Outer ligament insertion with small holes near resilifer (Dijkstra, 1995b: fig. 89).

Right valve smooth apart from faint hexagonal microsculpture (Dijkstra, 1995b: fig. 90). Anterior auricle with closely spaced commarginal lamellae. Byssal notch well developed.

**Habitat.** Living in the littoral zone (amongst algae) and in the bathyal zone amongst rubble on soft sediment (sand and mud).

**Distribution.** New Caledonia, 305–610 m (Dijkstra, 1995b); Fiji, 135–151 m (Dijkstra & Maestrati, 2008). Present material from Papua New Guinea (beached, dead) and Australia (northeastern Queensland southwards to New South Wales, Victoria and Tasmania, and westwards to South Australia and Western Australia up to Broome) (3–1000 m, alive).

**Remarks.** *Chlamydella favus* is variable in shape (almost circular to posteriorly oblique) and extremely variable in sculpture on the left valve (almost smooth to prominent commarginal, weak radial or reticulate sculpture, or intermediate variations). The specific epithet “favus” is an indeclinable noun (Latin, honeycomb), selected by Hedley (1902: 306) because of the hexagonal structure of the surface of the right valve.

### Pectinidae Rafinesque, 1815

Pectinidae Rafinesque, 1815 [emend. Waller, 1978]; formerly attributed to Wilkes (1810), but that work is not consistently binominal (Waller & Stanley 2005: 38; Dijkstra & Marshall 2008: 2; Bouchet & Rocroi, 2010: 65).

**Diagnostic characters.** Byssate, cemented, or free-living Pectinoidea with outer prismatic calcite layer on right valve limited to early dissoconch stage; some taxa with crossed-lamellar aragonite inside pallial line; with an aragonitic myostracum; byssal notch with ctenolium, at least in early growth stages; resilium single, triangular.

—	Shell circular, up to 100 mm high, almost equally convex, exterior smooth, auricles equal, internal ribs present .....	4
4	Shell circular, disc and auricles smooth, byssal notch shallow, ctenolium lacking, 20–34 single, widely spaced internal ribs present .....	<i>Amusium</i>
—	Shell circular, up to 140 mm high, almost equally convex, exterior smooth, auricles equal, internal ribs present .....	5
5	Shell circular, disc and auricles smooth, byssal notch shallow, ctenolium lacking, 42–54 internal ribs in vague pairs .....	<i>Ylistrum</i>
—	Shell circular, lv flat, rv convex, auricles equal, ribs solid .....	6
6	Shell circular, most species solid, lv flat or slightly concave, rv strongly convex, disc radially ribbed, with commarginal lamellae, auricles equal, byssal notch shallow, ctenolium lacking in late ontogeny .....	<i>Pecten</i>
—	Shell circular, lv concave, rv convex, auricles equal, commarginal lamellae lacking on right valve, ribs solid, byssal notch moderately deep .....	7
7	Shell circular, lv concave, rv strongly convex, disc simply radially ribbed, lv with weak commarginal lamellae, lacking on rv, byssal notch moderately deep, ctenolium present .....	<i>Minnivola</i>
—	Shell circular, lv flat, rv convex, auricles subequal, ribs with hollow sections .....	8
8	Shell circular, lv flat, rv convex, auricles subequal, radial ribs solid or with hollow sections, commarginal sculpture weak or lacking .....	<i>Serratovola</i>
—	Shell circular, both valves convex, primary and secondary radial sculpture present, commarginal lamellae delicate .....	9
9	Shell circular, solid, both valves convex, with a few strong radial plicae, numerous secondary radial riblets, commarginal lamellae delicate, auricles subequal, byssal notch weak in adult, ctenolium lacking .....	<i>Mesopeplum</i>
—	Shell circular, thin, both valves convex, macrosculpture lacking from most species, antimarginal microsculpture present, auricles unequal .....	10
10	Shell circular, thin, equally convex, macrosculpture lacking from most species, antimarginal microsculpture present, auricles unequal, byssal notch relatively deep, ctenolium well-developed .....	<i>Palliohum</i>
—	Shell oblong, solid, radially and commarginally sculptured, auricles small and equal, byssal notch and ctenolium lacking .....	11
11	Shell oblong, solid, both valves weakly convex, with primary and secondary radial sculpture, commarginal lamellae delicate and closely set, auricles small and equal, byssal notch and ctenolium lacking .....	<i>Anguipecten</i>
—	Shell circular, solid, lv slightly convex, rv more convex, simply radially sculptured, commarginal lamellae delicate, auricles subequal .....	12
12	Shell, circular, solid, lv slightly convex or flat (in a few species), rv more convex, disc with radial plicae and delicate, close-set commarginal lamellae, auricles almost equal, byssal notch shallow, ctenolium lacking .....	<i>Annachlamys</i>
—	Shell subcircular to oblong, solid, with prominent primary radial plicae bearing nodules in most species, secondary radial riblets present .....	13



- 13 Shell subcircular to oblong, solid, inequivalve, equilateral, with evenly spaced primary noduliferous radial plicae, secondary radial riblets present, commarginal lamellae delicate, auricles unequal, prominently ribbed, byssal notch relatively deep, ctenolium weak ..... *Bractechlamys*
- Shell oblong, solid, both valves weakly convex, auricles subequal, simply radially sculptured, commarginal lamellae delicate ..... 14
- 14 Shell oblong, solid, inequivalve, auricles subequal, primary radial plicae evenly spaced, commarginal lamellae closely spaced, byssal notch shallow, ctenolium weak ..... *Decatopecten*
- Shell circular, solid, lv almost flat, rv convex, strongly radially ribbed, with commarginal lamellae, auricles unequal to equal ..... 15
- 15 Shell circular, solid, left valve almost flat, right valve convex, strongly radially ribbed, commarginal lamellae delicate, auricles unequal to equal, byssal notch shallow, ctenolium weak or lacking ..... *Excellichlamys*
- Shell circular to oblong, solid, convex, with simple to quadrepartite radial sculpture, commarginal lamellae delicate ..... 16
- 16 Shell circular to oblong, solid, both valves convex, radial sculpture simple to quadrepartite, commarginal lamellae delicate, auricles unequal, byssal notch deep, ctenolium well-developed ..... *Glorichlamys*
- Shell (sub)circular, solid, both valves convex, radial plicae with prominent commarginal lamellae, auricles unequal ..... 17
- 17 Shell (sub)circular, solid, both valves convex, with evenly spaced simple radial plicae and prominent commarginal lamellae, most species with secondary radial riblets, auricles unequal with noduliferous macrosculpture, byssal notch deep, ctenolium well developed ..... *Gloripallium*
- Shell (sub)circular, inflated, resilifer strongly erect on one side, ctenolium on both valves ..... 18
- 18 Shell (sub)circular, inflated, lv almost flat, rv weakly convex, weakly radially and commarginally sculptured, auricles almost equal, resilifer strongly oblong on one side, byssal notch shallow, ctenolium on both valves ..... *Juxtamusium*
- Shell (sub)circular, inflated, sculptured with squamous radial costae ..... 19
- 19 Shell (sub)circular, flattened to inflated, rv more convex than lv, sculptured with primary and secondary squamous costae, commarginal lamellae delicate, byssal notch moderately deep, ctenolium well-developed ..... *Mirapecten*
- Shell oblong, radially sculptured, weakly convex, auricles highly unequal ..... 20
- 20 Shell strongly oblong, weakly convex, with primary and secondary radial sculpture, auricles highly unequal, byssal notch deep, ctenolium prominent ..... *Complicachlamys*
- Shell oblong, many specimens deformed, flattened, weakly convex, sculptured with numerous delicate radial riblets, auricles unequal ..... 21
- 21 Shell oblong, many specimens oblique and deformed in adult stage, weakly convex, sculptured with numerous squamous radial riblets, commarginal lamellae present, auricles highly unequal, byssal notch deep, ctenolium well-developed ..... *Coralichlamys*
- Shell circular, solid, valves almost equally convex, auricles almost equal, radial macrosculpture present, microsculpture shagreen ..... 22

22	Shell circular, solid, valve inflation almost equal, auricles almost equal, primary and secondary radial macrosculpture present, shagreen microsculpture present throughout, internal rib carinae prominent, byssal notch shallow, ctenolium lacking in adult .....	<i>Equichlamys</i>	
—	Shell oblong, weakly inflated, auricles highly unequal, with radial macrosculpture, intercalated antimarginal microsculpture .....		23
23	Shell oblong, weakly inflated, inequivalve, auricles highly unequal, primary (and secondary) radial macrosculpture present, shagreen microsculpture lacking from most species, antimarginal microsculpture intercalated, byssal notch deep, ctenolium well-developed .....	<i>Laevichlamys</i>	
—	Shell circular, solid, flattened, valves almost equally convex, auricles unequal, radial macrosculpture and shagreen microsculpture present .....		24
24	Shell circular, solid, flattened, valve inflation almost equal, auricles unequal, primary and secondary radial macrosculpture and shagreen microsculpture present, internal rib carinae weak, byssal notch deep, ctenolium well-developed .....	<i>Notochlamys</i>	
—	Shell oblong, solid, lv flattened, rv spatulate, deformed in many specimens .....		25
25	Shell oblong, solid, lv flattened, rv convex and spatulate, radial sculpture fine, scabrous, anterior auricle curved .....	<i>Pedum</i>	
—	Shell oblong, solid, flattened, weakly convex, radial macrosculpture scabrous, with shagreen microsculpture .....		26
26	Shell oblong, solid, flattened, valve inflation almost equal, auricles highly unequal, radial macrosculpture scabrous, shagreen microsculpture present, byssal notch deep, ctenolium strongly developed .....	<i>Scaeochlamys</i>	
—	Shell oblong, oblique in many species, flattened, weakly convex, with radial macrosculpture and shagreen microsculpture .....		27
27	Shell oblong, oblique in many species, solid to thin, flattened, weakly convex, auricles unequal, primary and secondary radial macrosculpture and shagreen microsculpture present, byssal notch deep, ctenolium well-developed .....	<i>Semipallium</i>	
—	Shell oblong, solid to thin, weakly convex, with commarginal lamellae, squamous radial macrosculpture and antimarginal microsculpture .....		28
28	Shell oblong, solid to thin, weakly convex, auricles unequal, primary and secondary squamous radial macrosculpture present, commarginal lamellae intercalated, antimarginal microsculpture present, byssal notch deep, ctenolium well developed .....	<i>Talochlamys</i>	
—	Shell oblong, oblique in many species, thin, weakly convex, with squamous radial macrosculpture and antimarginal microsculpture .....		29
29	Shell oblong, many species oblique in adult stage, thin, valves weakly convex, primary and secondary squamous radial macrosculpture and intercalated antimarginal microsculpture present, byssal notch deep, ctenolium well developed .....	<i>Veprichlamys</i>	
—	Shell (sub)circular, solid to thin, valves equally convex, auricles unequal, delicate radial macrosculpture and antimarginal microsculpture present .....		30

- 30 Shell (sub)circular, solid to thin, valve inflation almost equal, auricles unequal, primary and secondary scaly macrosculpture delicate, antimarginal microsculpture intercalated, byssal notch shallow, ctenolium weak ..... *Zygochlamys*
- Shell oblong, solid, valves equally convex, auricles unequal, radial macrosculpture and herringbone microsculpture present ..... 31
- 31 Shell oblong, solid, valve inflation almost equal in most species, auricles unequal, primary and secondary spinous radial macrosculpture and intercalated herringbone microsculpture present, byssal notch deep, ctenolium well-developed ..... *Mimachlamys*
- Shell (sub)circular, solid to thin, strongly to weakly inflated, auricles unequal, with vesicular radial sculpture and commarginal lamellae ..... 32
- 32 Shell (sub)circular, solid to thin, strongly to weakly inflated, auricles unequal, vesicular radial sculpture and intercalated commarginal lamellae present, byssal notch moderately deep, ctenolium well developed ..... *Cryptopecten*
- Shell circular, solid, valves strongly inequally convex, auricles small and almost equal, simple radial macrosculpture present ..... 33
- 33 Shell circular, solid, lv flattened, rv strongly convex, auricles small and almost equal, simple radial macrosculpture and closely spaced commarginal lamellae present, byssal notch deep, ctenolium present ..... *Haumea*
- Shell oblong to (sub)circular, solid, valves almost equally convex, auricles highly unequal, radial macrosculpture and imbricate microsculpture present ..... 34
- 34 Shell oblong to (sub)circular, solid, valves almost equally convex, auricles unequal, simple radial macrosculpture and commarginal lamellae present, with intercalated imbricate (early ontogeny) and radial (late ontogeny) microsculpture, byssal notch deep, ctenolium well-developed ..... *Volachlamys*

## Pectinidae

The subfamily position of the genus *Hyalopecten* is uncertain and not yet established

### *Hyalopecten* Verrill, 1897

*Hyalopecten* Verrill, 1897: 63, 71, pl. 18, fig. 5. Type species (by original designation): *Hyalopecten undatus* Verrill & S. Smith in Verrill, 1885 (junior secondary homonym of *Pecten undatus* DeFrance, 1825) = *Hyalopecten dilectus* Verrill & Bush in Verrill, 1897; see also North (1951a: 234); living, off Chesapeake Bay, Maryland, USA, 37°38'40"N 73°16'30"W, 2603 m.

**Diagnosis.** Shell inequivalve, hyaline; valves with commarginal undulations or corrugations and sculptured with fine radial lirae on one or both valves; lacking antimarginal microsculpture; auricles unequal; byssal notch well-developed, ctenolium present on most species.

**Distribution.** Miocene–Recent. Cosmopolitan, 800–7000 m (Knudsen, 1970).

**Remarks.** Grau (1959: 55) treated *Hyalopecten* as a subgenus of *Cyclopecten* (a propeamussiid), which was followed by Knudsen (1970: 97) and Rombouts (1991: 79). Hertlein

(1969: N354) considered *Hyalopecten* to be a subgenus of *Palliohum* (a pectinid), placed in the *Eburneopecten* group, and Vaught (1989: 119) placed *Hyalopecten* in the tribe Eburneopectinini. *Hyalopecten* was considered to be a valid Recent genus of Pectinidae by other authors (Bernard, 1983; Schein-Fatton, 1988; Schein, 1989; Dell, 1990; Dijkstra, 1991; Dijkstra & Goud, 2002).

In the opinions of Coan *et al.* (2000: 228), Palazzi & Villari (1996: 270) and T. R. Waller (USNM, pers. comm. 23 Jun 2017), *Hyalopecten* is a junior synonym of *Cyclopecten* Seguenza, 1877. Microscopic examination by the first author of specimens of *Cyclopecten peloritanus* Seguenza, 1877 (Pliocene, Italy; type species of *Cyclopecten*) revealed obvious antimarginal microsculpture, prominent on the right valve and weaker on the left. Palazzi & Villari (1996: figs 121, 122, 145, 146) illustrated specimens of *C. peloritanus* apparently not displaying antimarginal microsculpture, but in our opinion this is due merely to the low magnification of the illustrations. Antimarginal microsculpture is lacking in *Hyalopecten*, and we feel it is unwise to synonymize these names at this time, without further study.

Waller & Marincovich (1992: 219) considered *Hyalopecten* to be related to a radially sculptured ancestor, *Praechlamys* Allasinaz, 1972 from the Triassic. The position of *Hyalopecten* in the phylogeny of Waller (1991, 2006a) remains uncertain.

*Hyalopecten ponderi* sp. nov.

Figs 23B,E,G, 24

**Holotype** (pr), H 7.1 mm, W 7.0 mm, D 3.1 mm) AM C.209770, CORAL SEA: 11°40.98'S 145°36.85'E, alive, 2039–2052 m, benthic sled, leg. I. Loch, 23 Aug 1988 (ORV *Franklin* stn 15).

**Description.** Shell up to c. 7 mm high, fragile, opaque, whitish, left and right valve almost equally strongly convex, oblong, inequilateral, auricles unequal in shape and almost equal in size, umbonal angle c. 85°.

Left valve sculptured with strongly developed commarginal lamellae, widely spaced on central part of disc (4 per mm) but more closely spaced dorsally, ventrally and laterally (5–6 per mm), commencing at 0.5 mm shell height and enlarging near ventral margin, with unevenly spaced, interstitial radial riblets (5–7 per mm). Radial riblets weak, commarginal lamellae prominent, strongly projecting and curved towards ventral margin. Auricles with very closely spaced commarginal lamellae (10–12 per mm).

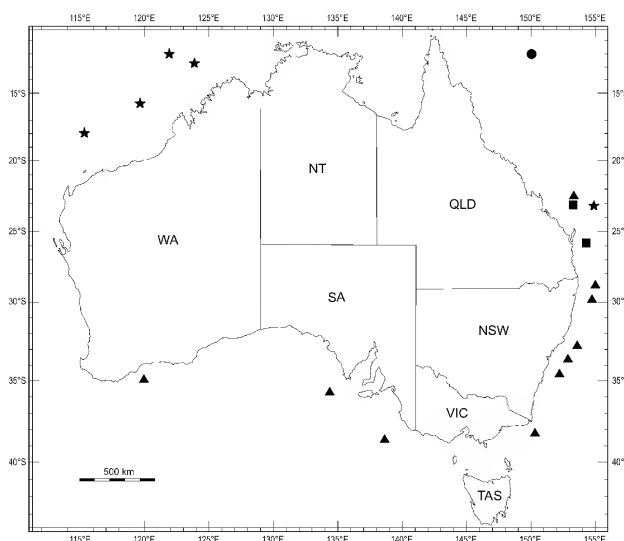
Right valve similar in sculpture to left valve, with somewhat weaker interstitial radial riblets on central part of disc, almost absent laterally. Dorsal margin straight. Byssal notch moderately deep, byssal fasciole rather broad, active ctenolium delicate, with 3 closely arranged teeth.

**Discussion.** *Hyalopecten ponderi* resembles *H. mireilleae* (Dijkstra, 1995), recorded from New Caledonia, the Loyalty Islands and Vanuatu. Both species are strongly convex, with prominent commarginal and weak radial sculpture, and are not commarginally undulated. However, the present species is smaller (c. 7 mm high, *H. mireilleae* c. 13.5 mm high) and more circular in shape, *H. mireilleae* being more oblong and posteriorly oblique, with more prominent radial riblets than *H. ponderi*. The right valve of *Hyalopecten ponderi* also is less convex than that of *H. mireilleae* and the anterior auricle of the right valve is smaller (in *H. mireilleae* the right anterior auricle is broader with a much smaller byssal fasciole, which is almost absent).

*Hyalopecten ponderi* also resembles *Hyalopecten tydemani* (Dijkstra, 1990) from Indonesia, but they differ somewhat in size (*H. tydemani* is c. 10 mm high) and in shape (*H. tydemani* is more oblong). The radial sculpture of *Hyalopecten tydemani* is very weak and only developed at an early growth stage (more prominent throughout ontogeny in *H. ponderi*). *Hyalopecten hadalis* (Knudsen, 1970) from the Kermadec Trench is larger (up to c. 20 mm high), oblong, strongly commarginally undulated, and sculptured only with delicate radial striae. *Hyalopecten* sp. (anterior and posterior part of left valve) (Knudsen, 1970: 102) from the Tasman Sea is much larger in size (up to c. 35 mm in height), also commarginally undulated, and sculptured with closely spaced radial riblets.

Kamenev (2016) described three new species of *Hyalopecten* from abyssal and hadal zones in the northwestern Pacific, and provided illustrations of and comparisons with all previously named living species. His illustrations (Kamenev, 2016: fig. 5) show that the most nearly similar species in their weak commarginal plications, prominent commarginal lamellae and weak radial riblets are *H. tydemani*, which is taller and narrower than *H. ponderi* sp. nov., and *H. bavayi* Dijkstra, 1990, which is shorter and wider than *H. ponderi*.

**Habitat.** Living in the upper abyssal zone on soft sediment.



**Figure 24.** Distribution of *Hyalopecten ponderi* sp. nov. (circle), *Delectopecten alcocki* (Smith) (stars), *D. fosterianus* (Powell) (triangles) and *D. musorstomi* (Poutiers) (squares).

**Distribution.** Only known from the type material at the type locality.

**Etymology.** Named after Dr Winston Ponder, former curator of the Malacology Section, AM, who stimulated this project.

**Camptonectinae Habe, 1977**

Camptonectinae Habe, 1977: 87 [in Japanese]; Waller & Marincovich, 1992: 218 [English translation].

**Diagnosis.** Pectinidae without prominent macrosculpture; with antimarginal microsculpture throughout ontogeny; shell microstructure of outer lathic or foliated calcite, inner crossed-lamellar aragonitic layer extending to margins; posterior auricle not significantly demarcated from disc; byssal notch well-developed, ctenolium present.

**Remarks.** For emended diagnostic characters and discussion of Camptonectinae see Waller & Marincovich (1992: 218–219).

**Delectopecten Stewart, 1930**

*Delectopecten* Stewart, 1930: 118 (proposed as a subgenus of *Palliolium*). Type species (by original designation): *Pecten (Pseudamusium [sic] vancouverensis* Whiteaves, 1893; living, Forward Inlet, Quatsino Sound, Vancouver Island, British Columbia, Canada, 18–37 m.

**Diagnosis.** Inequivalve, small, fragile, almost circular camptonectinines, valves almost equal convex, sculptured with commarginal rows of scales or vesicles, spinose radial ridges and/or fine antimarginal striae; byssal notch well-developed; ctenolium prominent.

**Distribution.** Lower Cretaceous–Recent (Waller & Marincovich, 1992: 219). Cosmopolitan, 27–4256 m (Clarke, 1962: 60).

**Remarks.** Grau (1959: 38) considered *Delectopecten* to be a subgenus of *Cyclopecten* Verrill, 1897, and placed *Arctinula* Thiele, 1934 and *Catillopecten* Iredale, 1939 in its synonymy. The morphological characters of *Arctinula*, however,

### Key to species of *Delectopecten* from Australia

- 1 Shell c. 15 mm high, growth lines crenulated, scaly sculpture radially arranged, with antimarginal microsculpture ..... *D. alcocki*  
 — Shell smooth, with delicate antimarginal microsculpture ..... 2
- 2 Shell c. 20 mm high, macrosculpture lacking, antimarginal microsculpture delicate ..... *D. fosterianus*  
 — Shell small, with radial macrosculpture ..... 3
- 3 Shell c. 5 mm high, macrosculpture of 14–20 delicate, scaly radial lirae, with antimarginal microsculpture ..... *D. musorstomi*

are identical to those of *Similipecten* Winckworth, 1932 (Schein, 1989: 96), at present placed in Propeamussiidae. *Catillopecten* is also considered to be a Recent genus of Propeamussiidae (Schein-Fatton, 1988; Schein, 1989) and a senior synonym of *Bathypecten* Schein-Fatton, 1985. Hertlein (1969: N354) treated *Delectopecten* as a subgenus of *Palliolum* Monterosato, 1884, placed in the *Eburneopecten* group. Currently, however, *Delectopecten* is interpreted as a Recent genus of Pectinidae (Moore, 1984: B13; Waller, 1991: 13; Waller & Marinovich, 1992: 219; Beu, 1995: 11; Coan *et al.*, 2000) and classed in the subfamily Camptonectinae. Malkowsky & Klussmann-Kolb (2012: figs 1, 2) included *Delectopecten vitreus* (Gmelin, 1791) in the subfamily Pallioliinae, but this likely results from the inclusion of too few species in their molecular phylogeny.

#### *Delectopecten alcocki* (E. A. Smith, 1904)

Figs 24, 25A,C–E

- Pecten alcocki* Smith, 1904: 13; Alcock *et al.*, 1907: pl. 18, fig. 4–4b; Knudsen, 1967: 282, pl. 2, figs 3–4, textfig. 19.  
*Pecten (Pseudamussium) alcocki* Smith.—Thiele & Jaekel, 1931: 6.  
*Propeamussium (Hyalopecten) alcocki* (Smith).—Winckworth, 1940: 26.  
*Delectopecten alcocki* (Smith).—Poutiers, 1981: 331, pl. 1, fig. 1; Dijkstra, 1991: 26, fig. 87; Dijkstra, 1995b: 50, figs 111–114, 147–150 [lectotype]; Dijkstra & Kastoro, 1997: 265, figs 101–108; Dijkstra, 2001: 91; Raines & Poppe, 2006: 56–57, upper figs; pl. 2, figs 3–4, 6, 9; Dijkstra & Maestrati, 2008: 105; Huber, 2010: 213; Raines, 2010: 594, pl. 988, figs 1–2; Dijkstra, 2013: 24, pl. 5, figs 1a–d; Dijkstra & Janssen, 2013: 201, figs 30–31, 54–55.

**Type data.** Lectotype (pr) ZSI M669/1 designated by Dijkstra (1995b: 50), 29 paralectotypes (pr) ZSI M667–668, M670–698/1. Type locality: off southern India, 7°17'N 76°54'E, alive, 786 m (*Investigator* stn 232).

**Comment on type data.** Although Smith (1904: 13) indicated the measurements of a type specimen, this specimen was not segregated from the type lot and several other type specimens are of similar size. Therefore, during his visit to the ZSI, Dijkstra (1991: 26) designated a specimen from the type lot as the lectotype, which has identical measurements to those mentioned by Smith in his original description.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Swain Reefs, 23°15'S 153°18'E, alive, 424 m (6 pr, QM MO33657). WESTERN AUSTRALIA: 200 km NNW of Dampier, 18°53'S 116°10'E, alive, 450 m (1 pr, C.157677); off Lacepede Islands, 16°57'S 119°48'E, 450 m, alive in sponge (1 pr, HM) [smooth var.]; SE of Cassini Island, 13°56'S 125°38'E, alive, 40–48 m (1 pr, WAM

S12963); NW of York Sound, approx. 12°48'S 122°56'E, 500 m, dredged alive (1 pr, HM). —PHILIPPINE ISLANDS: Bohol, Balicasag Island, tangle nets, alive, 500–600 m (3 pr, ZMA Moll.146300), 150 m (Raines, 2010). —INDONESIA: Tanimbar Islands, 08°20'S 132°11'E, alive, 399–405 m (1 pr, ZMA Moll.139809). —INDIAN OCEAN: between Port Darwin and Java (Indonesia), byssally attached to submarine cable, alive (1 pr, SAM TD11329). —NEW CALEDONIA: S New Caledonia, 23°02'S 166°57'E, alive, 558–647 m (1 pr, ZMA Moll.146246).

**Description.** Shell up to c. 19 mm high (Raines, 2010), circular, hyaline or opaque, whitish, auricles almost equal in size, umbonal angle c. 125°.

Left valve with delicate antimarginal striae over entire disc. Commarginal growth lines crenulated, with radially aligned scales. Auricles identically sculptured, posterior auricle continuous with disc. Dorsal margin straight.

Right valve sculptured as on left valve, although sculpture somewhat weaker. Anterior auricle separated from disc by suture; bearing 2–4 antimarginal ridges. Byssal fasciole and notch strongly developed. Inactive and active ctenolium (with 3–5 teeth) present. Resilifer triangular. External sculpture barely visible from interior.

Soft parts described by Knudsen (1967: 282).

**Habitat.** Living on the continental shelf and in the bathyal zone on soft sediment (mud and/or sand).

**Distribution.** Eastern Africa, 1079 m (Thiele & Jaekel, 1931); Gulf of Aden, 274–732 m (Knudsen, 1967); S India, 786 m, ?alive (Smith, 1904); western Sumatra, 614–750 m (Thiele & Jaekel, 1931); eastern Indonesia, 176–688 m, alive (Dijkstra & Kastoro, 1997); Philippine Islands, 150 m (Raines, 2010), 710–750 m (Knudsen, 1967); Japan, 274–1010 m (Higo *et al.*, 1999); Chesterfield Islands, 650–660 m (Dijkstra, 1995b); New Caledonia, 464–647 m (Dijkstra, 2001) and the Solomon Islands, 509–564 m (Dijkstra & Maestrati, 2008). Now also from Australia (Queensland and Western Australia), in 40–450 m (alive). Maximum depth range of live-taken specimens is 40–1010 m.

**Remarks.** The present specimens from Queensland and Western Australia are identical in all morphological characters to the type material.

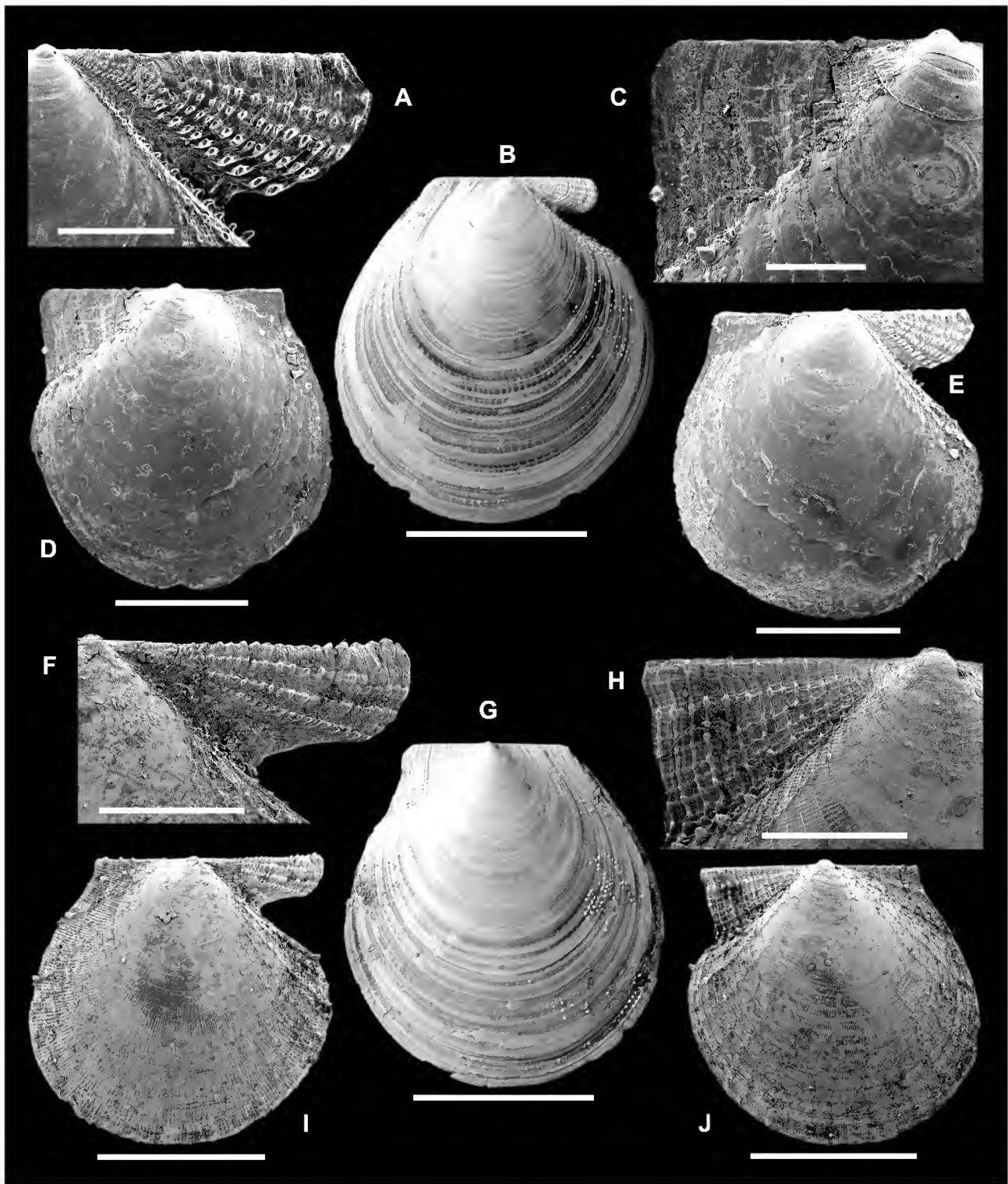
*Delectopecten alcocki* is a **new record** for Australia.

#### *Delectopecten fosterianus* (Powell, 1933)

Figs 24, 25B,G

- Palliolum fosterianum* Powell, 1933: 370, pl. 40, figs 6, 7.  
*Delectopecten fosterianus* (Powell).—Beu, 1970: 117; Powell, 1979: 379, pl. 73, fig. 3; Dell, 1990: 36; Beu, 1995: 11; Dijkstra & Marshall, 1997: 89; Beu & Darragh, 2001: 37;





**Figure 25.** *A, C–E, Delectopecten alcocki* (Smith), AM C.157677, pair, FRV *Soela* stn SO1-84-12, 200 km NNW of Dampier, WA, 18°53'S 116°10'E, 450 m, rv anterior auricle exterior (A), lv anterior auricle exterior (C), lv exterior (D), rv exterior (E). *B, G, Delectopecten fosterianus* (Powell), pair, AM C.449254, off Broken Bay, NSW, 1000 m, rv exterior (B), lv exterior (G). *F, H–J, Delectopecten musorstomi* Poutiers, pair, AM C.165233, HMAS *Kimbla* stn 6, Barwon Bank, ESE Noosa Heads, QLD, 26°32'S 153°32'E, 37 m, rv anterior auricle exterior (F), lv anterior auricle exterior (H), rv exterior (I), lv exterior (J). Scale bars represent 1 mm (A, C, F, H), 10 mm (B, G), 3 mm (D, E, I, J).

Raines & Poppe, 2006: 56–57, lower figs; pl. 2, figs 5, 7–8; Dijkstra & Marshall, 2008: 49, figs 40A, B, D–F, 41. *Cyclopecten* (*Delectopecten*) *fosterianus* (Powell).—Rombouts, 1991: 77. *Delectopecten fosterianum* [sic] (Powell).—Spencer & Willan, 1995: 45; Spencer *et al.*, 2009: 198.

**Type data.** Holotype (pr) (Powell, 1933: pl. 40, fig. 6) AIM AK70582, paratype (pr) AIM AK71427 (Powell, 1933: pl. 40, fig. 7). Type locality: New Zealand, Tasman Sea, 400 ml W of New Plymouth, 39°0'S 168°50'E, byssally attached to deep-sea cable, alive, 1080 m.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: 24.5 mls E of Lady Musgrave Island, 23°33'S 152°37'E, dead, 339–348 m (3 v, C.338772); NE of Lady Musgrave Island, 23°38'S 152°45'E, alive, 365 m (2 pr + 14 v, C.338773); c. 40 km E of Lady Musgrave Island, 23°44'S 152°49'E, dead, 348–357 m (3 v, C.338771); Capricorn Channel, E of Lady Elliott Island, 24°0'S 153°06'E, dead, 476–531 m (1 v, C.338770). NEW SOUTH WALES: ENE of Danger Point, 28°01'–27°58'S 154°0'E, alive, 550 m (2 pr, C.375392); off Tweed Heads, 28°06'S 153°58'E, alive, 412 m (2 pr, C.165240); ENE of Clarence River, 29°26'–29°20'S 153°49'–153°50'E, alive, 457 m (1 pr, C.375398); off Newcastle, 32°58'S 152°41'E, alive, 951–1150 m (many, C.310673); E of Broken Bay, 33°25'–33°30'S 152°03'–152°07'E, dead, 640 m (1 v, C.155812); off Broken Bay, 33°31'–33°28'S 152°11'–152°13'E, alive, 1040–1110 m (4 pr, C.375388); off Broken Bay, 1000 m (C.449254; illustrated, Fig. 14B, G, collected after initial list compiled); off Sydney, 33°36'S 152°09'E, alive, 1097 m (1 v, C.155796; 1 pr, C.375396); off Sydney, 33°36'S 152°09'E, dead, 1097 m (1 v, C.155827); E of Broken Bay, 33°40'–33°37'S 152°04'–152°06'E, alive, 988–1016 m (3 pr, C.375391); off Sydney, 33°38'–33°36'S 152°02'–152°09'E, alive, 960–988 m (1 pr, C.375395); off Botany Bay, 33°41'S 151°53'E, dead, 366 m (1 v, C.155807); NNE of Sydney, 33°42'S 151°53'–152°0'E, alive, 406 m (1 pr, C.375399); off Newcastle, 33°59'–33°54'S 152°42'–152°44'E, alive, 960–988 m (3 pr, C.375390); NE of Wollongong, 34°18'–34°24'S 151°26'–151°21'E, alive, 457–466 m (4 pr, C.338769); off Wollongong, 34°21'–34°19'S 151°23'–151°25'E, alive, 439 m (1 pr, C.375397); off Wollongong, 34°22'–34°19'S 151°27'–151°25'E, alive, 439–446 m (2 pr, C.375393); off Shoalhaven Bight, 34°50'–34°54'S 151°15'–151°17'E, alive, 1130–1180 m (3 pr, C.305399); off Shoalhaven Bight, 34°51'–34°55'S 151°15'–151°14'E, alive, 1043–1051 m (many, C.155804); off Shoalhaven Bight, 34°51'–34°55'S 151°15'–151°17'E, alive, 1161–1207 m (1 pr, C.375394); off Shoalhaven Bight, 34°53'–34°56'S 151°15'–151°13'E, alive, 1097 m (many, C.375387); off Shoalhaven Bight, 34°54'–34°50'S 151°14'–151°15'E, alive, 988–1006 m (many, C.155795); off Shoalhaven Bight, 34°54'–34°50'S 151°14'–151°15'E, alive, 988–1006 m (1 pr, C.155820); off Nowra, 34°56'–34°54'S 151°15'–151°17'E, alive, 1115–1152 m (2 pr, C.375389); E of Brush Island, 35°36'–35°34'S 150°44'–150°46'E, alive, 603 m (1 pr, C.110844); E of Merimbula, 36°56'–36°57'S 150°23'–150°22.5'E, dead, 1600 m (1 v, C.310675); E of Eden, 36°59'–36°58'S 150°21'–150°22.7'E, dead, 716–900 m (2 v, C.310674); 53 km SE of Green Cape, 37°33'–37°36'S 150°26'–150°30'E, dead, 860 m (1 v, C.338774). VICTORIA: S of Point Hicks, 38°19.60'S 149°24.30'E, alive, 930 m (1 pr, VMF.60158). SOUTH AUSTRALIA: off Beachport, 37°49'S 139.34'E, alive, 1219 m (1 pr, ZMA Moll.145011); 100 miles SW off Port Lincoln, 35°53'S 134°63'E, dead, 1000 m (2 v, ZMA Moll.146143). WESTERN AUSTRALIA: off Albany, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, dead, 748–776 m (1 v, WAMS77671). —NEW ZEALAND: E North Island, off Castlepoint, alive, 1020–1040 m (1 pr, ZMA Moll.145009); off Cook Strait, 39°02'S 171°09'E, alive, 492 m (many, AM C.031263); W of New Plymouth, alive, 400 m (3 pr, SAM D13015). TASMAN SEA: c.400 mls W of New Plymouth, 39°03'S 167°20'E, dead, 1100–1280 m (2 pr, C.160465). New Zealand material also listed by Dijkstra & Marshall (2008, p. 40, fig. 41).

**Description.** Shell up to c. 20 mm high, almost circular, hyaline to opaque, whitish, equivalve, equilateral, compressed, both valves almost equally convex, auricles almost equal in size, umbonal angle c. 125°.

Both valves sculptured with delicate antimarginal microsculpture, somewhat coarser marginally, and unevenly spaced commarginal growth lines. Macrosculpture almost absent, with only a few squamous radial ridges anteriorly on right valve and delicate vesicles on commarginal growth lines of some specimens. Auricles of left valve sculptured identically to disc, continuous with disc. Anterior auricle of right valve with 4–6 squamous radial ridges, separated from disc by a suture. Byssal fasciole and notch strongly developed. Functional ctenolium with 3–5 teeth. Resilifer triangular, somewhat oblique.

**Dimensions.** Illustrated specimen, AM C.449254, NSW, off Broken Bay, 1000 m; rv: H 19.2, L 17.6 mm; lv: H 19.5, L 17.3 mm; D 5.7 mm.

**Habitat.** Living in the abyssal zone on soft sediment (mud or muddy sand).

**Distribution.** Previously recorded from New Zealand (Three Kings Rise to the Chatham Rise and Doubtful Sound, SW South Island), the Tasman Sea and the Pacific-Antarctic Ridge (Dijkstra & Marshall, 2008: 40, fig. 41). Now also extended to Australia: eastern and southern Australia, from off Queensland, New South Wales, Victoria, South Australia and southernmost Western Australia. Present specimens from Australia taken alive in 365–1207 m.

**Remarks.** Australian specimens are identical to the type specimens from New Zealand in all morphological characters.

*Delectopecten fosterianus* differs somewhat from *D. alcocki* by having an almost smooth surface (*D. alcocki* has more strongly developed vesicles or scales on the commarginal growth lines) with more delicate and finer antimarginal microsculpture (*D. alcocki* has coarser antimarginal scratches).

*Delectopecten fosterianus* is a new record for Australia.

### *Delectopecten musorstomi* Poutiers, 1981

Figs 24, 25F,H–J

*Delectopecten musorstomi* Poutiers, 1981: 331, pl. 1, figs 2–3; Dijkstra, 1991: 26; Dijkstra, 1995b: 53, figs 69–70; Dijkstra & Marshall, 1997: 88, pl. 8, figs 1–6; Dijkstra & Knudsen, 1998: 51, pl. 7, figs 31–32; Dijkstra, 2001: 91; Dijkstra & Kilburn, 2001: 269, figs 1–2; Raines & Poppe, 2006: 58–59, lower figs; pl. 2, fig. 1; Dijkstra & Maestrati, 2008: 105; Dijkstra & Maestrati, 2009: 44, pl. 4, figs 29–31; Dijkstra & Maestrati, 2010: 344; Dijkstra, 2013: 25, pl. 5, figs 2a–d; Dijkstra & Janssen, 2013: 202, figs 56–57.

**Type data.** Holotype (pr) MNHN Moll21162. Type locality: Philippine Islands, N of Lubang, 13°57'N 120°16.5'E, alive, 150–159 m (MUSORSTOM I stn 18).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: 18.5 ml E of North Reef, 23°11.5'S 152°14.5'E, dead, 188 m (1 v, C.165518 [in part]); Barwon Bank, 26°32'S 153°32'E, alive, 37 m (1 pr, C.165233). TASMAN SEA: Lord Howe Shelf, 31°44'S 159°04'E, dead, 117.5 m (1 v, C.461385 [in part]).

**Description.** Shell small, up to 6.1 mm high (Dijkstra & Kilburn, 2001), circular, hyaline or opaque, equivalve, equilateral, anterior auricle somewhat larger than posterior, umbonal angle c. 120°. Prodissoconch c. 200 µm in height. Whitish with a few white spots; external sculpture visible from interior.

Left valve with microscopic antimarginal striae and 14–20 delicate, unevenly spaced, scaly radial lirae commencing at c. 1 mm shell height, enlarging progressively. Commarginal growth lines fine, evenly spaced, somewhat crenulated. Scales broken on many specimens. Auricles continuous with disc and similarly sculptured. Dorsal margin straight.

Right valve sculpture similar to that of left valve, with slightly more prominent microscopic commarginal lirae on early disc, commencing at about 1.5 mm shell height. Anterior auricle with 4–5 antimarginal ridges and commarginal lamellae, the latter strongly developed at dorsal margin, separated from disc by distinct suture. Byssal fasciole and notch well-developed. Functional ctenolium with 2–3 teeth. Resilifer triangular.

**Habitat.** Living on the continental shelf and in the bathyal zone, attached amongst sponge or coral rubble on mud or sand.

**Distribution.** Red Sea, 121–350 m, dead (Dijkstra & Knudsen, 1998); South Africa, 70–305 m (Dijkstra & Kilburn, 2001); Taiwan, 234 m, dead (Dijkstra & Maestrati, 2009: 45); Philippine Islands, 150–159 m (Poutiers, 1981); Indonesia, 175–185 m (Dijkstra, 1991); New Caledonia, 250 m (Dijkstra, 1995b); Norfolk Island, 210 m, dead (Dijkstra & Marshall, 1997); Solomon Islands, 302–396 m, dead (Dijkstra & Maestrati, 2008); Austral Islands, 176–340 m,

dead (Dijkstra & Maestrati, 2010). Now also from Australia. Maximum depth range of live-taken specimens 37–305 m. Present specimen from Queensland taken alive at 37 m.

**Remarks.** *Delectopecten musorstomi* is significantly smaller (up to 5 mm in height) than *D. alcocki* (up to 19 mm in height) and *D. fosterianus* (up to 20 mm in height). Its sculpture differs mainly in having numerous prominent scaly radial riblets, which are lacking in *Delectopecten alcocki* and *D. fosterianus*.

*Delectopecten musorstomi* is a **new record** for Australia.

### Palliolinae Korobkov *in* Eberzin, 1960

**Diagnosis.** Pectinidae with an inner shell surface microstructure of irregularly foliated calcite, producing small reflective surfaces on the inner surface of well-preserved shells.

**Remarks.** This subfamily was defined for the first time by Waller (2006a: 10, fig. 1.2) for genera related to *Palliolium* and *Mesopeplum*. Based on morphology and time ranges, he proposed that *Palliolium* was the stem genus of both Palliolini and Mesopeplini, and evolved from the largely Mesozoic genus *Dhontichlamys* during late Paleocene time.

### Palliolini Korobkov *in* Eberzin, 1960

**Diagnosis.** Palliolinae with left valve pre-radial area of disc bearing antimarginal and commarginal microsculpture, highly reflective patches of uniformly oriented calcite laths outside the pallial line, a delicate ctenolium with closely spaced teeth, a moderately shallow byssal notch, and without internal rib carinae.

### *Palliolium* Monterosato, 1884

*Palliolium* Monterosato, 1884: 5. Type species (by subsequent designation, Crosse, 1885): *Pecten incomparabilis* Risso, 1826; Recent, Mediterranean and adjacent E Atlantic.

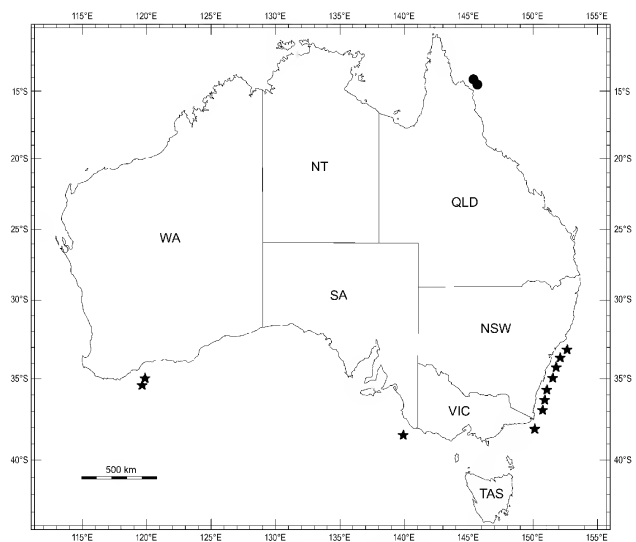
**Diagnosis.** Palliolini with prominent antimarginal microsculpture, radial macrosculpture almost absent, no shagreen microsculpture or commarginal macrosculpture, foliated calcite (uniformly oriented laths) outside pallial line, byssal notch and sinus shallow throughout ontogeny, a weak ctenolium with closely spaced teeth, and few, weakly developed hinge teeth.

**Distribution.** Paleocene–Recent (Waller, 2007: 17). Boreal Atlantic (Waller, 1991: 35) and southwestern Pacific, littoral to bathyal.

**Discussion.** So far the present species is the only living species of *Palliolium* from the Indo-West Pacific region. Representative genera of Palliolini, mainly fossil, were enumerated by Beu (1995) and Beu & Darragh (2001) from New Zealand and southern Australia, but Waller (2006a: 20) transferred all these to his new tribe Mesopeplini.

For phylogeny and stratigraphy see Waller (1991: 35; 1993: 198; 2006a: 17–21), Waller & Marincovich (1992: 219), Beu (1995: 19) and Beu & Darragh (2001: 154).

For comparison with *Delectopecten* see Dijkstra & Southgate (2000: 14).



**Figure 26.** Distribution of *Palliolium minutulum* Dijkstra & Southgate (circles) and *Pseudamussium challengerii* (Smith) (stars).

### *Palliolium minutulum* Dijkstra & Southgate, 2000

Figs 26, 27

*Palliolium minutulum* Dijkstra & Southgate, 2000: 13–18, figs 1–7; Raines & Poppe, 2006: 72–73, upper figs; pl. 5, figs 1–3; Dijkstra & Moolenbeek, 2008: 22; Huber, 2010: 212; Raines, 2010: 594, pl. 988, figs 3, 5–6; Dijkstra, 2013: 26, pl. 5, figs 3a–d.

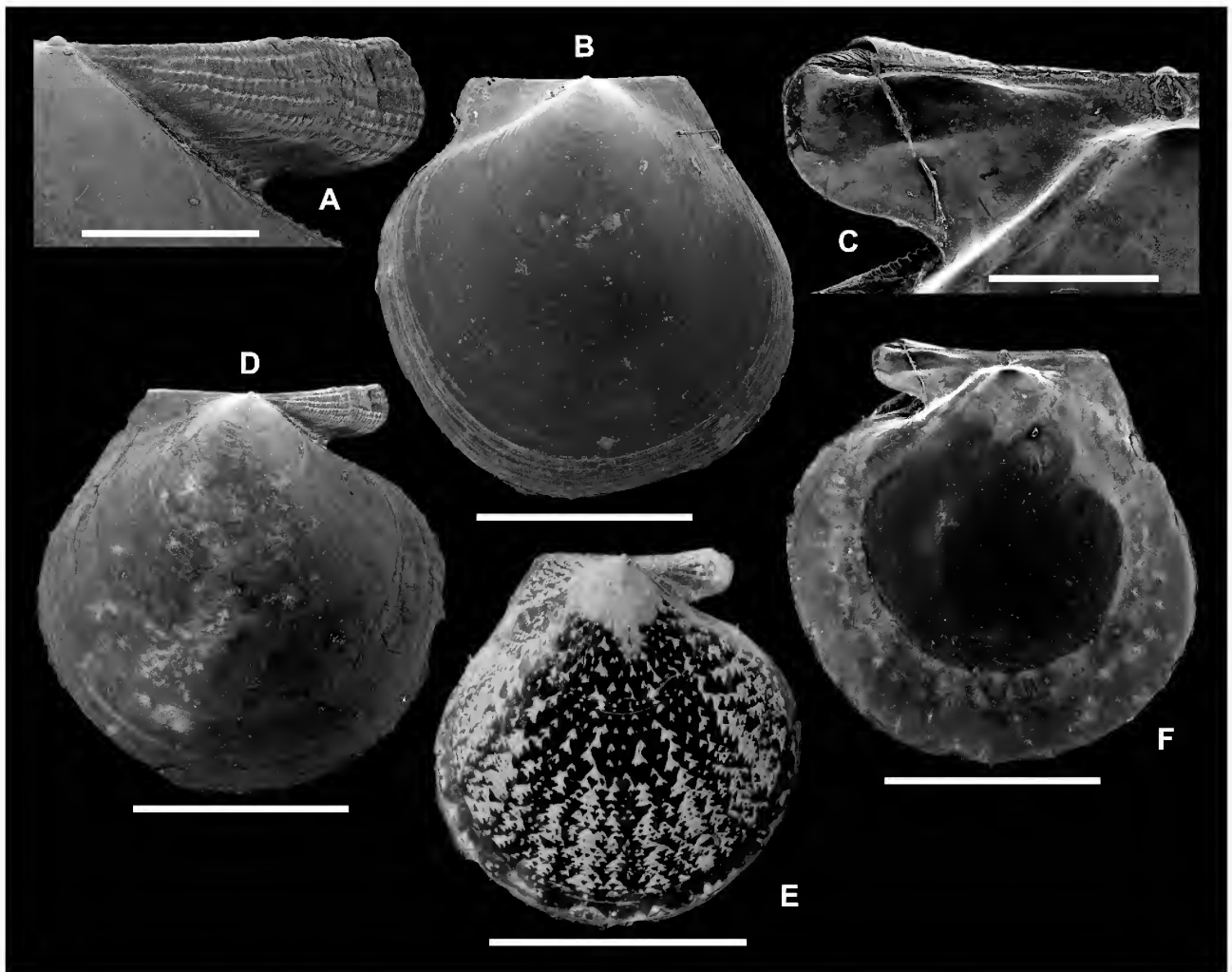
**Type data.** Holotype (pr) MNHN Moll21160, 6 paratypes (pr), 5 MNHN Moll21161, 1 ZMA Moll.400011. Type locality: New Caledonia, coral reef lagoon off Koumac, between mainland and Infernet reef, 20°34.4'S 164°13.0'E, alive, 12–14 m (MONTROUZIER stn 1299).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Lizard Island, Granite Head, 14°39'S 145°27'E, alive, 23 m (1 pr, C.165224); Endeavour Reef, 14°57'S 145°35'E, alive, 8–10 m (1 pr, C.165167 [in part]); off Townsville, Fantome Island, Juno Bay, live in sponges and algae on sandy rubble, 8–10 m, coll. P. Southgate, Mar 2002 (3 pr, GNS WM21249). —PHILIPPINE ISLANDS: Palawan, N of Fondedeo Island, 9°57'N 118°55'E, alive, 2–6 m (1 pr, C.167704). —PAPUA NEW GUINEA: Port Moresby, Horseshoe Reef, alive, 25 m (2 pr, ZMA Moll.146556). —SOLOMON ISLANDS: Furona Island, Santa Ysabel Island, alive, 2 m (1 pr, C.165229). —REP. OF KIRIBATI: off Taburao, in lagoon of Abaiang Atoll, alive, 6 m (2 pr, ZMA Moll.146479). —NEW CALEDONIA: Baie des Citrons, shallow water, dead (2 v, ZMA Moll.146530).

For more data see Dijkstra & Southgate (2000: 16).

**Description.** Shell up to c. 9 mm high, fragile, translucent, circular, almost equally convex and equilateral, auricles almost equal in size, umbonal angle about 90°; base colour highly variable, translucent white, cream, pink, reddish, or brownish, with white tent-shaped maculations.

Both valves smooth and glossy, with minute antimarginal scratches and commarginal growth lines. Auricles of left valve gradually merging into disc without demarcating disc flanks. Anterior auricle of right valve demarcated from disc flank, prominent, somewhat curved, with four unevenly spaced radial riblets bearing delicate gemmae where crossed by fine commarginal lirae. Posterior auricle of right valve not demarcated from disc flank. Dorsal margin almost straight, antero-dorsal margin slightly raised. Resilifer widely triangular. Byssal notch shallow, byssal fasciole rather broad, functional ctenolium well-developed with c. 10 small, oblique teeth. Hinge teeth lacking.



**Figure 27.** A–F, *Palliolium minutulum* Dijkstra & Southgate, 2 pairs, GNS WM21294, alive in sponges and algae on sandy rubble, 8–10 m, Juno Bay, Fantome Island, off Townsville, QLD, coll. P. Southgate; rv anterior auricle exterior (A), lv exterior (B), rv anterior auricle interior (C), rv exterior (D), rv exterior, light photo on black background showing colour pattern of translucent shell (E), rv interior (F). Scale bars represent 1 mm (A, C), 4 mm (B, D, F), 5 mm (E).

**Habitat.** Living in the littoral zone, generally amongst algae on varied substrata.

**Distribution.** Solomon Islands, northern Queensland, New Caledonia, Fiji and Kiribati, 6–16 m (Dijkstra & Southgate, 2000: 16); Indonesia, in littoral depths (Dijkstra & Moolenbeek, 2008: 22); Philippines, 2–100 m, and Papua New Guinea, 25 m (Poppe, 2010: 594; Raines, 2010: 594; Dijkstra, 2013: 27; present material); Philippines to Australia, 6–70 m (Huber, 2010: 212); Australia, Queensland, 25 m (Raines & Poppe, 2006: 73). Maximum depth range of living specimens 2–100 m. Present material from Australia alive at 8–23 m.

**Remarks.** It is possible that this recently discovered, tiny, alga-dwelling species has a much wider distribution throughout tropical northern Australia than present records indicate, as it is widely distributed throughout the Southwest Pacific. Most specimens are taken alive in algal washings or dead in shell grit.

### *Pseudamussium* Mörch, 1853

*Pseudamussium* Mörch, 1853: 59. Type species (ICZN Opinion 714, 1964): *Pecten septemradiatus* O. F. Müller, 1776 (= *Ostrea pestluræ* Linnaeus, 1771; Dijkstra, 1999: 427); Recent, eastern Atlantic.

**Diagnosis.** Palliolini with weakly inflated, fragile to sturdy, subcircular to circular shell, up to c. 50 mm in height; valves with plicae or costae, sculptured with delicate to rather prominent radial riblets and/or radial striae, and antimarginal microsculpture; left valve pre-radial microsculpture of fine, closely spaced commarginal lirae only. Auricles somewhat unequal in size. Byssal notch shallow, functional ctenolium weak (Dijkstra & Marshall, 2008: 70). Internal rib carinae lacking. Resilial teeth present, dorsal teeth weak or lacking, hinge surface with delicate, irregularly formed, transverse grooves.

**Distribution.** Miocene–Recent. Eastern Atlantic and southeastern Australia, sublittoral to bathyal.

***Pseudamussium challengerii* (E. A. Smith, 1891)**

Figs 26, 29A–B, 31A–B

*Pecten challengerii* Smith, 1891: 443, pl. 35, fig. 25.*Chlamys (Veprichlamys) challengerii* (Smith).—Iredale, 1929: 164; Rombouts, 1991: 34.*Chlamys (Chlamys) challengerii* (Smith).—Lamprell & Whitehead, 1992: [20], pl. 8, fig. 46.*Veprichlamys challengerii* (Smith).—Raines & Poppe, 2006: 248, 249, upper figs; pl. 197, fig. 4.*Pseudamussium challengerii* (Smith).—Dijkstra & Marshall, 2008: 70, figs 59A–F, 60; Spencer *et al.*, 2009: 198.

**Type data.** Lectotype (pr: H 19.0 mm, W 18.4 mm, D 4.6 mm) NHMUK1889.2.13.1, herein designated; paralectotype (rv) NHMUK1889.2.13.2. Type locality: off Sydney, 34°13'S 151°38'E, alive, 410 fathoms [750 m] (*Challenger* stn 164b).

**Additional material examined.**—AUSTRALIA: NEW SOUTH WALES: E of Cape Three Points, 33°28'–33°29'S 152°04'–152°03'E, dead, 457–476 m (1 v, C.155816); off Broken Bay, 33°32'–33°34'S 152°06'–152°05'E, dead, 823 m (1 v, C.123385); E of Broken Bay, 33°32'–33°38'S 152°0'–152°04'E, dead, 823 m (1 v, C.310689); off Broken Bay, 33°35'–33°33'S 152°0'–152°02'E, alive, 823 m (1 pr, C.343929); off Sydney, 33°42'–33°39'S 151°52'–151°54'E, dead, 457 m (2 v, C.155830); off Sydney, 34°05'S 151°43'E, dead, 750 m (1 v, C.339158); SE of Botany Bay, 34°21'–34°16'S 151°24'–151°28'E, dead, 421 m (2 v, C.102825); off Port Kembla, 34°39'–34°35'S 151°15'–151°17'E, dead, 466 m (1 v, C.140411; 1 v, C.140414); off Port Kembla, 34°42'–34°38'S 151°14'–151°18'E, alive, 498–521 m (1 pr, C.135831); off Nowra, 34°50'S 151°13'E, dead, 550 m (1 v, C.155801); off Shoalhaven Bight, 34°54'–34°50'S 151°14'–151°15'E, alive, 988–1006 m (1 pr, C.155803); E of Brush Island, 35°28'–35°33'S 150°50'–150°47'E, alive, 604 m (1 pr, C.155798); E of Ulladulla, 35°31'–35°36'S 150°47'–150°44'E, dead, 549 m (1 v, C.310687); off Brush Island, Batemans Bay, 35°36'–35°44'S 150°44'–150°38'E, dead, 549–586 m (1 v, C.310688); E of Brush Island, 35°44'–35°40'S 150°38'–150°41'E, dead, 549 m (1 pr, C.105420); E of Eden, 36°56'–36°58'S 150°20'E, dead, 274 m (2 v, C.155797); E of Eden, 36°59'–36°58'S 150°21'–150°22.7'E, dead, 716–900 m (1 v, C.310686). VICTORIA: SE of Gabo Island, 37°48'–37°37'S 150°13'–150°16'E, dead, 494 m (1 pr, C.134357). SOUTH AUSTRALIA: off Cape Martin, 38°07'S 140°0'E, dead, 667 m (1 v, C.339157). WESTERN AUSTRALIA: Albany, off Bald Island, 400–420 m, dead, trawled on sand and mud (2 v, HM); off Albany, 35°23'33"–35°24'04"S 118°18'32"–118°18'22"E, dead, 748–776 m (1 v, WAM S77661).

**Description.** Shell up to c. 25 mm high, thin, weakly inflated, somewhat prosocline, higher than wide, inequivalve, inequilateral, anterior auricles larger and longer than posterior, umbonal angle c. 100–105°; cream-brown, interior slightly darker, glossy.

Both valves sculptured with about 10 unevenly spaced, rounded, scaly, primary radial costae, commencing c. 2 mm below umbo, increasing by division into c. 20 (left valve) or 30 (right valve) scaly riblets near ventral margin; furrowing interior surface weakly, apart from short, prominent furrows around ventral margin; weak, irregular, commarginal growth costae and plicae also present. Pre-radial stage almost smooth; later with intercostal antimarginal microsculpture. Auricles with 4–6 scaly riblets, weak on posterior auricles, more prominent on anterior ones. Byssal notch rather deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–6 teeth. Hinge teeth weak.

**Dimensions.** Illustrated specimen: NSW, E of Brush Island, 604 m (AM C.155798): rv: H 18.4, L 17.5 mm; lv: H 18.1, L 17.0 mm; D 4.8 mm.

**Habitat.** Living in the bathyal zone on soft sediment, probably byssally attached to hard objects, as shown by its well-developed functional ctenolium. Present specimens alive at 498–1006 m.

**Distribution.** Australian temperate waters, from New South Wales (c. 33°S) to South Australia (c. 38°S); Tasman Sea

and New Zealand (Dijkstra & Marshall, 2008: 71–72, fig. 60), as far south as SW of Cape Foulwind, NW South Island (42°10.0'S 170°10.0'E, 610 m, 2 v, NMNZ M.05697).

**Remarks.** The South African species *Pseudamussium gilchristi* (G. B. Sowerby III, 1904) resembles *P. challengerii* in shape and colour, but lacks the intercostal antimarginal microsculpture, which is dominant in *P. challengerii*. The microsculpture of both *Pseudamussium challengerii* and *P. gilchristi* is extremely variable, ranging from the smooth undulated radial riblets characteristic of the New Zealand morph of *P. challengerii* to a more complicated sculpture of primary radial costae and secondary riblets, which are covered with spoon-shaped lamellae (Dijkstra & Marshall, 2008: 72).

Iredale (1929) and Rombouts (1991) referred *Pseudamussium challengerii* to *Veprichlamys* Iredale, 1929, presumably because the radial microsculpture is similar to that in *Veprichlamys*. However, the radial microsculpture is much more variable than in *Veprichlamys*, without the regular, even, narrow, widely spaced radial costae characteristic of *Veprichlamys*. This species more nearly resembles the type species of *Pseudamussium*, *P. peslutrae* (Linnaeus, 1771), in shape and convexity, in having weak radial sculpture, and in lacking commarginal microsculpture, at least in maturity (Dijkstra & Marshall, 2008: 72).

**Mesopeplini Waller, 2006**

**Diagnosis.** Palliolineae with radial costae clustered into broad radial plicae, posterior auricle with a distinctive posterior margin (at least in primitive members of the tribe), prominent widely spaced commarginal ridges in costal interspaces, with internal rib carinae in most taxa, and with byssal notch reduced in depth.

**Remarks.** Waller (2006a: 20–21) stated that the tribe Mesopeplini was established “to contain a phylogenetically closely knit group of five pallioline genera and one subgenus ... all of which are endemic to New Zealand and Australia ... : *Mesopeplum (Mesopeplum)* Iredale, 1929, ... *Mesopeplum (Borehamia)* Beu, 1978, ... *Sectipecten* Marwick, 1928, ... *Phialopecten* Marwick, 1928, ... *Kaparachlamys* Boreham, 1965, ... and *Towaipecten* Beu, 1995, ... Collectively, this group displays a higher level of variation in ribbing patterns and shell shapes than almost any other group of Pectinidae. What ties these genera together are demonstrations of morphological transitions in carefully collected stratigraphic sequences.” Waller (2006a) established the tribe in part because of their demonstrated phylogeny and geographical restriction, but also because they are the only Palliolineae with obvious commarginal ridges throughout ontogeny (limited to the early pre-radial disc in other Palliolineae), as well as the only Palliolineae that develop internal rib carinae. Further study of the New Zealand fossils has demonstrated that almost all of them develop internal rib carinae, including *Kaparachlamys* (which distinguishes it from the morphologically similar genus *Placopecten* Verrill, 1897). These genera were discussed by Beu (1995) and Beu & Darragh (2001).

Waller (2006a: 32) indicated that the relationship of *Mesopeplum* to the Palliolini needs to be re-evaluated,



implying that he thought it possible that Mesopeplini represents a subfamily separate from Pallioliinae. The molecular phylogeny by Sherratt *et al.* (2016: fig. 2) and Serb *et al.* (2017) placed *Mesopeplum* as almost the most basal of Pectinidae, separating Camptonectinae from Chlamydinae (i.e., Pedinae) plus Pectininae, and distinct from Pallioliinae. This needs confirmation from further comparisons. Only a single species of this tribe remains in Australia at present, along with one other living species in New Zealand, although *Mesopeplum* has a fossil record from Oligocene time onwards in Australia and from late Eocene time onwards in New Zealand. A further Australian fossil genus is possibly represented by *Mesopeplum*(?) *contrainflatum* Beu & Darragh (2001: 163, fig. 58A–D; late Miocene, eastern Victoria). A radiation of genera and species from *Mesopeplum* in New Zealand late Miocene–Pliocene rocks (the genera listed above, citing Waller) was described by Beu (1995).

### *Mesopeplum* Iredale, 1929

*Mesopeplum* Iredale, 1929: 162. Type species (by original designation): *Mesopeplum caroli* Iredale, 1929 (= *Chlamys fenestrata* Hedley, 1901); Recent, New South Wales, Australia.

*Dendopeecten* Hertlein, 1936: 26. Type species (by original designation): *Pecten dendyi* Hutton, 1902; early Pliocene, Momoe-a-toa Shellbed, Chatham Island, New Zealand.

**Diagnosis.** Mesopeplini with weakly subdivided radial plicae or costae on large radial plicae (five plicae in many species); left valve flat to weakly convex, right valve strongly convex; pre-radial dissoconch with reticulate commarginal and antimarginal microsculpture; radially sculptured area of disc with widely spaced commarginal lamellae; internal rib carinae prominent near ventral margin; resilial teeth prominent early in ontogeny but weak or absent in late ontogeny; ctenolium obsolete or almost so in late ontogeny in some species, functional in others.

**Distribution.** Late Eocene–Recent. New Zealand, temperate Western Australia, South Australia, Tasmania, New South Wales and southern Queensland, living in the littoral to bathyal zones on soft sediment.

For fossil records see Beu & Maxwell (1990), Beu (1995) and Beu & Darragh (2001). The holotype of *Mesopeplum polymorphoides* (Zittel, 1865) (Beu *et al.*, 2012: fig. 11B) from Glen Massey Formation at Waikato South Head, southwest Auckland, is early Whaingaroan in age, and so late Eocene (Priabonian). Also, a specimen of a typical *Mesopeplum* species collected by Prof. T. Kotaka from the Point Elizabeth section, north of Greymouth, Westland (IGPS96853) is Kaiatan or Runangan in age (Bartonian–Priabonian). *Mesopeplum* definitely occurs in late Eocene rocks in New Zealand, although suitable facies for it apparently are rare.

**Discussion.** Hertlein (1969, p. N366) treated *Mesopeplum* and its supposed junior synonym *Notochlamys* Cotton, 1930 as a subgenus of *Semipallium* Jousseaume in Lamy, 1928, placed in the *Decatopecten* group. Currently *Mesopeplum* and *Notochlamys* are considered to be valid genera (Waller, 1991) with different ancestries. *Mesopeplum* was placed in Mesopeplini by Waller (2006a) whereas *Notochlamys* is retained in Pedini.

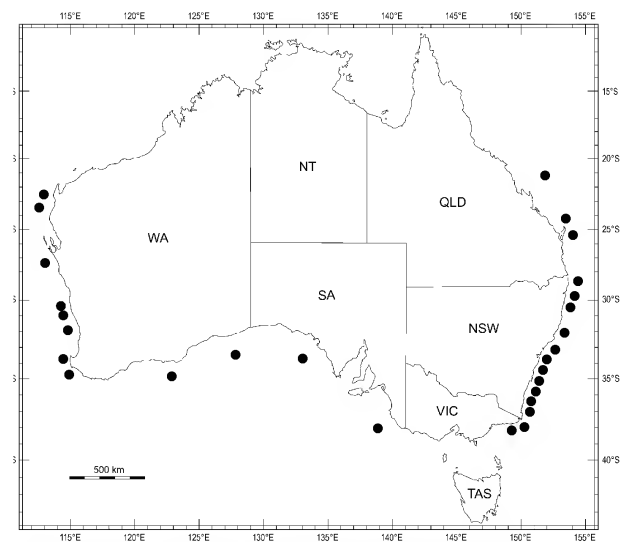


Figure 28. Distribution of *Mesopeplum fenestratum* (Hedley).

### *Mesopeplum fenestratum* (Hedley, 1901)

Figs 28, 29C–E, 31C–D

*Chlamys fenestrata* Hedley, 1901: 730, pl. 48, figs 17–19; Hedley, 1902: 307; Pritchard & Gatliff, 1904a: 265; Hedley, 1918a: M9; Iredale, 1924: 194.

*Chlamys hedleyi* Dautzenberg, 1902: 347 (unnecessary replacement name for *Chlamys fenestrata* Hedley, 1901, not preoccupied by *Pecten fenestratus* Forbes, 1844). See also Dijkstra (1998b: 248, 251).

*Mesopeplum caroli* Iredale, 1929: 162, pl. 38, figs 6–8; Allan, 1950: 281, pl. 37, fig. 4; Macpherson & Gabriel, 1962: 305, figs 346A–B; Iredale & McMichael, 1962: 11; Garrard, 1969: 11; Rombouts, 1991: 61, pl. 22, fig. 4; Waller, 1991: 30, pl. 3, figs 13, 17.

*Mesopeplum triggi* Cotton & Godfrey, 1938: 97, fig. 83; Cotton, 1961: 101, fig. 87; Rombouts, 1991: 61, pl. 28, fig. 5.

*Mesopeplum fenestratum* (Hedley).—Allan, 1950: 281; Iredale & McMichael, 1962: 11; Garrard, 1969: 5; Lamprell & Whitehead, 1992: [30], 173, pl. 13, fig. 78; Beu & Darragh, 2001: 171, figs 60F(?), 61A–I, 62A–H; Raines & Poppe, 2006: 84, 87, upper figs; pl. 23, figs 1–5; Huber, 2010: 212.

*Semipallium* (*Mesopeplum*) *caroli* (Iredale).—Hertlein, 1969: N366, figs C.88.3a–b. *Semipallium fenestratum* (Hedley).—Coleman, 1975: 280, fig. 770.

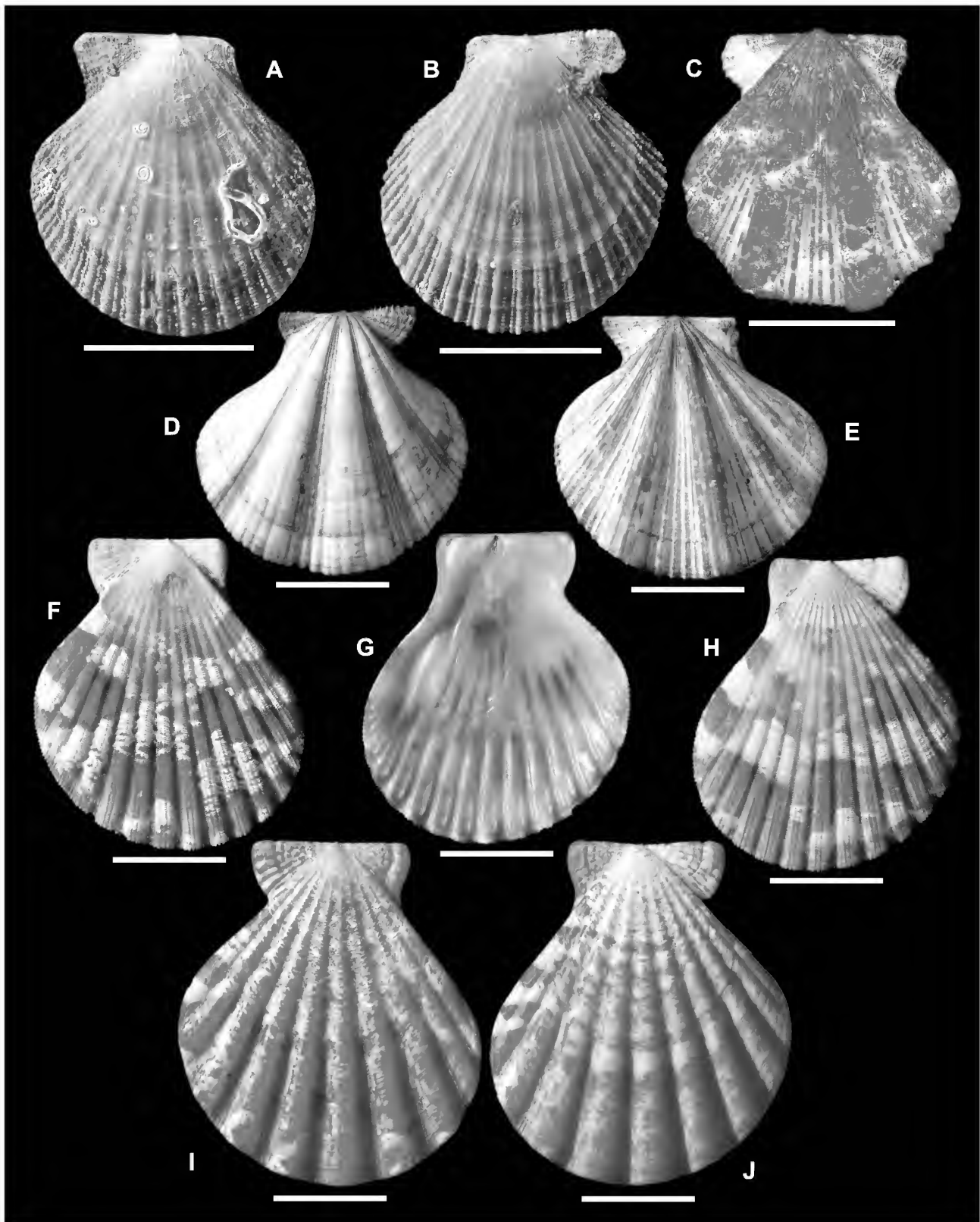
*Decatopecten caroli* (Iredale).—Wells & Bryce, 1985: 160, fig. 585.

*Mesopeplum convexum* (Quoy & Gaimard).—Lamprell & Whitehead, 1992: [30], 171, pl. 13, fig. 79 (misidentification).

**Type data.** *Chlamys fenestrata* Hedley: holotype (lv) AM C.008971 (Fig. 29C). Type locality: Australia, New South Wales, Sydney Harbour, off Ball's Head, 18 fathoms [33 m].

*Mesopeplum caroli* Iredale: holotype (pr) AM C.170894. Type locality: Australia, southern New South Wales, off Montague Island, 55–60 fathoms [101–110 m]. Despite being allocated a catalogue number, the holotype is not recognisable in the Australian Museum. The illustrated specimen, AM C.347523 (Figs 29D–E, 31C–D), from southern New South Wales, off Jervis Bay, 37–124 m, closely resembles Iredale's (1929: pl. 38, figs 6–8) illustration of the holotype, and is here designated the neotype of *Mesopeplum caroli* Iredale, 1929.





**Figure 29.** *A, B*, *Pseudamussium challengeri* (Smith), pair, AM C.155798, E of Brush Island, NSW, 35°28'–35°33'S 150°50'–150°47'E, 604 m, lv exterior (A), rv exterior (B). *C–E*, *Mesopeplum fenestratum* (Hedley), (C) immature lv exterior, holotype of *Chlamys fenestrata*, AM C.008971, lv, off Ball's Head, Sydney Harbour, NSW, 18 fathoms [33 m]; (D, E) neotype of *Mesopeplum caroli* Iredale, pair, AM C.347523, off Jarvis Bay, NSW, 35°05'S 150°45'E, 37–124 m, rv exterior (D), lv exterior (E). *F–H*, *Anguipecten picturatus* Dijkstra, pair, ZMA Moll.142043, Chesterfield Islands, Coral Sea, 19°12'S 158°50'E, 62 m; lv exterior (F), lv interior (G), rv exterior (H). *I, J*, *Anguipecten simoneae* Morrison & Whisson, paratype, pair, HM10773, near Mermaid Reef, Rowley Shoals, WA, 17°05'S 119°35'E, 100–150 m; lv exterior (I), rv exterior (J). Scale bars represent 10 mm (A–C, F–J), 20 mm (D, E).

*Mesopeplum triggi* Cotton & Godfrey: holotype (rv) SAMD13289, 3 paratypes (rv) SAMD15643. Type locality: Australia, SA, Great Australian Bight, 80 miles W of Eucla, 100 fathoms [183 m].

**Comments on type data.** Iredale's (1929) assertion that Hedley's species *Chlamys fenestrata* is based upon an adult specimen is incorrect. The holotype of *Chlamys fenestrata* is an immature specimen morphologically identical to adult specimens of *Mesopeplum caroli*.

Cotton & Godfrey (1938) introduced a species, *Mesopeplum triggi*, from the Great Australian Bight, which in their opinion is similar to the Miocene fossil species *Pecten polymorphoides* Zittel, 1865 (i.e., presumably intended for *Mesopeplum minimum* Beu & Darragh, 2001) and *M. incertum* (Tenison Woods, 1865), but which in our opinion is part of the variation of *M. fenestratum*. For comparison and discussion see Beu & Darragh (2001: 159; Beu *et al.*, 2012: 34). For comparison with *Mesopeplum convexum* see below.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Capricorn Channel, 22°30'S 152°0'E, dead (2 pr, C.303792); ESE of Noosa Heads, 26°34'S 153°40'E, dead, 128 m (3 v, C.096125); off Caloundra, 26°47'S 153°35'E, dead, 128 m (1 v, C.375126); E of Moreton Bay, 26°55'S 153°33'E, dead, 115–176 m (8 v, C.375129); NE of Cape Moreton, 26°55.5'S 153°33.5'E, dead, 115–124 m (7 v, C.375127); NE of Cape Moreton light, 26°55.5'S 153°33.5'E, dead, 115–119 m (11 v, C.375128); E of Cape Moreton, 27°0'S 153°36'E, dead, 128 m (5 v, C.097580); off Moreton Bay, 27°27.37'S 153°39'E, dead, 77 m (2 v, C.133546); off Moreton Bay, 27°31'S 153°40'E, dead, 75–80 m (9 v, C.095216). NEW SOUTH WALES: E of Tweed Heads, 28°11'–28°14'S 153°50'E, dead, 146 m (8 v, C.347730); E of Tweed Heads, 28°12'–28°19'S 153°50'E, dead, 152–155 m (1 v, C.116445); off Tweed Heads, 28°12'–28°14'S 153°50'–153°51'E, dead, 172 m (2 v, C.347731); off Danger Point, 28°13'–28°18'S 153°50'E, dead, 132–135 m (5 v, C.117875); E of Tweed Heads, 28°16'–28°12'S 153°50'–153°51'E, dead, 146 m (1 v, C.347729); off Tweed Heads, 28°17'S 153°44'E, dead, 73 m (14 v, C.117653); off Hastings Point, 28°20.4'S 153°47.1'E, dead, 82 m (1 v, C.096262); E of Tweed Heads, 28°21'–28°24'S 153°48'–153°49'E, dead, 165–174 m (1 v, C.347728); off Cape Byron, 28°43'–28°39'S 153°51'–153°50'E, dead, 128–139 m (2 v, C.116405); 18 km E of Ballina, 28°49.8'S 153°47.8'E, dead, 91 m (2 v, C.108688); N of Coffs Harbour, 29°40.3'S 153°30.4'E, dead, 71 m (1 v, C.347712); 14 km E of Coffs Harbour, 30°18.4'S 153°17.7'E, dead, 76 m (1 v, C.347726); off Coffs Harbour, 30°36'–30°39'S 153°19'–153°18'E, dead, 165 m (1 v, C.123477); off Manning River, 31°53'S 152°45'E, dead, 13.7–15.2 m (3 v, C.347722); S of Port Macquarie, 32°02'S 152°40'E, dead, 47 m (7 v, C.347725); NE of Port Stephens, 32°18'–32°12'S 152°43'E, dead, 91 m (9 v, C.347709); off Port Stephens, 32°26'S 152°41'E, dead, 100 m (2 v, C.347708); Broughton Island, 4.8 km offshore, 32°38'S 152°25'E, alive, 82–92 m (many, C.119746); off Broughton Island, 32°38'S 152°25'E, dead, 91 m (4 v, C.130897); Port Stephens, 32°42'S 152°05'E, dead (8 v, C.012049; 1 pr, C.097681); off Port Stephens, 32°42'S 152°15'E, dead, 35 m (2 v, C.097582); 8 ml [13 km] E of Port Stephens, 32°42'S 152°19'–152°20'E, dead, 101 m (1 v, C.100801); Nelson Bay, Port Stephens, 32°43.3'S 152°08.7'E, dead, 15 m (2 v, C.008972); off Broken Bay, 32°52'S 152°32'E, dead, 145 m (1 v, C.347653); off Newcastle, 32°58.8'S 152°41.6'E, dead, 951–1150 m (3 v, C.155844); off Norah Head, 33°17'S 151°39'E, alive, 46–55 m (1 pr, C.047898); off Tuggerah Lake, 33°20'S 151°39.4'E, dead, 60 m (2 v, C.130938); off Norah Head, 33°20'S 151°56'E, dead, 73–91 m (3 v, C.347651); 9–12 km NE of Cape Three Points, 33°32.5'–33°31.25'S 151°31.4'–151°34.9'E, dead, 75–91 m (1 pr + 2 v + fragm., C.013242); off Broken Bay, 33°34'S 151°30'E, dead, 82–137 m (2 v, C.070406; 3 v, C.347664); off Barrenjoey, Palm Beach, 33°35'S 151°35'E, dead, 110 m (2 pr, C.080113); off Sydney, 33°36'–33°37'S 151°30'–151°29'E, dead, 71–75 m (3 v, C.357996; 3 v, C.357996); 22 ml E of Narrabeen, N of Sydney, 33°42'S 151°43'E, dead, 146 m (2 v, C.026070); off Broken Bay, 33°43'–33°41'E 151°46'–151°43'E, dead, 170 m (5 v, C.347660); off Broken Bay, 33°43'S 151°40'E, dead, 143 m (10 v, C.347604); SE of Broken Bay, 33°43'–33°41'S 151°37'–151°39'E, dead, 139–146 m (2 v, C.082484); off Collaroy, 33°44'S 151°28'E, alive, 110 m (1 pr, C.077358); SW of Cape Naturaliste, 33°44.5'S 114°26.1'E, dead, 183–238 m (1 v, C.157642); Sydney N, Collaroy, E of Long Reef, 33°45'–33°43'S 151°30'–151°31'E, dead, 110–119 m (1 v, C.098764); off Sydney, 33°46'S 151°43'E, dead, 176 m (1 v, C.155808; 3 v, C.155828); 29 km off Manly & Sydney Heads, 33°48'–33°50'S 151°35'–151°36'E, dead, 137 m (1 v, C.117114); Sydney, 5.4 km E of North Head, 33°49.5'S 151°21.6'E, dead, 64–66 m (1 v, C.347797); Sydney, 5.6 km E of North Head, 33°49.5'S 151°21.8'E, dead, 66 m (1 v, C.347798); E of Port Jackson, 33°49.8'S 151°34'E, dead, 157–161 m, 1 v, dead (1 v, C.347618; 1 v, C.347620); off Sydney, 33°50'S 151°19'E, dead (1 v, C.347623); 5 ml off Sydney, 33°50'S 151°24'E, dead, 137 m (1 v, C.075954); off Port Jackson, 33°50'S 151°30'E, dead, 126–150 m (1 v, C.124113; 2 v, C.124117); E of Port Jackson, 33°50.8'S 151°32'E, dead, 135 m (2 v, C.124444); Sydney, Port Jackson, off Balls Head, 33°51'S 151°11.5'E, dead, 33 m (holotype) [v], C.029103); Sydney, 9 ml E of Coogee, 33°55.5'S 151°26.3'E, alive, 119 m (1 pr, C.347828); E of Coogee, 33°55.8'S 151°22.8'E, dead, 86–104 m (3 v, C.124125); Sydney, off Coogee, 33°56'S 151°17.3'E, dead, 60 m (2 v, C.347622); Sydney, off Coogee, 33°56'S 151°25'E, dead, 86 m (15 v, C.124256); 2.6 km E of Maroubra Beach, Sydney, 33°57.1'S 151°17.62'E, dead, 58 m (1 v, C.347801); Sydney, E of Malabar, 33°58'S 151°27'E, dead, 137 m (4 v, C.129072); off Sydney, 33°58'S 151°29'E, dead,

150 m (many v, C.129015); Sydney, 5.5 km E of Long Bay, 33°58.1'S 151°18.22'E, alive, 77 m (1 pr, C.347832); Sydney, E of Long Bay, 33°58.2'S 151°16.78'E, dead, 47 m (3 v, C.347802); Sydney, off Malabar, 33°58.17'S 151°17.17'E, dead, 67 m (1 v, C.347803); off Sydney, 33°59'S 151°17'–151°20'E, dead, 42–97 m (1 v, C.347791); Sydney, 2.3 km E of Malabar, 33°59.45'S 151°16.81'E, dead, 66–73 m (4 v, C.145003; 1 v, C.347608; 2 v, C.347610); Sydney, 2.3 km E of Malabar, 33°59.45'S 151°16.27'E, dead, 64 m (1 v, C.347800); E of Botany Bay, 34°0'–34°01'S 151°16'–151°17'E, dead, 73 m (1 v, C.347592); 13.7 km E of Cape Solander, 34°00.37'S 151°20.8'E, dead, 130–138 m (1 v, C.347598); 2.5–4 ml [4–6.4 km] off Botany Heads, 34°00.5'S 151°17.5'E, alive, 60–102 m (many, C.048076); E of Botany Bay, 34°00.9'S 151°20.1'E, dead, 104–110 m (3 v, C.124442); off entrance to Botany Bay, 34°01'S 151°16'E, dead, 60 m (1 v, C.124121); off Botany Bay, 34°01'S 151°19.8'E, alive, 91–101 m (1 pr, C.132127); Sydney, 10 km E of Cape Solander, 34°01.7'S 151°19.67'E, dead, 122 m (12 v, C.103634); 7 km E of Malabar, 34°02.25'S 151°18.92'E, dead, 70–130 m (1 pr, C.103637; 1 pr, C.347606); Sydney, off Cronulla, 34°03'S 151°12'E, dead, 64 m (4 pr, C.300341); Sydney, off Cronulla, 34°03'S 151°12.5'E, dead, 70–80 m (1 v, C.347571); NE of Port Hacking, 34°03'S 151°14.5'E, dead, 73 m (1 v, C.124252); off Sydney, 34°03'–33°52'S 151°37'–151°22'E, dead, 79–295 m (many v, C.347645); E of Port Hacking, 34°03.7'S 151°14.1'E, dead, 132 m (1 v, C.124448); off Cronulla, 34°04'S 151°14'E, dead, 40–100 m (7 v, C.081389; 6 v, C.121009; many v, C.347558); Sydney, off Cronulla, 34°04'S 151°15.5'E, dead, 100 m (1 v, C.347563); off Port Hacking, 34°04.8'S 151°25.2'E, dead, 145 m (2 v, C.097581); Port Hacking, off Jibbon, 34°05'S 151°13'E, dead, 85 m (many v, C.347584; 60–100 m, dead, 10 v, C.347585; 2 v, C.347586; 4 v, C.347587; 4 v, C.347589); off Port Hacking, 34°05'S 151°15'E, dead, 64 m (1 v, C.124255); off Wattamolla, 34°05'S 151°14.5'E, alive, 82 m (3 pr + 2 v, C.086740); off Botany to Wattamolla, 34°05'S 151°14.5'E, alive, 64 m (1 pr, C.111393); E of Botany Bay, 34°06'S 151°28'E, dead, 135–165 m, 2 v, dead (2 v, C.124173; 3 v, C.124183); SE of Cronulla, 34°07'–34°02'S 151°19'–151°21'E, dead, 130–134 m (1 v, C.347644); E of Wattamolla, 34°08'S 151°23.9'E, dead, 143 m (5 v, C.347535); E of Cronulla, 34°09.03'S 151°16.21'E, dead, 126–132 m (1 v, C.347561); off Stanwell Park, 34°13.8'S 151°07.8'E, alive, 91 m (3 pr + 6 v, C.063423); off Botany Bay, 34°19'–34°20'S 151°19'–151°18'E, dead, 161 m (6 v, C.123371); 10.75 ml SE of Bulli Point, 34°20'S 150°55.8'E, dead, 128 m (1 v, C.347540); off Port Kembla, 34°20'S 151°18'E, dead, 161 m (1 v, C.347528); 16 ml E of Wollongong, 34°25'S 151°15'E, dead, 183 m (4 v, C.017976); off Wollongong, 34°26.13'S 151°05'E, dead (1 v, C.074707); 5–8 ml off Port Kembla, 34°27.9'–34°30.4'S 151°04.5'–151°00.9'E, alive, 115–137 m (1 pr + 3 v, C.013202); off Shellharbour, 34°34'S 151°05'E, dead (2 v, C.347526); 4–4.8 km offshore in Shoalhaven Bight, 34°48.8'–34°52.1'S 151°49.1'–151°48.2'E, alive, 35–37 m (1 pr, C.013184); off Crookhaven, 34°55'S 150°54'E, alive, 55–64 m (2 v, C.089267; 1 pr + 1 v, C.119745); off Jervis Bay, 35°05'S 150°45'E, alive, 37–124 m (1 pr, C.347523); off Jervis Bay, 35°05'S 151°02.5'E, dead, 119 m (11 v, C.130896); off Wreck Bay, 35°11.8'S 150°38.2'E, alive, 27 m (3 pr, C.119744); off Ulladulla, 35°21'S 150°31.5'E, alive (3 pr + 2 v, C.130895); Ulladulla, 35°21.5'S 150°28.5'E, dead (1 v, C.073005); off Burrill Lake, S of Ulladulla, 35°22.5'S 150°26'E, alive (1 pr, C.132126); Broolee Beach, S of Batemans Bay, 35°51'S 150°10.5'E, dead (1 pr, C.347522); 11 km N of Montague Island, 36°08.8'S 150°13.1'E, alive, 90 m (16 v, C.097583); off Montague Island, 36°14.2'S 150°15'E, alive, 82–110 m (1 pr, C.130894); off Montague Island, 36°16.4'S 150°17'E, alive, 128 m (2 pr, C.347842); 10 ml N of Eden, 36°55'S 149°55'E, dead, 18–46 m (1 v, C.347525); Twofold Bay, Eden, 37°04'S 149°54.2'E, dead (1 v, C.347419); Twofold Bay, off Eden, 37°04.8'S 149°58.9'E, alive, 37–73 m (4 pr, C.130893); off Eden, 37°05'S 150°0'E, alive, 55–91 m (1 pr, C.130892; 1 pr, C.132125; 1 v, C.154255); off Green Cape, 37°16'S 150°13'E, alive, 91–128 m (2 pr, C.049895); S of Eden, 37°24'–37°19'S 150°17'–150°21'E, dead, 91–274 m (2 v, C.108311); 20 ml [32 km] SE of Twofold Bay, 37°26'S 150°15'E, dead, 149 m (2 v, C.346829). VICTORIA: off Twofold Bay, 37°40.5'S 150°04'E, alive, 71 m (1 pr, C.347481); off Lakes Entrance, 38°03'S 148°03.5'E, dead, 36–46 m (1 v, C.375124); Bass Strait, off Cape Everard, 38°07'S 149°17'E, dead, 128–146 m (1 v, C.300342); Bass Strait, 25 ml off Cape Everard, 38°22'S 149°13'E, dead, 132–146 m (1 v, C.375125). SOUTH AUSTRALIA: off Beachport, dead, 274 m (2 v, SAM D19025). WESTERNAUSTRALIA: Great Australian Bight, 50 ml SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (5 v, C.375120); Great Australian Bight, 33°20'S 128°45'E, dead, 140–147 m (3 v, C.375123); Great Australian Bight, 33°05'–33°20'S 128°40'–128°45'E, dead, 75–147 m (3 v, C.375122); Great Australian Bight, E of Hood Point, 34°25'S 121°20'E, dead, 158 m (13 v, C.124176); S of Cape Leeuwin, 34°25'–34°45'S 114°40'–115°0'E, dead, 73–144 m (1 v, C.375119); WSW of Cape Leeuwin, 34°25'S 114°36.5'E, dead, 142–146 m (3 v, WAM); off Cape Leeuwin, 34°14'S 114°27'E, dead, 116–190 m (1 v, WAM); NW Cape Freycinet, 33°57.2'S 114°30'E, dead, 153–160 m (1 v, WAM); 33°40'S 114°28'E, dead, 137 m (12 v, WAM); NW of Bunbury, 33°30'S 114°37'E, dead, 219–221 m (1 v, WAM); NW of Bunbury, 32°57.5'S 114°48'E, dead, 122–139 m (11 v, WAM); W of Garden Island, 32°19'S 115°07'E, dead, 148–154 m (5 v, WAM); W of Rottnest Island, 32°0'S 115°15'E, alive, 146–150 m (9 v, WAM); 1 pr + 5 v, WAM626-74; 6 v, WAM); W of Rottnest Island, 32°0'S 115°16'E, dead, 137–143 m (2 v, WAM); W of Rottnest Island, dead, 146–183 m (3 v, WAM; 2 v, WAM); 1 pr + 3 v, WAMI103-81; WNW of Rottnest Island, dead, 174–175 m (4 v, WAM N4256); NW of Rottnest Island, dead, 146–163 m (6 v, WAM N4416; 13 v, WAM N4347); W of Garden Island, 32°15.7'S 115°06.7'E, dead, 176–182 m (1 v, C.375121); W of Rottnest Island, 31°59'S 115°14'E, dead, 182 m (1 v, C.165588); W of Guilderton, 31°30'–31°34'S 114°56'–115°06'E, dead, 146 m (1 v [flat form], C.165584; 2 pr + many v, WAM); W of Guilderton, 31°45'S 115°06'E, dead, 106–110 m (7 v, WAM); W of Lancelin, 31°0'S 114°52'E, dead, 183 m (1 v, WAM); W of Lancelin, 31°0'S 114°52.5'E, dead, 146–150 m (3 v, WAM); NW of Green Island, 30°37'S 114°44'E, dead, 139–146 m (1 pr + 5 v, WAM); 30°34'S 114°44'E, dead, 128 m (1 pr + 3 v, WAM); 30°30'S 114°32'E, dead, 168–177 m (1 v, WAM); 30°21'S 114°38'E, dead, 165 m (4 v, WAM); 40 km W of Jurien Bay, 30°15.9'–30°16.5'S 114°38.6'–114°38.7'E, dead, 137.2 m (1 pr + 7 v, WAM); NW of Jurien Bay, 29°59'S 114°25'E, dead, 146–152 m (2 pr + 9 v, WAM); W of Dongara, 29°49'S 114°24'E, dead, 128–132 m (3 v, WAM); SW of Dongara, 29°49'S 114°24'E, alive, 128–132 m (13 v, WAM; 2 pr, WAM); NW of Beagle Island, 29°43'S 114°20'E, dead, 183 m (3 v, WAM); WSW of Dongara, 29°31'S 114°11'E, dead, 221–227 m (1 v,

WAM); W of Cliff Head, 29°31.7'–29°32.5'S 114°15.5'–114°16.2'E, dead, 145 m (3 v, WAM); W of Cliff Head, 29°28'–29°28.5'S 114°11'–114°11.2'E, dead, 183 m (2 v, WAM); W of Dongara, 29°15'S 114°01'E, dead, 139–146 m (1 pr + many v, WAM; many v, WAM); W of Dongara, 29°11'–29°12'S 113°52.2'–114°01'E, alive, 137 m (2 pr + many v, WAM; 3 v, WAM; 2 pr, WAM); W of Dongara, 29°08.5'–29°09'S 113°55.5'–113°56'E, alive, 165 m (many v, WAM; 2 pr, WAM); W of Dongara, 29°07.5'–29°08'S 113°57.4'–113°58'E, dead, 110 m (11 v, WAM); W of Dongara, 29°07.2'–29°08'S 113°56.4'–113°56.7'E, dead, 140.8 m (many v, WAM); SW of Geraldton, 29°05'S 113°56'E, dead, 99 m (14 v, WAM); SW of Bluff Point, 28°14'S 113°28'E, dead, 110 m (many v, WAM); NW of Bluff Point, 27°40'S 113°03'E, dead, 128 m (many v, WAM); Albrohlos, E of Zeeuyk Channel, dead, 110–146 m (13 v, WAM); W of Shoal Point, 27°59'S 113°21'E, dead, 110 m (1 v, WAM); W of Bluff Point, 27°40'S 113°20'E, dead, 131 m (5 v, WAM); NW of Bluff Point, 27°18'S 113°16'E, dead, 99 m (1 v, WAM); off Zuytdorp Cliffs, 27°0'S 113°0'E, dead, 146 m (1 v, WAM); NW of Carnarvon, 24°04'S 112°39'E, dead, 183 m (1 v, WAM); SW of Point Cloates, 23°39'S 113°11'E, dead, 137 m (1 v, WAM); SW of Point Cloates, 23°25'S 113°14'E, dead, 187 m (1 v, WAM).

**Description.** Shell up to c. 55 mm high, solid, moderately inflated, right valve slightly more convex than left, subcircular, weakly prosocline, inequivalve, inequilateral, auricles almost equal in size and shape, moderately small; umbonal angle c. 90°; left valve whitish, cream or brownish, with magenta near the umbo of both valves and magenta maculations on plicae and costae, particularly towards dorsal margin, right valve otherwise uniform white.

Left valve sculptured with 3 prominent primary radial plicae and one weaker at each end of disc, with interspaces each broader than one plica; entire surface bearing secondary radial riblets. Auricles with 3–5 radial riblets. Surface bearing delicate, widely spaced, commarginal lamellae throughout, particularly preserved in radial interspaces, more closely spaced on auricles.

Right valve with 4 broad, flatter radial plicae, more prominent on centre of disc than on ends, with narrower interspaces than on left valve. Secondary radial riblets and commarginal lamellae as on left valve, but radial riblets weaker on plicae. Anterior auricle with 4–6 riblets, weaker or lacking on posterior auricle. Dorsal margin straight. Byssal notch large in specimens up to 5 mm high, decreasing in size with growth, shallow by 15 mm high, very small in adults; functional ctenolium well-developed in juveniles, lacking in adults. Hinge teeth weak.

**Dimensions.** Illustrated specimen: NSW, off Jervis Bay, 37–124 m (AM C.347523): rv: H 47.4, L 49.6 mm; lv: H 46.9, L 48.8 mm; D 20.4 mm. Hedley (1901: 730) stated the dimensions of the holotype of *Chlamys fenestrata* as “height 20, length 20 mm”.

**Habitat.** Living free (not byssally attached to substrates) on the continental shelf and in the upper bathyal zone (in 27–256 m) amongst rubble on soft sediment (sand and mud).

**Distribution.** All around southern Australia from North West Cape, Western Australia (Well & Bryce, 1985: 160), Great Australian Bight, South Australia, Tasmania, Victoria, New South Wales, northwards to southern Queensland. Maximum depth range 73–256 m (Cotton, 1961: 102). Present material alive at 27–165 m.

**Remarks.** Specimens from southwestern Australia (*Mesopeplum triggi* morph) are somewhat atypical in having coarser secondary radial costae, but intermediates are also observed and other characters are identical to those of *M. fenestratum*. As also stated by Beu & Darragh (2001: 173) this form is part of the variation of *M. fenestratum*. Iredale (1924: 194) correctly pointed out that Dautzenberg's (1902: 347) replacement name *Chlamys hedleyi* for *Chlamys fenestrata* is unnecessary, as *C. fenestrata* Hedley is not a homonym of *Pecten fenestratus* Forbes, 1844.

*Mesopeplum convexum* from New Zealand differs from *M. fenestratum* in being larger, up to c. 70 mm high (*M. fenestratum* up to c. 55 mm), more variable in shape (more variable in prosocline shape and more variable in inflation), more variable in sculpture (number and prominence of plicae and prominence of secondary costae), much more variable in coloration, and in retaining a short functional ctenolium and moderately deep byssal notch in adults (see also Beu & Darragh, 2001: 173; Dijkstra & Marshall, 2008: 72, figs 61A–D, 62). Specimens of *Mesopeplum convexum* vary clinally, southern specimens reaching a larger size and tending to be more weakly inflated and more finely sculptured than northern ones. *Mesopeplum fenestratum* is extremely conservative in sculpture and coloration compared with *M. convexum*.

Reeve's (1853: pl. 22, fig. 84) illustration of *Pecten roseopunctatus* shows a species similar to *Mesopeplum fenestratum*, despite Cuming's incorrect locality, “Moluccas”. The colour pattern also is similar to that of immature specimens of the common SE Australian form of *M. fenestratum*. Unfortunately, there is no type material of *P. roseopunctatus* in NHMUK. Dijkstra & Marshall (2008: 73) listed this name as a synonym of *M. convexum*, despite the unusual colour pattern. The specimen illustrated by Reeve (1853: pl. 22, fig. 84) has unusually coarse radial sculpture and a very prominent commarginal growth step, and closely resembles some of the more coarsely sculptured New Zealand specimens of *M. convexum* in these characters. We regard it as a synonym of *M. convexum*. The specimen of *Mesopeplum convexum* illustrated by Dijkstra & Marshall (2008: fig. 61C, D) from Stewart Island (NMNZ M155905) is here designated the neotype of *Pecten roseopunctatus* Reeve, 1853, to attach this name permanently to *M. convexum* rather than replace the name *M. fenestratum*.

## Pectininae Rafinesque, 1815

**Diagnosis.** Pectinidae with generally strongly inflated right valve, flat or weakly concave left valve; radial ribs simple rounded or crenellated, non-branching; byssal notch shallow; ctenolium absent in late ontogeny.

## Decatopectinini Waller, 1986

**Diagnosis.** Pectininae with very closely spaced commarginal lamellae, delicate antimarginal microsculpture restricted to the pre-radial growth stage, absent from auricles and sides of disc; dentition with dorsal and/or intermediate teeth, the latter multiple or absent in some taxa, resiliar teeth weak or absent. Internal plicae carinate or with carinate edges of internal plicae near ventral margin.

**Discussion.** Waller (1986: 40) introduced a new tribe Decatopectinini with *Decatopecten* Sowerby II, 1839 as the type genus and included the following genera: *Anguipecten* Dall, Bartsch & Rehder, 1938, *Annachlamys* Iredale, 1939, *Fractechlamys* Iredale, 1939, *Excellichlamys* Iredale, 1939, *Flexopecten* Sacco, 1897, *Gloripallium* Iredale, 1939, *Juxtamusium* Iredale, 1939, *Mirapecten* Dall, Bartsch & Rehder, 1938, and *Somalipecten* Waller, 1986. Dijkstra (1991) later included a new genus *Glorichlamys*, Dijkstra & Kilburn (2001: 283) synonymized *Somalipecten* Waller, 1986 with *Mirapecten* Dall, Bartsch & Rehder, 1938, and

Waller (2006a: 27, fig. 1.3) transferred *Annachlamys* to tribe Pectinini and *Flexopecten* to tribe Aequipectinini. Waller (2011) added the new genus *Antillipecten* Waller, 2011 and transferred *Nodipecten* Dall, 1898 from Pectinini to Decatopectinini, although the latest molecular phylogeny by Serb (2016) included *Nodipecten* in Amusiini. As noted in the introduction, despite varying positions in recent molecular phylogenies, we retain *Annachlamys* in Pectinini here.

**Anguipecten**

**Dall, Bartsch & Rehder, 1938**

*Anguipecten* Dall, Bartsch & Rehder, 1938: 92. Type species (by original designation): *Anguipecten gregoryi* Dall, Bartsch & Rehder, 1938. Recent, Hawaiian Islands and New Caledonia.

**Diagnosis.** Subcircular to oblong Decatopectinini with 6–40 radial costae, laterally compressed, sculptured with delicate closely spaced commarginal lamellae; auricles unusually small, subequal to equal; byssal notch obsolete, no byssal fasciole, ctenolium weakly developed. Hinge teeth consisting of weak resilial and short prominent intermediate and dorsal teeth. Internal rib carinae well-developed.

**Distribution.** Miocene–Recent (Hayami, 1989: 15). Hertlein & Grant (1972: 205) recorded *Anguipecten* from the Miocene of New Caledonia, without citing a source; neither D. Jablonski (who pointed the record out to us) nor we have been able to substantiate this record. H. J. Campbell (GNS, Lower Hutt, pers. comm. Sept 2017) and New Caledonian colleagues are not aware of Miocene fossil scallops from New Caledonia. We are not aware of other fossil records of *Anguipecten*. Indo-West Pacific.

**Remarks.** Species of *Anguipecten* occur only in the (sub)tropical Indo-West Pacific. The following species are included: *Anguipecten superbus* (G. B. Sowerby II, 1842) known from southern Japan southwards to northern Australia and eastwards to the Solomon Islands; *Anguipecten gregoryi* Dall, Bartsch & Rehder, 1938 from the Hawaiian Islands; *Anguipecten lamberti* (Souverbie in Souverbie & Montrouzier, 1874) from New Caledonia; *Anguipecten picturatus* Dijkstra, 1995 (a replacement name for *Pecten aurantiacus* A. Adams & Reeve, 1850) from southern Japan southwards to northern Australia, westwards to northern Zululand (South Africa), and eastwards to the Solomon

Islands; *Anguipecten simoneae* Morrison & Whisson, 2009 from Rowley Shoals, northern Western Australia; and *Anguipecten pacificus* Dijkstra, 2002 from the Marquesas Islands (French Polynesia).

**Anguipecten picturatus Dijkstra, 1995**

Figs 29F–H, 30, 31E–F

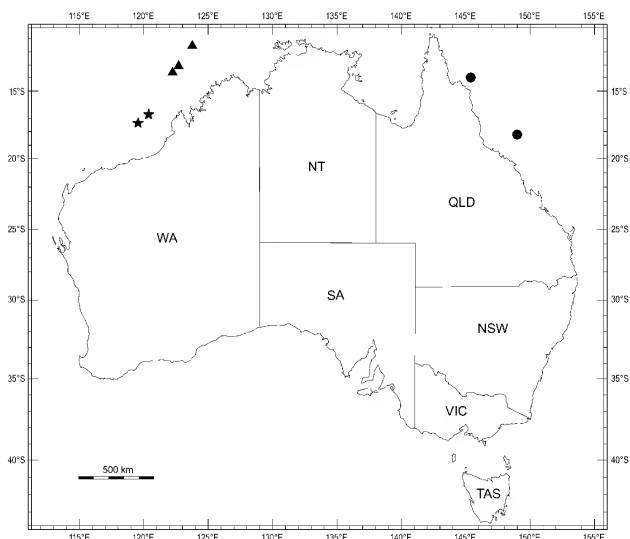
*Pecten aurantiacus* A. Adams & Reeve, 1850: 74, pl. 21, fig. 12 (junior homonym of *Pecten aurantiacus* of Röding, 1798, of J. Sowerby, 1820, and of DeFrance, 1825); Reeve, 1853: sp. 105, pl. 26, fig. 105; Küster & Kobelt, 1888: 171, pl. 47, fig. 7.  
*Gloripallium aurantiacum* (A. Adams & Reeve).—Masuda, 1962: 197.  
*Anguipecten lamberti* (Souverbie in Souverbie & Montrouzier).—Abbott & Dance, 1982: 312, unnumbered fig. (misidentification).  
*Anguipecten aurantiacus* (A. Adams & Reeve).—Dijkstra, 1991: 41; Dijkstra, (1983–1989) 1984: 9, figs; Dijkstra, (1983–1994) 1991: 18, figs; (1983–1994) 1992: 34; Dijkstra, Drivas & Jay, 1998: 4, fig. 1; Wang, 2002: 209, fig. 89.  
*Bractaechlamys* [sic] *aurantiaca* (A. Adams & Reeve).—Matsukuma *et al.*, 1991: 185, pl. 134, fig. 4.  
*Decadopecten (Anguipecten) aurantiacus* (A. Adams & Reeve).—Rombouts, 1991: 38, pl. 13, fig. 12.  
*Bractechlamys aurantiaca* (A. Adams & Reeve).—Bernard *et al.*, 1993: 50; Lan, 1993: 161, fig.; Higo *et al.*, 1999: 444; Higo *et al.*, 2001: 156, fig. B462 (holotype).  
*Anguipecten picturatus* Dijkstra, 1995a: 15–19 (replacement name for *P. aurantiacus* A. Adams & Reeve); Dijkstra, 1998a: 14, pl. 2, fig. 1; Dijkstra, 1998b: 250; Hayami, 2000: 903, pl. 449, fig. 29; Dijkstra, 2002: 140, fig. 8; Raines & Poppe, 2006: 89–90, pl. 24, figs 1–3, 5–7; Dijkstra & Maestrati, 2010: 352, fig. 5C; Huber, 2010: 198; Raines, 2010: 596, pl. 989, figs 1–3; Dijkstra, 2013: 33, pl. 7, figs 2a–d, pl. 9, figs 1a–b, pl. 26, figs 1a–b.

**Type data.** Holotype (pr) NHMUK1950.11.14.8; Type locality: “China Sea” [= South China Sea].

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Lizard Island, lagoon, 14°66'S 145°47'E, dead (1 v, ZMA Moll.142047); Townsville, Helix Reef, 18°19'S 149°51'E, alive, 15 m (pr [photo T.C. Good], AM). —REUNION: off west coast, alive, c. 50 m (1 pr, ZMA Moll.142042). —THAILAND: Ko Raya Ya, 7°36'N 98°22'E, alive, 30 m (1 pr, ZMA Moll.143683). —JAPAN: Okinawa, Seragaki, alive, 40–50 m (3 pr, ZMA Moll.141402); Okinawa, off Bolo Point, alive, 40–45

**Key to species of *Anguipecten* from Australia**

- 1 Shell c. 50 mm high, lv flat and rv weakly inflated, auricles short and almost equal, 12–14 primary radial plicae, secondary radial riblets on ribs and interstices, byssal notch shallow, byssal fascioli lacking, ctenolium weakly developed ..... *A. picturatus*
- Shell with 8 primary radial plicae ..... 2
- 2 Shell c. 37 mm high, lv flat and rv weakly inflated, auricles almost equal, 8 primary radial plicae, secondary radial riblets in late growth stage on lirae and interstices, byssal notch distinct, byssal fasciole weak, ctenolium rudimentary ..... *A. simoneae*
- Shell with 20–25 primary radial plicae ..... 3
- 3 Shell c. 70 mm high, valves weakly inflated, auricles short and almost equal, 20–25 obsolete primary radial plicae, byssal notch and byssal fasciole almost lacking in adult stage, ctenolium rudimentary ..... *A. superbus*



**Figure 30.** Distribution of *Anguipecten picturatus* Dijkstra (circles), *A. simoneae* Morrison & Whisson (stars) and *A. superbus* (G. B. Sowerby II) (triangles).

m (2 pr, ZMA Moll.141494). —PHILIPPINE ISLANDS: Cebu, Punta Engano, tangle net, alive, c. 90 m (2 pr, ZMA Moll.142044). —INDONESIA: NW Irian Jaya, Sorong, N side of Batauta, dead, 37 m (1 v, ZMA Moll.146414). —PAPUA NEW GUINEA: Laing Island, alive, c. 40 m (1 pr, ZMA Moll.145646). —SOLOMON ISLANDS: W Honiara, alive, 20–35 m (1 pr, ZMA Moll.142851). CORAL SEA: Chesterfield Islands, 19°12'S 158°50'E, dead, 62 m (1 pr, ZMA Moll.142043). —NEW CALEDONIA: Koumac, 20°40.7'S 164°14.7'E, alive, 66–87 m (1 pr, ZMA Moll.139691). —FIJI ISLANDS: Viti Levu, Beqa Island, alive, 27 m (1 pr, ZMA Moll.142048).

**Description.** Shell up to c. 50 mm high, most specimens smaller; solid, somewhat triangularly elongate, posterior margin longer than anterior, left valve almost flat, right valve weakly convex, slightly inequivalve and inequilateral, auricles short and almost equal in size, umbonal angle 80–85°; cream, maculated with orange or red dots and streaks, right valve paler and more uniform in colour than left.

Both valves sculptured with 12–14 primary radial costae and secondary radial riblets, riblets somewhat more prominent on costae than in interstices. Microsculpture of closely spaced commarginal lamellae. Auricles weakly sculptured with radial riblets near disc flank, sculpture of anterior auricle of right valve most prominent. Dorsal margin straight, somewhat raised on right valve. Inner surface plicated, internal rib carinae present near margin. Adductor scar insertion prominent. Resilifer narrowly triangular, resilial teeth weak, intermediate teeth strongly developed. Byssal notch shallow, byssal fasciole absent; functional ctenolium weak, with 3 teeth.

**Dimensions.** Illustrated specimen: Coral Sea, Chesterfield Islands, 19°12'S 158°50'E, dead, 62 m, pr (ZMA Moll. 142043): H 27.3, L 23.6, D 7.2 mm.

**Habitat.** Living in the subtidal to sublittoral zones under coral slabs or boulders or amongst coral rubble on soft sediment (sand). The maximum depth range is intertidal zone to 90 m. Present material from Queensland alive at 15 m.

**Distribution.** Indo-West Pacific, from southern Japan to northern Australia, westwards to the east coast of Africa and eastwards to Fiji; Okinawa (Japan) southwards to tropical West Pacific, 10–50 m (Hayami, 2000: 903); Taiwan, South China Sea, intertidal zone to 25 m (Bernard *et al.*, 1993: 50); Philippines, 25–90 m (Raines, 2010; Dijkstra, 2013: 33);

Indonesia, 59–275 m, dead (Dijkstra, 1991: 41); Zululand (South Africa), 100 m, dead (Dijkstra & Kilburn, 2001: 273); Austral Islands, 558–1000 m, dead (Dijkstra & Maestrati, 2010: 352). The specimen recorded at a bathyal depth from the Austral Islands is possibly the result of post-mortem down-slope transport.

*Anguipecten picturatus* is a **new record** for Australia, so far known only from Queensland.

*Anguipecten simoneae*  
Morrison & Whisson, 2009

Figs 29I–J, 30, 31G–H

*Anguipecten simoneae* Morrison & Whisson, 2009: 45–51, figs 1–22 (figs 2–9, holotype).

**Type data.** Holotype (pr) WAM S42740; Type locality: Western Australia, near Imperieuse Reef, southernmost atoll of Rowley Shoals, 17°35'42.35"–17°35'20.75"S 118°58'54.12"–118°58'47.64"E, 108–140 m, alive, dredged.

**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: near Mermaid Reef, northernmost atoll of Rowley Shoals, 17°05'S 119°35'E, dead, 100–150 m (1 pr, HM10773; 1 lv, MNHN22277; 1 lv, ZMA Moll.409015; 1 rv, HM10774; 1 rv, NTM P43650; 1 rv, WAM S43262; 1 rv, HM10775; 1 rv, RGF; 1 rv, HM10776); near Imperieuse Reef, southernmost atoll of Rowley Shoals, alive, 108–140 m (1 pr, WAM S42741). All additional material examined consists of paratypes.

**Description.** Shell up to 37 mm high; solid, compressed, oblong, somewhat triangularly elongate, left valve almost flat, right valve slightly more convex than left valve, nearly equivalve and equilateral, anterior auricles somewhat larger in size and shape than posterior auricles, umbonal angle c. 75°; cream with interrupted angular bands of orange to orange-red, right valve paler.

Both valves sculptured with 8 primary radial plicae, and a few weaker plicae laterally. Plicae narrower than interstices dorsally, widening down disc to equal width of interspaces ventrally. Secondary radial sculpture of obsolete radial riblets on plicae and in interstices. Sculpture of right valve somewhat weaker than left. Microsculpture of closely spaced commarginal lamellae. Anterior auricles sculptured with 5–6 distinct radial riblets, posterior auricles with 3–4 weaker radial riblets and 2–3 prominent folds. Dorsal margin straight, somewhat raised on right valve. Inner surface plicated, short internal rib carinae present near margin. Adductor scar insertion prominent. Resilifer narrowly triangular, resilial teeth weak, intermediate teeth strongly developed. Byssal notch distinct, byssal fasciole weak; functional ctenolium rudimentary, with 3–4 teeth.

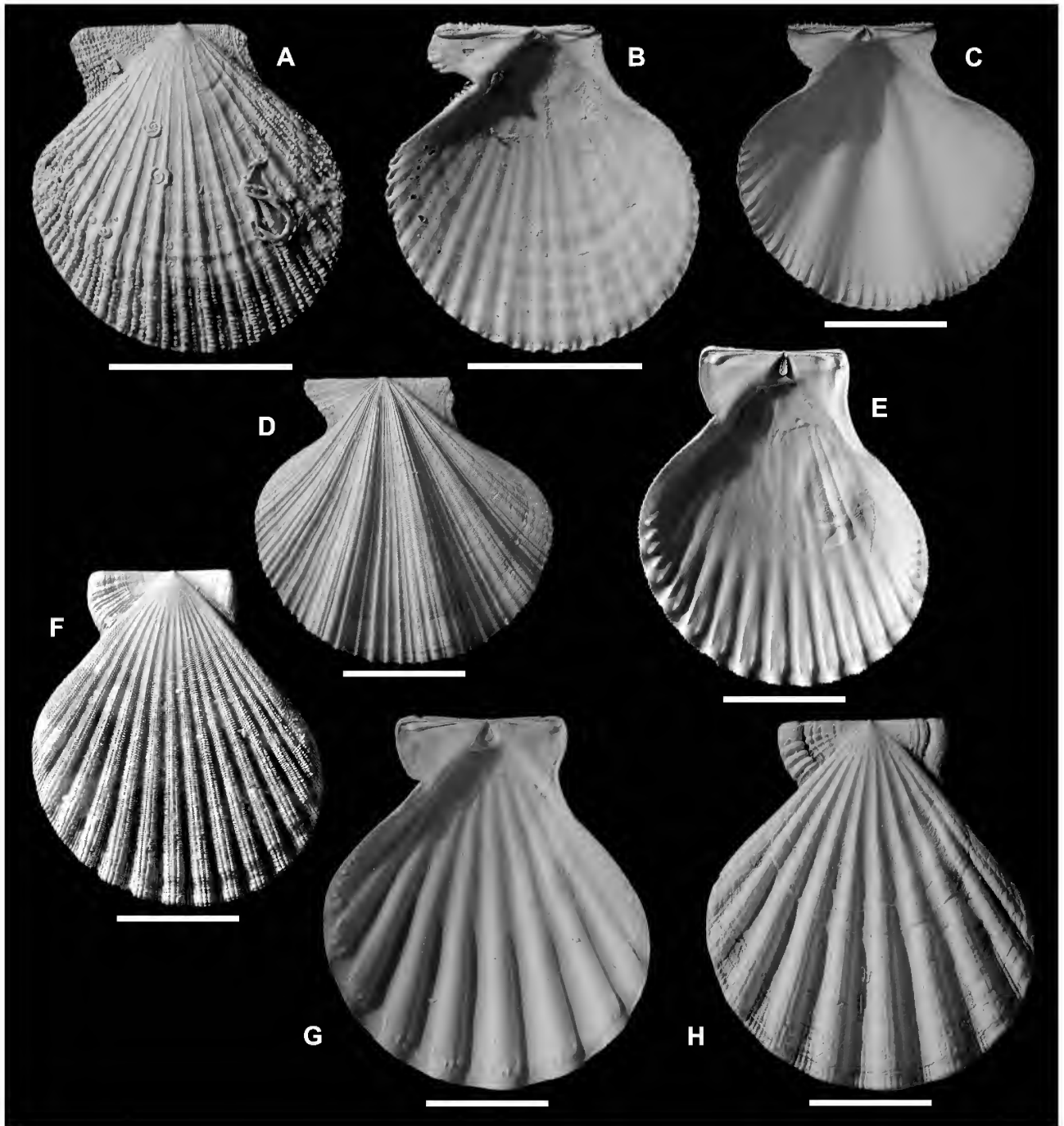
**Dimensions.** Illustrated paratype: 100–150 m, off Mermaid Reef, Rowley Shoals, WA (HM10773): H 30.5, L 26.8 mm.

**Habitat.** Living on the outer continental shelf, probably on coarse sand, shell grit and fine rubble, similar to the other species of *Anguipecten*.

**Distribution.** So far only known from the Rowley Shoals off northern Western Australia. Present material alive at 108–140 m. Specimens from the Kai Islands, Indonesia, possibly also belong here (see below).

**Remarks.** The present species is morphologically close to *Anguipecten pacificus* Dijkstra, 2002, known from the Marquesas Islands, French Polynesia, but differs in size





**Figure 31.** *A, B*, *Pseudamussium challengeri* (Smith), pair, specimen in Fig. 29A, B, lv exterior (A), rv interior (B). *C, D*, *Mesopeplum fenestratum* (Hedley), neotype of *Mesopeplum caroli* Iredale, specimen in Fig. 29D, E, rv interior (C), lv exterior (D). *E, F*, *Anguipecten picturatus* Dijkstra, pair, specimen in Fig. 29F–H, rv interior (E), lv exterior (F). *G, H*, *Anguipecten simoneae* Morrison & Whisson, paratype, pair, specimen in Fig. 29I, J, rv interior (G), lv exterior (H). Scale bars represent 10 mm (A, B, E–H), 20 mm (C, D).

(*A. simoneae* up to 37 mm in height, *A. pacificus* up to 60 mm), in having more numerous radial plicae (*A. simoneae* 8, *A. pacificus* 6–7), and in having a byssal notch, byssal fasciole and active ctenolium, features that are lacking in adult specimens of *A. pacificus*.

Dijkstra (2002: 139–140) identified four specimens from the Kai Islands, eastern Indonesia (Morrison & Whisson, 2009: 48, fig. 11a–b, as *Anguipecten* sp.) as atypical specimens of *A. pacificus*. In fact these specimens are closer to *Anguipecten simoneae* than to *A. pacificus* and provisionally are determined as *A. simoneae*.

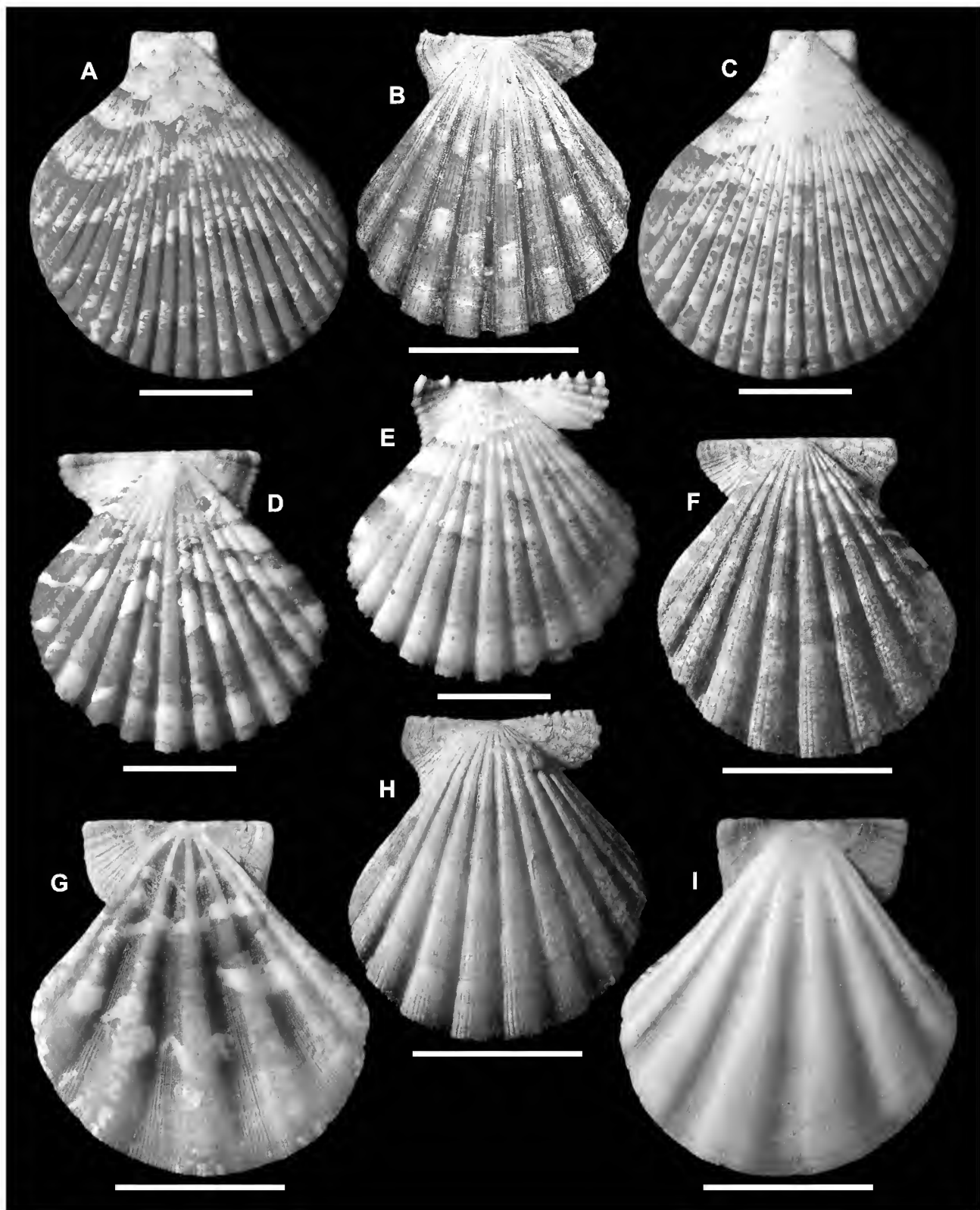
### *Anguipecten superbus* (G. B. Sowerby II, 1842)

Figs 30, 32A,C, 34A,C

*Pecten superbus* G. B. Sowerby II, 1842: 62, pl. 12, fig. 11; Reeve, 1853: sp. 107, pl. 26, fig. 107.

*Anguipecten superbus* (Sowerby).—Koyama *et al.*, 1981: 69, pl. 1, fig. 3; Abbott & Dance, 1982: 312, fig.; Dijkstra, (1983–1989) 1984: 8, figs; Springsteen & Leobrera, 1986, 328, pl. 93, fig. 8; Bernard *et al.*, 1993: 51 [in part]; Dijkstra, 1998a: 15, pl. 2, figs 2–3; Hayami, 2000: 903, pl. 449, fig. 31; Dijkstra, 2002: 140, fig. 9; Wang,





**Figure 32.** *A, C*, *Anguipecten superbus* (G. B. Sowerby II), pair, HM, N side of Ashmore Reef, WA, 12°17'S 123°02'E, 34 m, lv exterior (A), rv exterior (C). *B, F, H*, *Bracteochlamys vexillum* (Reeve), (B) rv of pair, holotype of *Bracteochlamys evecta* Iredale, AM C.075283, Great Barrier Reef Exped. stn 14, 0.5 ml SE of Lizard Island, GBR, 19 fathoms [35 m], (F, H) pair, AM C.119718, 0.8 km N of Eagle Isle, GBR, QLD, 18 m; rv exteriors (B, H), lv exterior (F). *D, E*, *Bracteochlamys oweni* (Gregorio), pair, HM, off Hibernia Reef, WA, 30–35 m; lv exterior (D), rv exterior (E). *G, I*, *Decatopecten strangei* (Reeve), pair, AM C.097573, Dundowran Beach, Hervey Bay, QLD; lv exterior (G), rv exterior (I). Scale bars represent 20 mm (A–C, F–I), 10 mm (D, E).

2002: 206, fig. 87; Raines & Poppe, 2006: 90–91, pl. 25, figs 1–5; Xu & Zhang, 2008: 85, fig. 235; Dijkstra & Maestrati, 2010: 352, fig. 5D; Huber, 2010: 198; Raines, 2010: 596, pl. 989, figs 4–6; Dijkstra, 2013: 34, pl. 7, figs 3a–d, pl. 9, figs 2a–b.

*Decatopecten (Anguipecten) superbus* (Sowerby).—Rombouts, 1991: 38, pl. 14, figs 2–2a.

**Type data.** Lectotype (largest pr) NHMUK1950.11.14.78, herein designated; possible paralectotype (pr) NHMUK 1950.11.14.79. Type locality: Not mentioned.

**Comments on type data.** The type lot consists of two selected articulated specimens with the registered numbers NHMUK1950.11.14.78–79. However, Sowerby (1842, p. 62) recorded in his original description: “We have only seen one specimen of this magnificent shell which is in the collection of Mr. Cuming.” The designated lectotype is closest to the measurements mentioned by Sowerby: “Long. 2.40; lat. 0.65; alt. 2.60 poll.” [= width 60.89 mm, thickness 16.49 mm, height 65.96 mm] and to Reeve’s (1853: pl. 26, fig. 107) figure. Although no type locality was indicated by Sowerby, “Amboina” [= Ambon, Indonesia] is written on labels of the type lot.

**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: Scott Reef, N entrance, approx. 14°0'S 121°45'E, dead, 42 m (1 v, WAM); Scott Reef, NE corner, approx. 14°0'S 121°45'E, dead, 28–30 m (2 v, WAM); Scott Reef, SE corner, approx. 14°0'S 121°45'E, dead, 32 m (1 v, WAM); Seringapatam Reef, NE corner, approx. 13°40'S 121°59'E, dead, 28 m (1 pr, WAM); Ashmore Reef, N side, 12°17'S 123°02'E, alive, 34 m (1 pr, HM). —JAPAN: Okinawa, Seragaki, alive, 40–55 m (5 pr, ZMA Moll.142853). —PHILIPPINE ISLANDS: Cebu, alive, 40 m (1 pr, WAM). —MALAYSIA: Malacca Strait, alive, 66 m (1 pr, ZMA Moll.142854). —PAPUA NEW GUINEA: Hansa Bay, Laing Island, alive (1 pr, ZMA Moll.145641). —SOLOMON ISLANDS: Guadalcanal, W Honoraria, alive, 30–35 m (2 pr, ZMA Moll.144005); Russell Group, Mbanika Island, Yandina, alive, 55 m (1 pr, ZMA Moll.142852). —MARSHALL ISLANDS: Kwajalein Atoll, Kwajalein Island, ocean side of reef, dead, 30 m (1 v, ZMA Moll.144023).

**Description.** Shell up to c. 70 mm high, most specimens smaller; solid, somewhat triangularly oblong, weakly inflated, posterior margin longer than anterior, left and right valves almost equally convex, slightly inequivalve and somewhat inequilateral, auricles very short and almost equal in size, umbonal angle 85–90°; cream maculated with dots and streaks (cream, orange, red or brown), right valve paler and more uniform than left.

Both valves sculptured with 20–25 evenly spaced radial costae, with only a few secondary radial riblets on anterior and posterior ends. Microsculpture of very closely spaced commarginal lamellae. Auricles almost smooth, anterior auricle of right valve weakly sculptured with radial riblets. Dorsal margin straight. Inner surface plicated, with weak internal rib carinae near margin. Adductor scar insertion prominent. Resilifer narrowly triangular, with sides erect. Resilial teeth weak, intermediate teeth well-developed. Byssal notch shallow in juveniles, almost absent in adults, byssal fasciole absent. Weak functional ctenolium with 1–3 teeth in juveniles, absent from adults.

**Dimensions.** Illustrated specimen: WA, S side Hibernia Reef, N of Ashmore Reef, 30–35 m (HM): H 61.5, L 56.4 mm.

**Habitat.** Living in the littoral zone and on the continental shelf, under coral slabs or boulders or amongst coral rubble on soft sediment (sand).

**Distribution.** Indo-West Pacific, from southern Japan southwards to northern Australia, and eastwards to the Marshall and Solomon Islands; Amami Islands, southwards to tropical West Pacific, 10–30 m (Hayami, 2000: 903); Philippines, 10–30 m (alive), 80–120 m (dead) (Raines, 2010: 596; Dijkstra, 2013: 34), Camotes Sea, “deep water” (Springsteen & Leobrera, 1986: 328), Calituban Island, Aliguay Island, Olango Island, 10–30 m (Raines, 2010); East and South China Sea, Borneo, Indian Ocean, intertidal–50 m (Bernard *et al.*, 1993: 51, in part); Japan and SW Pacific, 10–80 m (Abbott & Dance, 1982: 312); Japan, Okinawa to Australia, 10–130 m (Huber, 2010: 198); Papua New Guinea (Rombouts, 1991: 38); Austral Islands, 90–120 m (Dijkstra & Maestrati, 2010: 352); South Africa, Zululand, 100 m, dead (Dijkstra & Kilburn, 2001: 273). Maximum depth range is intertidal to 165 m (HHD, unpublished data).

**Remarks.** *Anguipecten superbus* is a **new record** for Australia, so far only collected alive from coral reefs (southern Timor Sea) outside the continental waters of northern Western Australia. Huber (2010: 198) also recorded specimens from “Australia”, but he did not specify the locality. Specimens from that region differ slightly from the lectotype in having one or two more radial costae, but the other characters are identical.

### *Bractechlamys* Iredale, 1939

*Bractechlamys* Iredale, 1939: 366. Type species (by original designation): *Bractechlamys evecta* Iredale, 1939 (= *Pecten vexillum* Reeve, 1853). Recent, 0.5 ml SE of Lizard Island, QLD, 19 fathoms [35 m]; widespread in tropical western Pacific.

**Diagnosis.** Decatopectinini with 8–15 primary radial plicae, some species with nodules on plicae; with secondary radial riblets; shape oblong to subcircular; with prominent intermediate teeth, a relatively deep byssal notch, prominent costae on auricles, and an obsolete ctenolium.

**Distribution.** Recent. Tropical Indo-West Pacific and eastern Atlantic, living in the littoral to sublittoral zones amongst coral rubble on soft sediment.

**Discussion.** Grau (1959: 120) and subsequently Hertlein (1969: N366) treated *Bractechlamys*, together with *Comptopallium* Iredale, 1939 and *Complicachlamys* Iredale, 1939, as junior synonyms of *Semipallium* Jousseaume *in* Lamy, 1928 in the *Decatopecten* group. Waller (1972a: 245) pointed out that *Semipallium* has reticulate (“shagreen”) microsculpture, lacking on *Bractechlamys* and its relatives, and belongs in tribe Pedini. At present *Bractechlamys* is treated as a valid genus, placed in Decatopectinini by Waller (1986: 40).

Key to species of *Bractechlamys* from Australia

- 1 Shell c. 30 mm high, almost circular, valves nearly equal, rv slightly more inflated than lv, 11–13 radial ribs, byssal notch moderately deep, byssal fasciole narrow, ctenolium with 3–4 teeth ..... *B. oweni*
- Shell oblong, with 9–11 radial plicae ..... 2
- 2 Shell c. 60 mm high, oblong, valves inflated and almost equally convex, 9–11 radial plicae, secondary radial riblets in late growth stage, byssal notch shallow, byssal fasciole moderately wide, ctenolium lacking or rudimentary in adult stage ..... *B. vexillum*

***Bractechlamys oweni* (de Gregorio, 1884)**

Figs 32D–E, 33, 34B,D

*Pecten pictus* G. B. Sowerby II, 1842: 62, 163, pl. 20, fig. 233; Reeve, 1853: sp. 116, pl. 28, fig. 116; Küster & Kobelt, 1888: 165, pl. 46, fig. 2 (junior primary homonym of *Pecten pictus* of Da Costa, 1778, of Röding, 1798, of Deshayes in Laborde & Linant, 1830, and of Goldfuss, 1833).

*Pecten oweni* de Gregorio, 1884: 133 (replacement name for *P. pictus* Sowerby, 1842).

*Chlamys (Aequipecten)* sp. cf. "*picta* (Sowerby)".—Kuroda, 1932: 95, fig. 108.

*Pecten (Chlamys) oweni* de Gregorio.—Hertlein, 1936: 55. *Cryptopecten oweni* (de Gregorio).—Habe, 1951: 77; Habe, 1977: 84; Koyama *et al.*, 1981: 67, pl. 5, fig. 2; Bernard *et al.*, 1993: 50; Higo *et al.*, 1999: B479.

*Semipallium (Semipallium) oweni* (de Gregorio).—Dijkstra, 1990a: 8.

*Chlamys (Cryptopecten) oweni* (de Gregorio).—Rombouts, 1991: 24, pl. 8, fig. 4.

*Bractechlamys oweni* (de Gregorio).—Dijkstra, 1998a: 16; Wang, 2002: 193, fig. 81; Raines & Poppe, 2006: 102–103, lower figs; pl. 38, figs 1–6; pl. 51, fig. 4; Xu & Zhang, 2008: 85, fig. 237; Huber, 2010: 199; Raines, 2010: 600, pl. 991, figs 1–2; Dijkstra, 2013: 35, pl. 8, figs 1a–d, 4a–b.

*Bractechlamys* [sic] *oweni* (de Gregorio).—Hayami, 2000: 907, pl. 450, fig. 42.

**Type data.** Holotype (pr) NHMUK1950.11.14.53. Type locality: "Isle of Baicus". Herein more precisely: Philippine Islands, Negros Island, "Baicus Isle", 13 m, in coarse sand.

**Comments on type data.** G. B. Sowerby II (1842: 163) mentioned a more accurate locality in Latin with data in a subsequent description of *Pecten pictus*: "Hab. Ins. Baiae, Ins. Negros, Philippinarum. H. Cuming legit. Found in coarse sand at a depth of seven fathoms" [13 m]. "Isle of Baicus" or "Ins. Baiae" is possibly a small island near Bais, southeastern Negros. However, as many of Hugh Cuming's localities have proved to be incorrect, the accuracy of the supposed type locality is questionable.

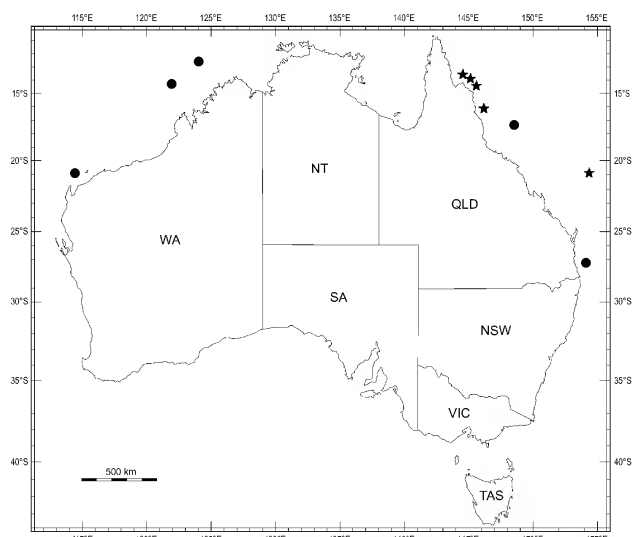
**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Flinders Reefs, c. 170 n.m.l off Townsville, 17°61'S 148°52'E, alive, c. 18 m (1 pr, photo AM); Moreton Island, NE of Cape Moreton, SW side of Hutchinson Shoal, 26°59'S 153°48'E, dead, 27 m (1 pr, R.C. Willan colln). WESTERN AUSTRALIA: Onslow, Peak Island, W side, 21°36'S 114°30'E, dead, 18 m (1 v, WAM 520.91); Scott Reef, north reef, approx. 14°0'S 121°45'E, exposed reef flat, dead (1 pr, ZMA Moll.143825); Cartier Island, 12°32'S 123°33'E, dead (1 v, WAM); Ashmore Reef, central N side, 12°17'S 123°02'E, dead, 3 m (1 v, WAM 525.91); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 18 m (1 v, WAM). —JAPAN: Okinawa, Manzamo, alive, 49 m (1 pr, ZMA Moll.141181). —PHILIPPINE ISLANDS: Davao, Samal Island, Matanos, alive, 165 m (4 pr, ZMA Moll.145086); Davao, Talikud Island, alive, 120–180 m (3 pr, ZMA Moll.146103). —INDONESIA: Java, off Semarang, alive, 46–48 m (1 pr, ZMA Moll.139609). —PAPUA NEW GUINEA: Madang, E of Worgat Island, dead (1 pr, WAM); Port Moresby, Quayles Reef, alive, 20 m (1 pr, ZMA Moll.142676). —SOLOMON ISLANDS: W side of Malanpaina Island, 10°14.05'S 161°58'E, dead, 15 m (1 pr, WAM); Ontong Java, alive, 34–38 m (6 pr, ZMA Moll.142679).

**Description.** Shell up to c. 30 mm high, solid, inflated, adults somewhat pyxoid, almost circular, adult shells slightly higher than wide, almost equivalve and equilateral, auricles unequal in shape and size, umbonal angle c. 90°; colour of left valve highly variable with cream, orange, red, pink or brown spots, many specimens with 3 uniformly coloured (cream or yellowish) radial costae, right valve paler and more uniform in colour (cream or whitish), laterally some blotches. Inner surface of left valve usually reddish, of right valve whitish, dorsally reddish or brownish.

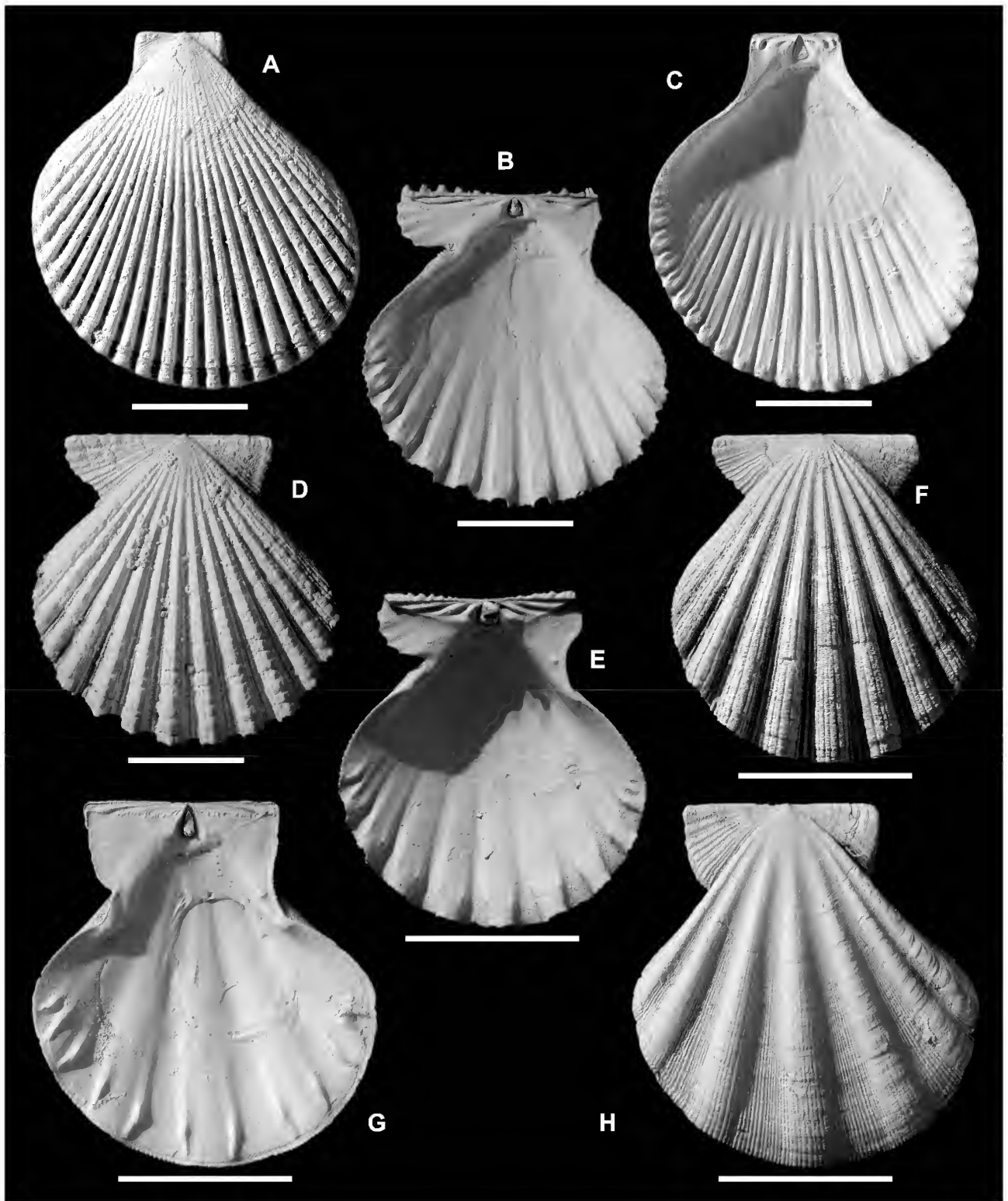
Both valves sculptured with 11–13 radial costae and covered with closely spaced commarginal microsculpture; surfaces of costae bearing 2–3 narrow costellae near ventral margin, more numerous and obvious on right valve than left; a few secondary interstitial radial riblets near ventral margin on some specimens. Anterior auricle of right valve with 4 prominent noduliferous radial costae, other auricles weakly ribbed or almost smooth. Dorsal margin of right valve with prominent tubercles. Dorsal margin straight. Byssal fasciole small, byssal notch moderately deep, functional ctenolium with 3–4 teeth beneath suture ridge. Resilifer narrowly triangular. Intermediate and dorsal teeth well-developed. Internal rib carinae present near ventral margin.

**Dimensions.** Illustrated specimen: off Hibernia Reef, WA, 30–35 m (HM): H 26.6, L 25.7 mm.

**Habitat.** Living free in the intertidal zone and on the continental shelf, amongst coral rubble under coral slabs on sand.



**Figure 33.** Distribution of *Bractechlamys oweni* (Gregorio) (circles) and *B. vexillum* (Reeve) (stars).



**Figure 34.** *A, C*, *Anguipecten superbus* (G. B. Sowerby II), specimen in Fig. 32A, C, rv exterior (A), lv interior (C). *B, D*, *Bractechlamys oweni* (Gregorio), specimen in Fig. 32D, E, rv interior (B), lv exterior (D). *E, F*, *Bractechlamys vexillum* (Reeve), specimen in Fig. 32F, H, rv interior (E), lv exterior (F). *G, H*, *Decatopecten strangei* (Reeve), specimen in Fig. 32G, I, rv interior (G), lv exterior (H). Scale bars represent 20 mm (A, C, E–H), 10 mm (B, D).

**Distribution.** Amami Islands (Japan) southwards to tropical West Pacific, 10–20 m (Hayami, 2000: 907); East China Sea, Taiwan, South China Sea, intertidal–20 m (Bernard *et al.*, 1993: 50); Philippines, 10–25 m (alive), 627–645 m (dead) (Raines, 2010: 600; Dijkstra, 2013: 35); Tiur Island, Indonesia, 54 m (Dijkstra, 1990a: 8); Hansa Bay, Papua

New Guinea, 3–25 m, live (Dijkstra, 1998a: 16); Japan to Indonesia, 5–86 m (Huber, 2010: 199). Maximum depth range intertidal to 180 m (HHD, unpublished data). Present material from Australia alive at c. 18 m.

**Remarks.** *Bractechlamys oweni* is a **new record** for Australia. The present specimens from Queensland and

Western Australia differ slightly from the type specimen from the Philippine Islands in their greater convexity and the more prominent sculpture on the anterior auricle of the right valve. However, these characters are also observed on other material from the Philippine Islands and the Solomons.

### *Bractechlamys vexillum* (Reeve, 1853)

Figs 32B,F,H, 33, 34E–F

*Pecten distans* Lamarck, 1819.–G. B. Sowerby II, 1842: 61, pl. 13, fig. 46; pl. 18, fig. 182; Reeve, 1853: sp. 49, pl. 13, fig. 49 (misidentification).

*Pecten digitatus* Hinds, 1845: 61, pl. 27, fig. 2 (junior primary homonym of *Pecten digitatum* [sic] Perry, 1811).

*Pecten vexillum* Reeve, 1853: sp. 114, pl. 27, figs 114a–b.

*Pecten janus* Montrouzier in Fischer, 1858: 340 (replacement name for *Pecten distans* Lamarck as figured by Reeve (1853: pl. 13, fig. 49); junior primary homonym of *Pecten janus* Münster in Goldfuss, 1833); Küster & Kobelt, 1888: 186, pl. 51, figs 3–4.

*Pecten (Chlamys) zeteki* Hertlein, 1935: 306, pl. 19, fig. 9 (replacement name for *Pecten digitatus* Hinds, 1845).

*Bractechlamys evecta* Iredale, 1939: 367, pl. 5, figs 20–20a; Lamprell & Whitehead, 1992: [30].

*Semipallium zeteki* (Hertlein).–Grau, 1959: 122, pl. 41, figs 1–2.

*Comptopallium vexillum* (Reeve).–Waller, 1972a: 243, pl. 4, figs 64–75, pl. 5, figs 76–83, 86; Abbott & Dance, 1982: 307, fig.; Dijkstra, (1983–1994) 1985: 7, figs.

*Semipallium vexillum* (Reeve).–Rombouts, 1991: 60, pl. 22, figs 2–2a; Xu & Zhang, 2008: 89, fig. 248.

*Bractechlamys vexillum* (Reeve).–Springsteen & Leobrera, 1986: 328, pl. 93, fig. 12; Dijkstra, 1991: 44; Dijkstra, 1998a: 16, pl. 2, fig. 4; Raines & Poppe, 2006: 104, 105, upper figs; pl. 39, figs 1–7; pl. 40, figs 1–7; pl. 41, figs 1–8; pl. 42, figs 1–7; pl. 47, fig. 6; pl. 297, fig. 2; Huber, 2010: 198; Raines, 2010: 600, pl. 991, figs 3–8.

**Type data.** *Pecten digitatus* Hinds: holotype (pr) NHMUK 1879.2.26.190, refigured by Waller (1972a: 243, figs 76–79, 81, 82). Type locality: “Bay of Guayaquil” [erroneous], mud, 23 fathoms [42 m].

*Pecten vexillum* Reeve: lectotype (pr) NHMUK197010, figured by Reeve (1853: pl. 27, fig. 114a), designated and refigured by Waller (1972a: 243, figs 64–68, 71). Type locality not mentioned in original description, although on labels of type lot “Australian Seas”.

*Bractechlamys evecta* Iredale: holotype (rv) AM C.075283 (Fig. 32B). Type locality: Great Barrier Reef Exped. stn XIV, Australia, Great Barrier Reef, 0.5 ml SE of Lizard Island, 19 fathoms [35 m].

**Comments on type data.** The type locality “Bay of Guayaquil” [Ecuador] of *Pecten digitatus* Hinds, 1845 is incorrect. Species of *Bractechlamys* do not occur in the eastern Pacific. See also Grau (1959: 122, pl. 41 figs 1–2).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, 0.5 ml NW of Howick Isle, 14°29'S 144°57'E, dead, 18 m (1 v, C.075244); Lizard Island, Rocky Point, 14°40'S 145°26'E, alive, 6–9 m (1 pr, C.105244); Lizard Island, off Rocky Point, 14°40'S 145°26'E, dead, 15 m (1 v, C.363917); Lizard Island, Watsons Bay, 14°40'S 145°27'E, alive, 10.5–23 m (4 pr + 6 v, C.104440; 1 pr, C.105836; 1 pr, C.106274; 2 pr, C.131837; 3 pr + 3 v, C.363916; 5 pr, C.364030; 1 pr, C.364034; 1 pr, C.364037); GBR, 0.5 ml N of Eagle Isle, 14°41'S 145°22'E, alive, 18 m (1 pr, C.119718); GBR, 0.5 ml SE of Lizard Island, 14°41'S 145°29'E, dead, 35 m (1 v, C.075283; 3 v, C.119716); GBR, 0.25 ml N of North Direction Isle, 14°44'S 145°31'E, dead, 34.5 m

(11 v, C.119717); 0.5 ml W of North Direction Isle, 14°45'S 145°30'E, alive, 36.5 m (11 v, C.119719); Low Isles, 16°23'S 145°34'E, alive (1 pr, C.097432); Michaelmas Cay, 16°36'S 145°59'E, alive, 20 m (2 pr, C.053721; 9 v, C.119720); Green Island, 16°46'S 145°58'E, dead (1 pr, C.009982); Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, dead, 64–73 m (3 v, C.363918); Swain Reefs, Bylund (Gillett) Cay, W shore, 21°43'S 152°25'E, intertidal, dead (1 pr, C.363919). —PHILIPPINE ISLANDS: Cebu Sea, alive, 20–40 m (4 pr, ZMA Moll.140612); Sulu Sea, Laminusa Island, alive, 5 m (3 pr, ZMA Moll.141353); Mindanao, Davao Gulf, Talikud Island, alive, 20–28 m (1 pr, ZMA Moll.144472). —MALAYSIA: Singapore, off Sentosa, alive, 15–20 m (1 pr, ZMA Moll.140282). —SOLOMON ISLANDS: Ontong Java, alive, 38 m (2 pr, ZMA Moll.143053). —NEW CALEDONIA: Poum Bay, Daomboui, 20°09'S 163°59'E, alive, 0–3 m (2 pr, C.364038); Poindimié, 20°56'S 165°20'E, alive (1 pr, C.105836); Noumea, Anse Vata, 22°19'S 166°27'E, alive, 1–3 m (3 pr, C.364039). VANUATU: Efate Island, Port Vila, 17°44'S 168°18'E, dead (4 v, C.131843).

**Description.** Shell up to 74 mm high (Huber, 2010), most specimens 30–40 mm; solid, inflated, almost equally convex, oblong, almost equivalve and equilateral, auricles slightly unequal in shape and size, umbonal angle about 90°; left valve brightly coloured, highly variable, uniformly cream, yellow, orange, red, mauve, maroon or dark brown with whitish dots or streaks; right valve of most specimens paler, interior of most white with dark brown hinge plate.

Both valves sculptured with 9–11 prominent radial plicae, most specimens with 9, covered throughout with very closely spaced commarginal lamellae. Secondary radial riblets on plicae and interspaces in late growth stage, near ventral margin. Interspaces almost the same width as plicae. Anterior auricle of right valve with 3–4 radial costae, other auricles very weakly ribbed or almost smooth. Dorsal margin of right valve with low tubercles. Dorsal margin of left valve straight, of right valve slightly raised. Byssal notch shallow, byssal fasciole rather wide, functional ctenolium lacking in mature specimens. Resilifer narrowly triangular. Intermediate and dorsal teeth well-developed, prominent. Internal rib carinae present near ventral margin.

**Dimensions.** Illustrated specimen: QLD, GBR, 0.8 km N of Eagle Isle, 18 m (AM C.119718): rv: H 38.0, L 34.8 mm; lv: H 37.2, L 34.6 mm; D 17.5 mm. Iredale (1939: 367) stated the dimensions of the holotype of *Bractechlamys evecta* as H 35, L 30 mm.

**Habitat.** Juveniles living byssally attached to substrates, adults free amongst marine grasses or coral rubble on soft sediment (sand or mud), in the intertidal to sublittoral zones.

**Distribution.** Tropical Indo-West Pacific from the Philippines southwards to northern Australia, westwards to Andaman, and eastwards to Vanuatu. Philippines, Irian Jaya (Indonesia), Solomon Islands, New Caledonia, Palau Islands, and Marshall Islands, intertidal to 55 m (Waller, 1972a: 246); Andaman to China, 1–67 m (Huber, 2010: 198); Philippines, 40 m (Raines, 2010: 600). Maximum depth range of live-taken specimens is of the intertidal zone to 80 m (HHD, unpublished data). Present material from Australia alive at intertidal to 40 m.

**Remarks.** Lamprell & Whitehead (1992: [30]) did not record this species from Australia due to lack of material at that time. *Bractechlamys vexillum* is now recorded alive from Queensland and is morphologically identical to the type specimens. The Philippines morph is slightly different from the type specimens in having one or two more primary radial plicae. Other characters are identical. The specific epithet *vexillum* is an indeclinable noun (Latin, a flag or standard).

***Decatopecten* G. B. Sowerby II, 1839**

*Decatopecten* [Rüppell] Sowerby, 1839: 37, 78, 121, fig. 172.  
 Type species (by monotypy): *Pecten* [sic] *plica* Linnaeus, 1758 (= *Ostrea plica* Linnaeus, 1758). Recent, Indonesia (see Dijkstra, 1999: 404).  
*Pallium* Schumacher, 1817: 41, 120 (junior homonym of *Pallium* Schröter, 1802). Type species (by monotypy): *Pallium striatum* Schumacher, 1817 (= *Ostrea plica* Linnaeus, 1758). Recent, Indonesia.  
*Decadopecten* Swainson, 1840: 388. Type species (by monotypy): *Pecten plicata* [sic] Sowerby, 1839, error for *Pecten plica* Sowerby, 1839 (junior homonym of *Pecten plicata* [sic] J. de C. Sowerby, 1829).  
*Dentipecten* Gray, 1847: 200 (no diagnosis, obj.). Type species (by original designation): *Ostrea plica* Linnaeus, 1758.  
*Comptopallium* Iredale, 1939: 359. Type species (by original designation): *Comptopallium pauciplicatum* Iredale, 1939 [= *Ostrea radula* Linnaeus, 1758]. Recent, Queensland. See Waller (1986: 40).

**Comments on synonymy.** *Decadopecten* is an incorrect subsequent spelling of *Decatopecten* (ICZN, 1999: 42, Article 33.3). See also Hertlein (1969: N365).

**Diagnosis.** Elongate plicate *Decatopecten* with closely spaced commarginal lamellae and delicate antimarginal microsculpture in early ontogeny, and with secondary radial sculpture in late ontogeny; hinge dentition dominated by prominent dorsal and/or intermediate teeth; resilial teeth obsolete or absent; byssal notch small, ctenolium weak; internal plicae with short carinate edges near margin.

**Distribution.** Miocene–Recent (Hayami, 1989: 15). The earliest record is probably Pliocene, even if one accepts the synonymy of *Comptopallium* (pers. comm. D. Jablonski, 2017). (Sub)tropical Indo-West Pacific, living in the littoral to sublittoral zones on soft sediment.

**Discussion.** Grau (1959: 366) and later Hertlein (1969: N366) placed *Comptopallium* in the synonymy of *Semipallium* Lamy, 1928. However, Waller (1972a: 245) indicated that this is unacceptable, based on differences in shell microsculpture. Waller (1986: 40) treated *Comptopallium* as a junior synonym of *Decatopecten*, and (Waller, 1991) placed *Semipallium* in *Chlamymini* (i.e., *Pedini*). Several recent phylogenies (Alejandrino et al., 2011; Sherratt et al., 2016; Serb, 2016) show species assigned to *Bractechlamys* and *Decatopecten* as intermingled, suggesting that the relationships of these genera need revision, and possibly that *Comptopallium* deserves recognition, but this is beyond the scope of the present review.

***Decatopecten radula* (Linnaeus, 1758)**

Figs 35, 36A,C, 38A,C

*Ostrea radula* Linnaeus, 1758: 697, no. 161; Linnaeus, 1764: 525, no. 105; Linnaeus, 1767: 1145, no. 191; Born, 1778: 83; Born, 1780: 100; Gmelin, 1791: 3318, no. 11; Dillwyn, 1817: 251, no. 10; Dijkstra, 1999: 402, fig. 8A [lectotype].  
*Pecten radula* (Linnaeus).–Bruguière, 1797: pl. 208, fig. 2; Lamarck, 1819: 166, no. 13; Bosc, 1824: 256, pl. 2, fig. 3; Defrance, 1825: 240; Deshayes, 1832a: 719, no. 12; Deshayes, 1836: 134, no. 13; G. B. Sowerby II, 1842: 63, pl. 17, figs 154–155; Chenu, 1843: 4, pl. 15, figs 8–10; Reeve, 1853: sp. 83, pl. 21, fig. 83; Fischer, 1858: 341; Küster & Kobelt, 1888: 54, pl. 15, figs 1–2; Martens, 1902: 126.  
*Chlamys radula* (Linnaeus).–Röding, 1798: 162; Wells, Slack-Smith & Bryce, 2000: 42.  
*Pecten* (*Pallium*) *radula* (Linnaeus).–Dautzenberg & Bavay, 1912: 24; Oostingh, 1925: 256; Adam & Leloup, 1939: 59.  
*Comptopallium pauciplicatum* Iredale, 1939: 359.  
*Pecten* (*Comptopallium*) *radula* [var.] *griggi* Webb, 1957: 53, pl. 4, figs 1–3.  
*Comptopallium radula* (Linnaeus).–Kira, 1962: 141, pl. 50, fig. 15; Waller, 1972a: 245, pl. 5, figs 84–85; Abbott & Dance, 1982: 307, fig.; Dijkstra, (1983–1994) 1984: 11, figs; Springsteen & Leobrera, 1986: 328, pl. 93, fig. 14; Dijkstra et al., 1989: 24; Dijkstra et al., 1990: 7–8, fig.; Dijkstra, 1991: 43; Rombouts, 1991: 35, pl. 13, fig. 4; Dharma, 1992: 84, pl. 20, fig. 12; Lamprell & Whitehead, 1992: [28], pl. 12, fig. 74; Bernard et al., 1993: 50; Hayami, 2000: 903, pl. 449, fig. 32; Dharma, 2005: 250, pl. 100, figs 4a–c; Huber, 2010: 198.  
*Semipallium* (*Semipallium*) *radula* (Linnaeus).–Dijkstra, 1990a: 9, 12.  
*Comptopallium radula griggi* (Webb).–Rombouts, 1991: 35, pl. 13, fig. 5; Lamprell & Whitehead, 1992: [30], pl. 13, fig. 75.  
*Decatopecten radula* (Linnaeus).–Dijkstra, 1997: 329, figs 33–35; Dijkstra, 1999: 403; Wang, 2002: 204, fig. 86; Slack-Smith & Bryce, 2004: 237; Xu & Zhang, 2008: 87, figs 242a–b; Raines, 2010: 604, pl. 993, figs 1–6.  
*Chlamys* (*Comptopallium*) *radula* (Linnaeus).–Wells, Slack-Smith & Bryce, 2000: 42.  
*Decatopecten radula radula* (Linnaeus).–Raines & Poppe, 2006: 106, 107, lower figs; pl. 50, figs 1–7; pl. 51, figs 1–3, 5–6; pl. 295, fig. 2; Dijkstra, 2013: 30, pl. 6, figs 1a–d.  
*Decatopecten radula griggi* (Webb).–Raines & Poppe, 2006: 106, 109, upper figs; pl. 52, figs 1–5.

**Comments on synonymy.** Iredale’s (1939: 359) statement about *Ostrea radula* is incorrect (Dijkstra, 1999). He distinguished a Queensland species *Comptopallium*

**Key to species of *Decatopecten* from Australia**

- 1 Shell c. 120 mm high, valves inequivalve and inequilateral, lv flat to weakly inflated, rv more convex, auricles subequal, 9–13 radial plicae, fine to coarse lamellae on plicae, secondary radial riblets in late growth stage, byssal notch shallow, byssal fasciole moderately wide, ctenolium weak ..... *D. radula*
- Shell oblong, with 5–7 radial plicae ..... 2
- 2 Shell c. 45 mm high, almost equally convex, equivalve and equilateral, auricles subequal, 5 radial plicae, rarely 6–7, secondary radial riblets on plicae and interstices in late growth stage, byssal notch, byssal faciole and ctenolium lacking in adult stage ..... *D. strangei*



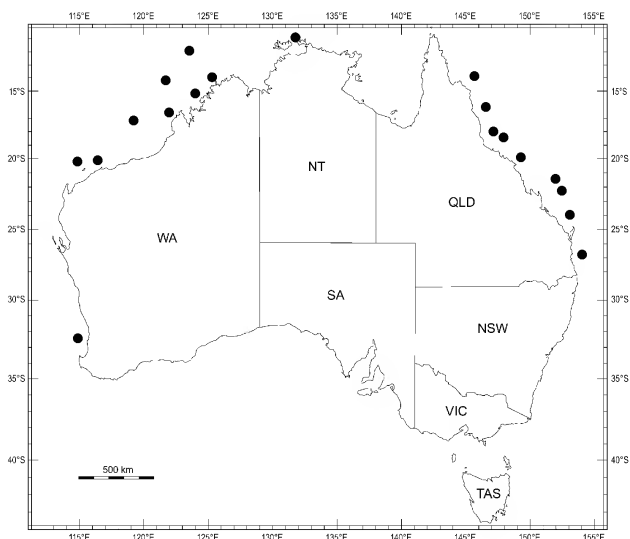


Figure 35. Distribution of *Decatopecten radula* (Linnaeus).

*pauciplicatum* from *C. radula*, known from the Indo-West Pacific, based on the number of primary plicae (*C. radula*—12, *C. pauciplicatum*—10). The number of plicae in *D. radula* in fact varies rather strongly (see remarks).

Webb (1957: 53) introduced a new form, *Pecten (Comptopallium) radula* var. *griggi*, from northwestern Australia. According to ICZN (1999: 50, Article 45.6.4) this taxon should now be treated as a subspecies, although we do not recognize it as a formal geographical subspecies.

**Type data.** *Ostrea radula* Linnaeus: lectotype (pr) UUZM [not registered], a paralectotype (pr) and possible paralectotype (pr) UUZM [not registered], and a possible paralectotype (pr) LSL [not registered], designated by Dijkstra (1999: 403). Type locality: “Habitat in *O. Indico*”. Restricted to Indonesia by Dijkstra (1999: 402).

*Comptopallium pauciplicatum* Iredale: syntypes not recognized with certainty in AM. Type locality: Queensland.

*Pecten (Comptopallium) radula* [var.] *griggi* Webb: holotype (pr) ANSP225038. Type locality: Western Australia, Escape Pass near Cape Leveque, from intertidal to 6 fathoms [11 m].

**Comments on type data.** Iredale (1939: 359) did not indicate or figure type material in the original description of *Comptopallium pauciplicatum*. He mentioned as type locality “Queensland”, and subsequently as additional localities (Iredale, 1939: 371) “Shore, Station XIX” at Low Isles. In the AM collection several lots are preserved from Queensland and Low Isles (see material examined), but none of these was labelled by Iredale as type material, so it is not possible to recognize the syntypes with any certainty.

Although Webb (1957: 53) indicated several paratypes of *Pecten (Comptopallium) radula griggi*, these are not held in the ANSP collection. Possibly Webb kept some in his own collection and distributed some to other institutions (not traced).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Murray Island, 9°56'S 144°04'E, dead (1 v, C.029786; 3 v, C.030271); GBR, off Lizard Island, Carter Reef, 14°33'S 145°36'E, dead, 15 m (1 v, C.120942); Lizard Island, off Rocky Point, 14°40'S 145°26'E, dead, 9 m (1 v, C.343811); Lizard Island, off Peppy Beach, 14°40'S 145°26'E, dead, 1.5–8 m (1 v, C.343817); N end of Lizard Island, Watsons Bay, 14°40'S 145°27'E, dead (1 v, C.105506); Lizard Island, 14°40'S 145°28'E, dead (1 v, C.008623; 6 v, C.041560; 1 pr, C.102183); GBR, No Name Reef, SW end, 14°40'S 145°39'E, dead, 15–20 m (1 pr, C.153119); Lizard

Island, Casuarina Beach, 14°41'S 145°27'E, low tide, dead (1 pr, C.343813); Lizard Island, Bird Islet, 14°41'S 145°28'E, dead, 0–24 m (1 v, C.343812); Lizard Island, W & NW of Bird Island, 14°41'S 145°28'E, dead, 2–14 m (1 v, C.343815); Lizard Island, Bommie No. 2, 14°41'S 145°28'E, dead, 9–12 m (3 v, C.343816); Lizard Island, Eagle Island, N side, 14°42'S 145°23'E, dead, 3 m (1 pr, C.105188; 1 v, C.343814); Eagle Island, 14°42'S 145°23'E, dead, 5.5 m (1 v, C.343848); Lizard Island, South Island, 14°42'S 145°27'E, alive, 3–18 m (1 pr, C.343995); GBR, Low Isles, 16°23'S 145°34'E, dead (1 v, C.132134; 2 v, C.132135; 1 v, C.170896); GBR, Michaelmas Cay, 16°36'S 145°59'E, dead (7 v, C.053646); Green Island, near Cairns, 16°46'S 145°58'E, dead (1 v, C.131214; 1 v, C.132137); Palm Islands, Fantome Island, 18°40'S 146°29'E, alive (1 pr, C.303789); Palm Islands, 18°40'S 146°33'E, dead (1 v, C.010052); GBR, Broadhurst Reef, E of Townsville, 18°57'S 147°44'E, alive (1 pr, C.132139); Broadhurst Reef, E of Townsville, 18°57'S 147°44'E, subtidal, alive (1 pr, C.343821; 1 pr, C.343822; 1 pr, C.343823); Whitsunday Islands, Hayman Island, 20°03'S 148°53'E, dead (1 v, C.132138); Bowen, Edgecumbe Bay, 20°08'S 148°23'E, dead (1 v, C.119712); Brampton Island, 20°49'S 149°17'E, dead (1 v, C.132136); Swain Reefs, Reef 21–230, 21°12'S 152°20'E, dead, 13–15 m (1 v, C.162341); Swain Reefs, Centenary Reef, 21°17'S 152°20'E, alive, 10–11 m (1 pr, C.161812); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 4–6 m (1 v, C.343827); Swain Reefs, Mystery Reef, 21°23'S 152°01'E, alive, 3–8 m (1 pr, C.161814); Swain Reefs, Mystery Reef, 21°23'S 152°01'E, dead, 10 m (1 pr, C.161817); Swain Reefs, Reef 21–189, 21°27'S 151°41'E, dead, 9–10 m (8 v, C.343825); Swain Reefs, 22°12'S 152°37'E, dead, 7–19 m (1 v, C.143135); Swain Reefs, 22°12'S 152°37'E, dead, 6–9 m (1 v, C.143404); Capricorn Group, Wistari Reef, 23°28'S 151°53'E, dead (1 v, C.119711); off Burnett Heads, 24°46'S 152°24'E, alive, 46–55 m (1 pr, C.097424; 1 v, C.097563); Moreton Bay, Stradbroke Island, 27°35'S 153°28'E, alive (1 pr, C.019175). **WESTERN AUSTRALIA:** off Fremantle, 32°03'S 115°44'E, dead (1 pr, C.343810); Onslow area, 21°38'S 115°07'E, dead (1 v, C.343809); Dampier Archipelago, Gidley Island, 21°37'S 115°49'E, dead (1 pr, WAM); Montebello Islands, Hermit Island, 20°30'S 115°31'E, alive (1 pr, WAM S12590); Dampier Archipelago, Kendrew Island, 20°28.30'S 116°32'E, alive (1 pr, WAM; 1 pr, WAM; 1 pr, WAM); Montebello Islands, 20°26'S 115°32'E, dead (3 v, C.049664; 1 pr, C.121323); Montebello Islands, Alpha Island, 20°24.30'S 115°30.12'E, dead (1 pr, WAM); Montebello Islands, North West Island, 20°20'S 115°32'E, dead (1 pr + 1 v, WAM); Seringapatam Reef, approx. 17°10'S 119°20'E, dead, 8 m (5 v, WAM); Kimberley, Leonie Island, 16°25'S 123°03'E, alive (2 pr + 1 v, WAM); Cape Leveque, 16°24'S 122°55'E, dead, 0–0.5 m (1 pr, C.097561); Yampi Sound, Cockatoo Island, 16°06'S 123°37'E, dead (2 pr, C.070657); Kimberley, Sunday Island, 16°26'S 123°09'E, dead, 23 m (1 pr, WAM); One Arm Point, 16°26'S 123°04'E, alive (3 pr, C.303790); Montgomery Island, 15°58'S 124°12'E, exposed reef, dead (1 pr, WAM); Port George IV, 15°20'S 124°34'E, dead (1 v, WAM); Bonaparte Archipelago, Champagny Island, 15°18'S 124°15'E, dead (1 pr, C.121333); Lucas Island, 15°13'S 126°31'E, alive (1 pr, WAM); Kimberley, E of Montalivet Island, 15°06'S 125°18'E, dead (1 pr, WAM); Kimberley, Careening Bay, 15°06'S 125°0'E, dead (1 v, WAM); Cleghom Island, 14°22'S 125°25'E, dead (1 v, WAM); Albert Reef, 14°15'S 125°09'E, dead (1 pr, WAM); Kimberley, La Fontaine Island, 14°10'S 125°47'E, dead (1 v, WAM; 3 v, WAM); Fenelon Island, 14°09'S 125°39'E, dead (1 v, WAM); Scott Reef, approx. 14°0'S 121°45'E, dead (1 v, WAM); Scott Reef, W side of North Reef, approx. 14°0'S 121°45'E, dead, 13 m (1 pr, WAM 2203–84); Ashmore Reef, N of West Island, 12°17'S 123°02'E, reef top, alive (1 pr, WAM); Ashmore Reef, Middle Reef, 12°17'S 123°02'E, dead (2 v, WAM). **NORTHERN TERRITORY:** Cape Don, 11°19'S 131°45'E, dead (1 v, WAM). —INDIA: Maldive Islands, Bandros, alive, 2–4 m (1 pr, ZMA Moll.140083). **COCOS KEELING ISLANDS:** Central lagoon, alive (3 pr, WAM; 1 v, WAM; 1 v, WAM). —CHINA: Hainan, alive, intertidal to 20 m (1 pr, ZMA Moll.145737). —PHILIPPINE ISLANDS: Davao Gulf, Mindanao Island, 7°0'N 125°50'E, dead (1 pr, C.097562); Panglao Island, NW corner, 9°39'N 123°50'E, dead, 2 m (1 pr, C.162974); Bohol Island, Danajon Bank, Banacon Island, 10°12'N 124°10'E, alive (4 pr + 2 v, C.106413). —MALAYSIA: off Mersing, alive, 2–3 m (2 pr, ZMA Moll.143704). **CAROLINE ISLANDS:** Palau Island, 7°21'N 134°29'E, dead (1 pr, C.132131). **SINGAPORE:** Pulau Sudong, 1°13'N 103°42'E, dead (1 pr, C.138713). —INDONESIA: 14 km N of Mahakam River mouth, 0°20'S 117°27'E, dead, beach (1 v, C.343864); Schouten Islands, Sakfandu (Sakfandoe) Island, 1.5 m SSW of Soweik (Saweik), 0°49'S 135°28'E, dead (5 v, C.100702); Pulau Japen, NE tip Pulau Ambai, 1°56'S 136°21'E, alive, 3–4.5 m (1 pr, C.119706). —PAPUA NEW GUINEA: New Ireland, Mongop, via Kavieng, 2°53'S 151°22'E, alive (2 pr, C.343860); off New Britain, Duke of York Island, 4°10'S 152°29'E, dead (1 pr, C.068230); Mililat Harbour, N of Madang, 5°07'S 145°49'E, dead (2 v, C.076250); Madang, Kranket Island, inlet at N end, 5°11'S 145°51'E, intertidal, alive (3 pr, C.343994); Madang, off Madang Island, 5°12'S 145°49'E, alive (2 pr, C.087968); Madang, Kranket Island, 5°12'S 145°49'E, alive, 3–6 m (1 pr, C.343992); Milne Bay District, China Straits, Logeia (= Rogeia) Island, NE end, 10°39'S 150°39'E, dead (1 pr, C.343863); Louisiade Archipelago, Calvados Chain, Nimboa Island, 11°18'S 153°15'E, dead, beach (1 pr, C.343862). —SOLOMON ISLANDS: Choiseul Island, Wagina (= Vaghena) Island, 7°26'S 157°46'E, dead (1 v, C.343861); Russell Group, Pavuvu Island, Samata, alive, 6 m (2 pr, ZMA Moll.142840); Russell Group, Kokolaonhol Sound, alive, 2–3 m (3 pr, ZMA Moll.142842). **YANUATU:** Elafate Island, Port Vila, 17°44'S 168°18'E, dead (3 v, C.132143); S coast of Elafate Island, Erakor Lagoon, 17°45'S 168°20'E, low tide, alive (1 pr, C.108801). —FIJI ISLANDS: Viti Levu, Nadi Bay (Tomba Ko Nandi), 17°44'S 177°25'E, dead (7 v, C.344001). —NEW CALEDONIA: Poum, 20°13'S 164°03'E, low tide, alive (1 pr, C.343977); Noumea, Magenta, Ouemo, Baie des Isoles, 22°16'S 166°29'E, alive (2 pr, C.343996); Noumea, Magenta, Marie, NW & W side, 22°18'S 166°29'E, alive, 0–2 m (2 pr, C.343977); Anse Vata, Aquarium de Noumea, 22°19'S 166°27'E, alive (2 pr, C.343999; 9 v, C.344000). —SAMOA ISLANDS: Pago Pago Harbour, alive, 10 m (3 pr, ZMA Moll.143938).

**Description.** Shell up to c. 120 mm high, most specimens 60–70 mm; solid, oblong, left valve flat to weakly inflated, right valve more convex, inequivalve, inequilateral (posterior margin longer than anterior), auricles well-developed, slightly

unequal in shape and size, umbonal angle about 85°; left valve cream with commarginal brown spots and bands, right valve paler or whitish, interior of hinge plate dark brown.

Both valves sculptured with 9–13 primary radial plicae; secondary riblets on plicae and in interspaces in late growth stage. Closely spaced, delicate to coarse commarginal lamellae on plicae. Auricles with 3–8 weak to coarse radial costae. Dorsal margin straight. Byssal notch shallow, byssal fasciole moderately wide, functional ctenolium weak or lacking in mature specimens. Internal rib carinae very weak or absent. Resilifer narrowly triangular. Hinge teeth very weak or lacking.

**Dimensions.** Illustrated specimen: WA, Montebello Islands (AM C.049664): rv: H 100.4, L 92.1 mm; lv: H 100.3, L 89.7 mm; D 24.2 mm.

**Habitat.** Commonly living free in the littoral zone in several different habitats: 1) Under large slabs in silty mud at extreme low tide; 2) Amongst branching corals and rubble inside calm lagoons, usually in clean shallow water; 3) In shallow water on clean sand, surrounded by large groups of sea urchins; 4) Amongst coral slabs and rubble in shallow water on soft sediment (muddy bottoms) in strong currents; 5) Rarely in deep water amongst rubble on soft sediment, muddy sand or mud.

**Distribution.** Throughout the Indo-West Pacific from southern Japan southwards to northern Australia, westwards to the Maldiv Islands, according to Huber (2010) to East Africa, and eastwards to the Samoan Islands; South China Sea, intertidal zone to 20 m (Bernard et al., 1993: 50); Philippines, intertidal zone to c. 80 m (Raines, 2010: 604; Dijkstra, 2013: 31); Indonesia, intertidal to 6 m (Dijkstra, 1991: 43); Papua New Guinea, 2–30 m (Dijkstra, 1998a: 18); East Africa to East China, 0–32 m (Huber, 2010: 198). Maximum depth range from intertidal to 120 m (unpublished data, HHD). Present material from Australia living at subtidal to 55 m.

**Remarks.** The 9–11-ribbed geographical form with weak commarginal lamellae on the radial plicae, similar to *Comptopallium pauciplicatum*, has a wide distribution from the Northern Territory through Queensland, P. N. G. and eastwards to Samoa. Examined material from off Kimberley (northwestern Australia) is more closely similar to *Decatopecten radula griggi* (9-ribbed with closely spaced, strong commarginal lamellae on the radial plicae). This ecomorph is restricted to the northwestern coast of Australia. Most examined material from the Cocos Keeling Islands and Indonesia and northwards to China and southern Japan has 11–13 radial plicae, although a few specimens have been examined with 9–10 costae from Singapore and southern Japan (NSMT). The present specimens from the Montebello Islands region (WA) are similar in radial sculpture to those from Indonesia, although the commarginal lamellae on the plicae are slightly more prominent.

The geographical morphs recognized are: *Decatopecten radula radula* (11–14 ribs, most specimens 11–13): Cocos Keeling Islands, Monte Bello-Onslow area (WA), Scott Reef, Seringapatam Reef and Ashmore Reef (Timor Sea), Indonesian Archipelago, Philippine Islands, China and southern Japan. *Decatopecten radula pauciplicatus* (9–11 ribs, most specimens 9–10): Northern Territory, S Arafura Sea (Indonesia), Papua New Guinea, Solomon Islands, Coral Sea, New Caledonia, Fiji Islands, Samoa. The 9-ribbed

Kimberley (Northwestern Australia) ecomorph described by Webb (1957) in our opinion is a “sister-population” of the *D. radula pauciplicatus* morph. It is observed that other pectinid species (viz. *Mimachlamys scabricostata* and *Complicachlamys wardiana*) from northern Western Australia also have extremely strongly developed commarginal lamellae on the radial costae, possibly due to ecological conditions in that area. Again, the specific epithet *radula* is an indeclinable noun (Latin, a scraper).

### *Decatopecten strangei* (Reeve, 1852)

Figs 32G,I, 34G–H, 37

*Pecten strangei* Reeve, 1852: sp. 22, pl. 4, fig. 22; Küster & Kobelt, 1888: 169, pl. 47, fig. 2.

*Pecten strangei* var. Reeve, 1853: sp. 148, pl. 32, fig. 148.

*Decatopecten strangei* (Reeve).–Iredale, 1936: 269, pl. 20, fig. 3; Iredale, 1939: 361; Allan, 1950: 280, fig. 6; Iredale & McMichael, 1962: 11; Slack-Smith, 1990: 134, 147; Lamprell & Whitehead, 1992: [28], pl. 12, fig. 68; Slack-Smith & Bryce, 2004: 237; Taylor & Glover, 2004: 262; Huber, 2010: 198.

*Decatopecten edentiplica* [sic] Iredale, 1939: 362.

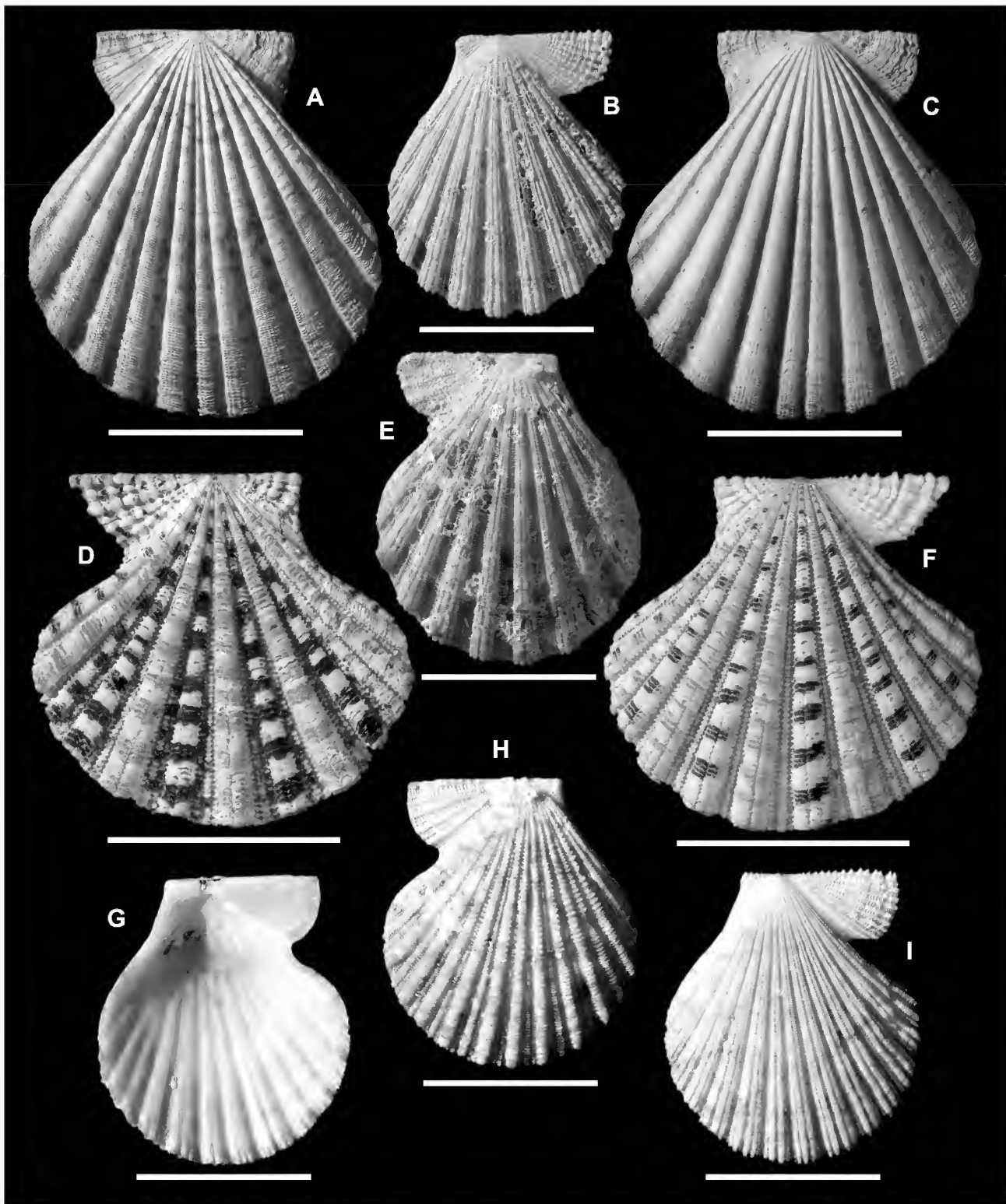
*Decatopecten* (*Decatopecten*) *strangei* (Reeve).–Rombouts, 1991: 37, pl. 13, figs 9–9a.

**Type data.** *Pecten strangei* Reeve: three syntypes NHMUK 1950.11.14.74-76. Type locality: Moreton Bay, Australia.

[*Decatopecten edentiplica* Iredale: holotype (1 pr, immature) AM (not registered). Type locality: GBR, Low Isles, 9–12 fathoms [16–22 m], mud & muddy sand, leg. Dr C. M. Yonge (Iredale, 1939: 220–221)].

**Comments on type data.** Iredale (1939: 362) did not treat “*Decatopecten edentiplica*” clearly according to the ICZN Code. He did not introduce a new species name, but only a new epithet “*Edentiplica*” (the initial capital is presumably a typographical error). It is possible that he only wanted to distinguish the “immature” specimen from the Low Isles, the only specimen mentioned under this name, from *D. plica* and not to introduce a distinct new species. The immature holotype is identical to young specimens of *Decatopecten strangei*.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, 10°22.14'S 141°42.42'E, dead, 16 m (2 pr, C.164910); Cape York Peninsula, 10°41.3'S 142°31.75'E, alive (1 pr, C.097567); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (2 v, C.036134); GBR, off Cape Grenville, Sunday Island, 11°56'S 143°12'E, dead (1 v, C.075231); Gulf of Carpentaria, 10 ml SW of Mapoon, 12°05'S 141°40'E, dead, 18 m (8 v, C.014080); Gulf of Carpentaria, 12°38'S 141°0'E, dead, 59 m (1 pr, WAM); Gulf of Carpentaria, 16°27.15'S 140°01.20'E, dead, 29 m (1 v, WAM); GBR, 0.5 ml NW of Howick Isle, 14°29'S 144°57'E, dead, 18 m (1 v, C.075243); GBR, 0.5 ml N of Eagle Isle, 14°41'S 145°22'E, dead, 18 m (1 v, C.119738); Gulf of Carpentaria, W of Edward River, 14°46'S 141°20.7'E, dead, 18 m (1 v, C.372104); GBR, Decapolis Reef, off Cape Flattery, 14°50'S 145°17'E, dead, 12–14 m (1 v, C.372111); GBR, 0.5 ml W of Two Isles, 15°01'S 145°26'E, dead, 30 m (1 v, C.119737); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (8 v, C.027534); between Cairns & Endeavour Reefs, 15°45'S 145°35'E, dead, 37 m (2 v, C.044615); E Gulf of Carpentaria, W of Nassau River, 15°51'S 140°54.2'E, alive, 22 m (1 pr, C.372156); E Gulf of Carpentaria, W of Nassau River, 15°53.5'S 140°42'E, alive, 25.6 m (2 pr + 7 v, C.111135); Gulf of Carpentaria, SW of Nassau River, 16°06'S 141°01.8'E, dead, 14.6 m (1 v, C.107314); Gulf of Carpentaria, SW of Nassau River, 16°08.5'S 140°52.6'E, dead, 18 m (1 v, C.107300); GBR, Low Isles, 16°23'S 145°34'E, dead, 16–22 m (5 v, C.093401); off Cairns, 16°51.6'–16°51'S 146°01.2'–146°0.4'E, dead, 33–35 m (2 v, C.372113; 25 v, C.372124); off Cairns, 16°52'–16°53'S 146°0.6'E, dead, 37–38 m (1 v, C.372125); Gulf of Carpentaria, 28 ml S of Sweets Island, 17°06'S 139°37'E, dead (1 v, C.372108); Horseshoe Bay, Magnetic Island, 17°07'S 146°51'E, dead, 6–9 m (1 v, C.372126); Forrest Beach, S of Lucinda, 18°43'S 146°18'E, dead (8 v, C.372155); off Townsville, 19°06'S 146°48'E, dead, 8–9.5 m (1 v, C.372128); Magnetic Island, 19°08'S 146°50'E, dead (1 v, C.075240); S of Townsville, 19°17'S 147°32'E, dead, 24 m (3 v, C.123883); between Bowen & Townsville, 19°30'S 148°0'E, alive, 37 m (1 pr, C.097568); off Cape Upstart, 19°42'S 147°45'E, dead, 36 m (1 pr, C.097571); off Bowen, 19°44'S 148°14'E, dead, 40 m (2 v, C.119548); E of Bowen, 19°45.7'S 148°19'E, dead, 46 m (1 v, C.372136); Gloucester Island, 20°01'S 148°27'E, dead (1 pr,



**Figure 36.** *A, C*, *Decatopecten radula* (Linnaeus), pair, AM C.049664, Montebello Islands, WA, 20°26'S 115°32'E, lv exterior (A), rv exterior (C). *B, E*, *Glorichlamys quadrilirata* (Lischke), separate valves, AM C.165151, 80 nautical miles NNE of Port Hedland, WA, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, 82 m; rv exterior (B), lv exterior (E). *D, F*, *Excellichlamys spectabilis* (Reeve), pair, WAM S43979, MV *Davena*, N end of Flying Foam Passage, Dampier Archipelago, WA; lv exterior (D), rv exterior (F). *G–I*, *Glorichlamys elegantissima* (Deshayes), pair, NTM P054288, off NE side of Flinders Reef, N of Cape Moreton, Moreton Island, QLD, 27°01'S 153°43'E, 12–15 m; lv interior (G), lv exterior (H), rv exterior (I). Scale bars represent 50 mm (A, C), 10 mm (B, E, G–I), 20 mm (D, F).

C.067817); W of Hayman Island, 20°03'S 148°50'E, dead, 33 m (4 v, C.120138); Bowen, 20°04'S 148°22'E, dead (1 pr, C.103806); Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, dead (21 v, C.058939); off Shaw Island, N of Mackay, 20°29'S 149°0.5'E, dead, 37 m (6 v, C.372138); Whitsunday Passage, 20°32.3'S 149°01.4'E, dead, 27 m (2 v, C.120173); E of Mackay, 20°52'S 149°29'E, dead, 35 m (4 v, C.116567); E of Sarina, 21°27.5'S 150°08'E, alive, 42 m (1 pr + 4 v, C.119586); E of Sarina, 21°28'S 150°08.5'E,

dead, 40 m (1 v, C.372139); SE of Sarina, 21°47'S 150°34'E, dead, 59 m (1 v, C.116488); off Broad Sound, 22°06'S 150°49'E, dead, 53 m (1 v, C.116498); off Yeppoon, 22°40'S 151°16'E, dead, 58 m (1 v, C.372140); Keppel Bay, W of North Keppel Island, 23°04'S 150°53'E, dead, 3.5 m (2 v, C.372143); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, dead (2 v, C.077224); Keppel Bay, between Outer Rock & Man & Wife, NE of South Keppel Island, 23°08'S 150°56'E, dead, 24–26 m (8 v, C.372142); Keppel Bay,

1.5 ml NW of South Keppel Island, 23°08'S 150°56'E, alive, 13–20 m (1 pr, C.372157); Keppel Bay, 1.5 ml NW of South Keppel Island, 23°09'S 150°57'E, dead, 13–20 m (1 v, C.372141); Keppel Bay, Humpty Island, 23°13'S 150°58'E, dead, 3.5 m (2 v, C.124012); Keppel Bay, 23°25'S 150°55'E, dead (1 pr, C.130887); Port Curtis, 23°55'S 151°23'E, dead (1 v, C.012050); Port Curtis, Hummock Hill Island, 24°01'S 151°28'E, dead (1 pr, C.069959); off Burnett Heads, 24°46'S 152°24'E, alive, 27–46 m (3 pr, C.097570; 6 pr, C.097572); Bargara, near Bundaberg, 24°49'S 152°28'E, (2 pr, alive, C.130888; 4 v, dead, C.130889); Hervey Bay, 25°06'S 152°49'E, alive, 18–27 m (3 pr, C.130890); Hervey Bay, off Picnic Point, 25°06'S 152°49'E, alive, 15 m (2 pr, C.097565); Hervey Bay, Frazer Island, Moon Point, 25°13'S 153°0'E, alive (1 pr, C.071651); Hervey Bay, Torquay, 25°17'S 152°52'E, dead (10 v, C.103804); Hervey Bay, Urangan, 25°17'S 152°54'E, alive (1 v, C.070049; 2 pr, C.071924; 2 pr, C.103801; 18 v, C.130891); Hervey Bay, Dundowran, 25°18'S 152°46'E, alive (2 pr, C.083154; 6 pr, C.097573; 3 v, C.372144); Hervey Bay, Dundowran Beach, 25°18'S 152°46'E, dead (2 v, C.372145); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (3 pr, C.097569); off Tin Can Bay, 25°50'S 153°27.5'E, alive (1 pr, C.062511); Moreton Bay, 27°15'S 153°15'E, dead (1 pr, C.303784); off S end of Stradbroke Island, 27°43'S 153°35'E, alive, 48–59 m (1 pr, C.372150); Moreton Bay, Stadbroke Island, Amity Point, alive (7 pr, WAM). **NEW SOUTH WALES:** SE of Yamba, 29°28'–29°33'S 153°30'–153°25'E, dead, 51–55 m (6 v, C.154253); Sydney Harbour, 33°51'S 151°14'E, 1 v, dead (C.060601). **WESTERN AUSTRALIA:** Dirk Hartog Island, SE corner, 26°04'S 113°12'E, dead, 4–7 m (1 v, WAM); Dirk Hartog Island, E side, Louisa Point, 25°43'S 113°15'E, dead, 18 m (4 v, WAM); Shark Bay, 10 mls W of Bernier Island, 24°52'S 112°58'E, alive, 73 m (1 pr, WAM); Shark Bay, Denham Sound, 25°43'S 113°15'E, alive, 16–18 m (1 pr, WAM); Shark Bay, approx. 25°30'E 113°30'E, alive (1 pr, WAM); Shark Bay, 26°07'S 113°25'E, alive (1 pr, C.119736); Shark Bay, Useless Loop, 26°08'S 113°25'E, dead (1 v, C.372154); Exmouth Gulf, off Exmouth, Town Beach, 21°57'S 114°07'E, dead, 10 m (1 v, WAM); Onslow, c. 10 mls NNW, 21°30'S 115°03'E, dead, 119 m (1 v, WAM); Dampier Archipelago, North Enderby Island, 20°36'S 116°30'E, dead, 16 m (1 v, WAM); Dampier Archipelago, Causeway Beach, 20°40.5'S 116°41.5'E, alive (1 pr, C.372158); ENE of Montebello Islands, 20°18'–16'S 116°01'E, alive (1 pr, WAM); North West Shelf, 26 n.ml NNE of Dampier, 20°14.6'S 116°50.9'–116°50.6'E, dead, 40–41 m (1 v, C.149897); North West Shelf, 44 n.ml NW of Port Hedland, 19°56.7'–19°56.9'S 117°53.6'–117°53.4'E, alive, 40 m (2 pr, C.372159); North West Shelf, 45 n.ml NNE of Port Hedland, 19°55.2'–19°55.6'S 117°56'–117°55.6'E, dead, 40 m (2 v, C.372093); 72 mls NW of Bedout Island, dead, 46 m (2 v, WAM); Dampier Archipelago, N of Rosemary Island, 19°47'–45'S 116°33'–35'E, dead, 60–64 m (1 v, WAM); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30.9'–19°28.2'S 118°49.2'–118°55.4'E, alive, 36–37 m (2 pr + 9 v, C.148705); North West Shelf, 76 n.ml NNE of Port Hedland, 19°04.9'–19°04.7'S 118°50.6'–118°50.8'E, dead, 81 m (1 v, C.148671); North West Shelf, 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (6 v, C.147423); 10–20 mls W of Lagrange Bay, dead, 22–46 m (1 v, WAM); c. 200 mls ENE of Troughton Island, dead, 64 m (2 v, WAM). **NORTHERN TERRITORY:** E of Darwin, Gun Point, dead (3 v, WAM); Clarence Strait, NW of Charles Point, 12°08'S 130°06.7'E, dead, 33 m (1 v, WAM); Arafura Sea, 10°13'S 133°58'E, dead, 72 m (1 v, C.129686); Arnhem Land, North West Crocodile Island, 11°42'S 135°10'E, dead (1 v, C.090470); Gulf of Carpentaria, Grootte Eylandt, 14°0'S 136°25'E, dead (4 v, C.372100).

**Description.** Shell up to c. 50 mm high, solid, inflated, many specimens pyxoid to more compressed, oblong, almost equally convex, almost equivalve and equilateral; left valve almost flat, right valve slightly more convex; auricles slightly unequal in shape and size, the anterior longer; umbonal angle 85–90°; left valve uniform cream, yellowish, pinkish or brownish, many specimens maculated with dots and streaks; right valve paler or whitish; interior of hinge plate dark brown, paler ventrally.

Both valves sculptured with 5–7 primary radial plicae, most specimens with 5; with a narrow, weak plica at anterior and posterior ends of disc; numerous fine, closely spaced secondary riblets on plicae and in interspaces in late growth stage. Closely spaced commarginal microsculpture on pre-radial and radial stages. Auricles with closely spaced commarginal microsculpture, on left valve with numerous radial riblets, on right valve fewer in number, weak or absent on some specimens. Dorsal margin straight. Byssal

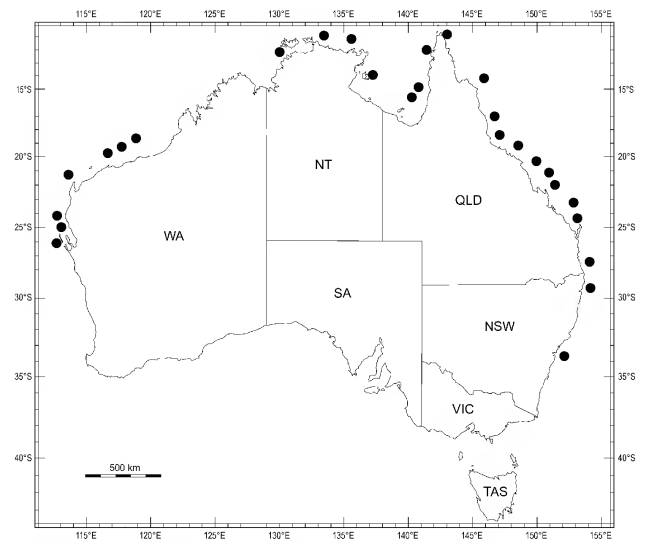


Figure 37. Distribution of *Decatopecten strangei* (Reeve).

notch, fasciole and functional ctenolium lacking. Intenal rib carinae prominent near ventral margin. Resilifer narrowly triangular. Hinge teeth consisting of weak resilial teeth and 3–7 prominent intermediate and dorsal teeth.

**Dimensions.** Illustrated specimen: QLD, Hervey Bay, Dundowran Beach (AM C.097573): rv: H 42.3, L 39.4 mm; lv: H 42.3, L 40.1 mm; D 12.4 mm.

**Habitat.** Juveniles byssally attached to clumps of oysters, adults free-living amongst clumps of oysters and sea grass (*Zostera*) on soft sediment in the littoral zone (sand or muddy sand).

**Distribution.** Restricted to Australia, from Dirk Hartog Island (Western Australia) northwards to the Northern Territory, eastwards to Torres Straits (northern Queensland) and southwards to Yamba, northern New South Wales. The single valve from Sydney Harbour, New South Wales (AM C.060601; Iredale, 1936: 269, pl. 20, fig. 3) was dredged from beneath the harbour floor and is possibly a fossil from a previous warm interglacial period. *Decatopecten strangei* does not occur in other areas of the Indo-West Pacific. The maximum living depth range is from intertidal to 73 m.

**Remarks.** *Decatopecten strangei* is closely allied to *D. plica* (Linnaeus, 1758), a common species from the tropical Indo-West Pacific. The two species can be more-or-less distinguished by the characters identified in Table 2. It is possible that the present species is only a southern geographical variant of *Decatopecten plica*, because their differences in shape, size and sculpture are weak.

Table 2. Characters distinguishing *Decatopecten plica* (Linnaeus) from *D. strangei* (Reeve).

characters	<i>Decatopecten plica</i>	<i>Decatopecten strangei</i>
size	up to 50 mm high	up to 45 mm high
shape	lv more inflated, compressed to swollen	lv flattened, commonly pyxoid
ribs	strongly variable (3–7), lower, narrower	rather constant (5), higher, broader
colour	strongly variable	less brightly coloured

***Excellichlamys Iredale, 1939***

*Excellichlamys* Iredale, 1939: 366. Type species (by original designation): *Pecten spectabilis* Reeve, 1853; Recent, unknown locality [(sub)tropical Indo-West Pacific].

**Diagnosis.** Small to medium-sized Decatopectinini with 9–12 radial plicae, elongate to subcircular, most species with large unequal auricles; with commarginal macro- and microsculpture, prominent noduliferous radial sculpture on auricles, short internal rib carinae, weak resilial hinge teeth (dorsal and intermediate teeth absent), byssal notch shallow, ctenolium obsolete to prominent.

**Distribution.** Miocene–Recent (Hayami, 1989: 15). Tropical Indo-West Pacific, living in the littoral to sublittoral zones amongst coral or coral rubble on soft sediment.

**Discussion.** Hertlein (1969: N366) treated *Excellichlamys* as a subgenus of *Semipallium* Lamy, 1928, placed in the *Decatopecten* group. However, *Excellichlamys* differs strongly in morphology from *Semipallium*, which has shagreen microsculpture and is placed in Pedini. Waller (1986: 40) raised *Excellichlamys* to a genus and placed it in Decatopectinini.

***Excellichlamys spectabilis* (Reeve, 1853)**

Figs 36D,F, 38E–F, 39

*Pecten parvus* G. B. Sowerby I, 1835: 110 (junior homonym of *P. parvus* da Costa, 1778); G. B. Sowerby II, 1842: 67, pl. 20, figs 227–228; Reeve, 1853: pl. 29, fig. 133.

*Pecten spectabilis* Reeve, 1853: sp. 128, pl. 29, fig. 128; Dunker, 1882: 241, pl. 11, figs 12–13; Küster & Kobelt, 1888: 61, pl. 16, fig. 3.

*Pecten histrionicus* Gmelin var. –Petit [de la Saussaye], 1853: 150, pl. 5, fig. 2.

*Pecten (Aequipecten) histrionicus* var. *spectabilis* Reeve. –Dautzenberg & Bavay, 1912: 22.

*Chlamys (histrionica* var.?) *spectabilis* (Reeve). –Kuroda, 1932: 95.

*Aequipecten histrionicus* var. *spectabilis* (Reeve). –Lamy, 1935: 314.

*Excellichlamys spectabilis* (Reeve). –Iredale, 1939: 366; Kuroda *et al.*, 1971: 366, pl. 79, figs 12–13; Waller, 1972a: 224, 225F, 227, 246–250, 247F, 248T, 25–259, pl. 5, figs 87–92; pl. 6, figs 93–102; Dijkstra, (1983–1994) 1987: 9, figs; Dijkstra, Drivas & Jay, 1998: 7, fig. 8; Dijkstra, 1991: 44; Slack-Smith & Bryce, 2004: 237; Dharma, 2005: 250, pl. 100, fig. 5; Raines & Poppe, 2006: 110–111, lower figs; pl. 55, figs 1–7; Dijkstra & Moolenbeek, 2008: 22; Huber, 2010: 198; Raines, 2010: 606, pl. 994, figs 1–4; Dijkstra, 2013: 38, pl. 8, figs 2a–d, pl. 9, figs 3a–b, pl. 26, figs 2a–b.

*Semipallium (Excellichlamys) xishaensis* Wang, 1985: 504, figs 4a–d.

*Semipallium spectabilis* (Reeve). –Wells & Slack-Smith, 1986: 54.

*Excellichlamys spectabilis parva* (Sowerby I). –Dijkstra, 1989: 2 (colour fig.), 14 (fig.), 15, 18.

*Excellichlamys sowerbyi* Dijkstra, 1998b: 247 (replacement name for *P. parvus* Sowerby).

*Excellichlamys histrionica* (Gmelin). –Xu & Zhang, 2008: 89, fig. 252 (misidentification).

**Type data.** *Pecten parvus* Sowerby: holotype (pr) NHMUK197011, refigured by Waller (1972a: pl. 6, figs 97–102). Type locality: French Polynesia, Tuamotu Archipelago, Actaeon Group, Lord Hood's Island (now Marutea), in coral sand on the reefs.

*Pecten spectabilis* Reeve: holotype (pr) UMZC.1461 (Jane Saul collection). Type locality unknown.

*Semipallium (Excellichlamys) xishaensis* Wang: holotype (pr) IOAS M25777. Type locality: China, South China Sea, Xishi Islands, Jinqing Island, intertidal, leg. F. Xu, 1 May 1958.

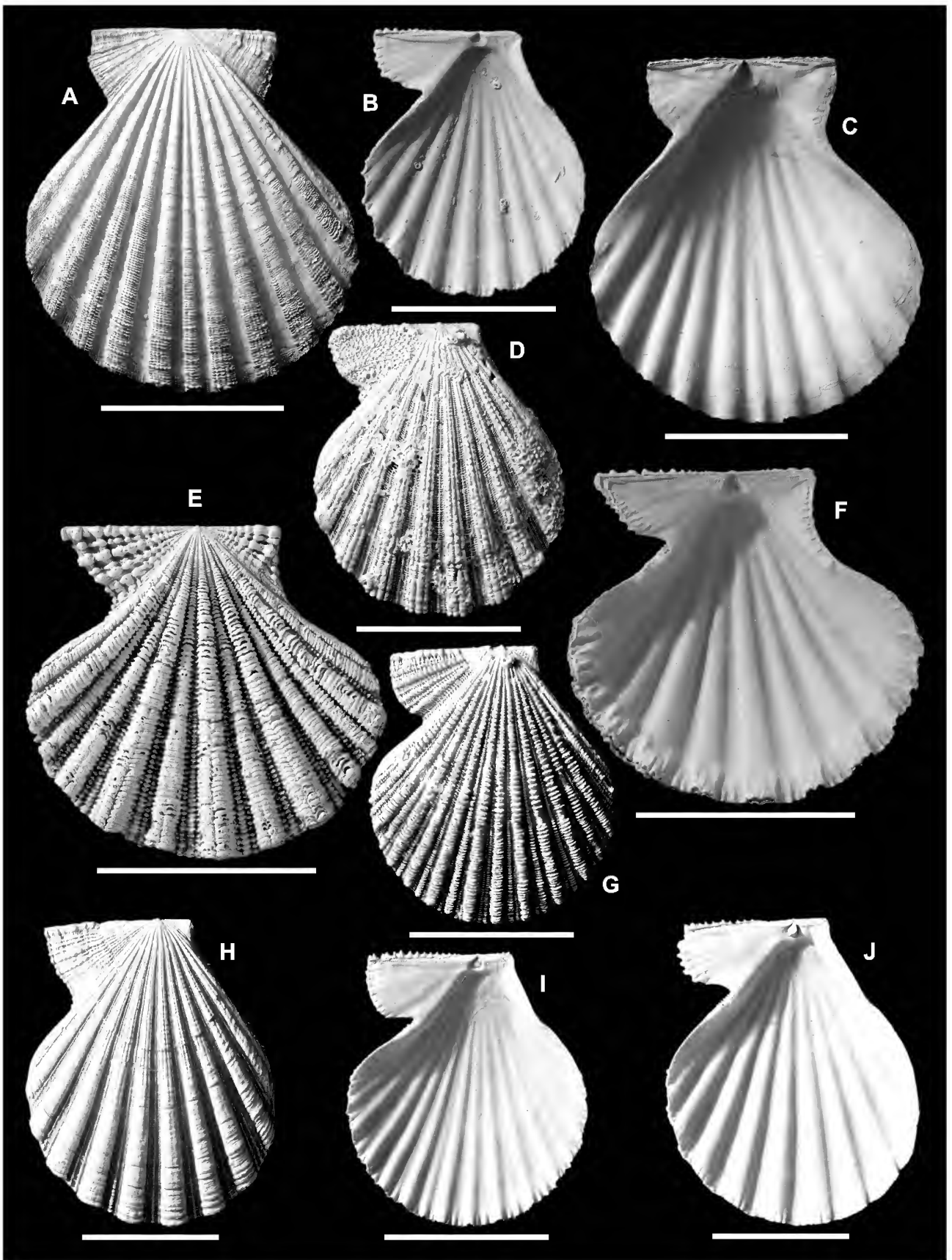
**Comments on type data.** A sample consisting of three articulated specimens (NHMUK, not registered) from Mauritius is similar to the holotype of *Pecten spectabilis* and could have come from the same lot as the Saul collection. According to labels written by S. Morris, these specimens have no type status.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Lizard Island, Casuarina Beach, 14°67'S 145°45'E, dead (2 v, ZMA Moll.142904); Townsville, “Yongala” wreck, 19°24'S 146°82'E, alive, 27 m (1 pr, photo T. C. Good, AM). WESTERN AUSTRALIA: Dampier Archipelago, Rosemary Island, Norbay, 20°31'S 116°35'E, dead, beach (1 v, WAM); Dampier Archipelago, NE side of Rosemary Island, Lady Dora Flats, approx. 20°29'S 116°35'E, alive (1 pr, WAM); Dampier Archipelago, Kendrew Island, 20°28.30'S 116°32'E, dead (1 v, WAM); Dampier Archipelago, Kendrew Island, N of Citadel, 20°28.30'S 116°32'E, dead (1 v, WAM); Rowley Shoals, Clerke Reef, approx. 17°10'S 119°20'E, dead, 9–18 m (1 v, WAM 1621.82); Kimberley, Doubtful Bay, Raft Point, 16°04'S 124°27'E, dead (1 v, WAM); Kimberley, Gibbings Reef, 15°56.05'S 123°46.05'E, dead (2 v, WAM); Kimberley, Macleay Island, 15°56.02'S 123°62.03'E, on reef, dead (1 v, WAM); Kimberley, Macleay Island, 15°56.02'S 123°42.03'E, dead, 30 m (10 v, WAM); Kimberley, E of Wilson Point, 15°33'S 124°25'E, dead, beach (1 v, WAM); Churchill Reef, 15°31'S 123°17'E, dead (1 v, WAM); Kimberley, Lucas Island, SW corner, 15°13'S 124°31'E, dead (1 v, WAM); Kimberley, Rob Roy Reef, 14°51.09'S 124°25.06'E, alive (1 pr, WAM); Kimberley, Wollaston Island, 14°29'S 125°30'E, dead (1 v, WAM); Descartes Island, 14°11'S 125°38'E, dead (1 v, WAM); Kimberley, W side of Long Reef, 13°58'S 125°38'E, dead (1 v, WAM); Kimberley, E of Montalivet Island, dead (1 v, WAM); Cassini Island, 13°56'S 125°38'E, dead (5 v, WAM); Cassini Island, 13°56'S 125°38'E, dead, 20 m (3 v, WAM); Cassini Island, 13°56'S 125°38'E, dead, 20–25 m (11 v, WAM); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 20–25 m (1 v, WAM); Hibernia Reef, 11°58'S 123°19'E, dead, 5 m (1 v, WAM). —RED SEA: Gulf of Aqaba, S of Elat, alive, 10–15 m (2 pr, ZMA Moll.142901). —MAURITIUS: alive, 32 m (1 pr, ZMA Moll.142910). —REUNION: Boucan-Canot, alive, 34 m (1 pr, ZMA Moll.142913). —THAILAND: Phuket Island, alive, 4–8 m (1 pr, ZMA Moll.140284); S Phuket Island, Kho Raya Ya, alive, 25–40 m (2 pr, ZMA Moll.143687); off Pangga, alive, 73 m (1 pr, ZMA Moll.140843). —JAPAN: Okinawa, Seragaki, alive, 38–43 m (1 pr, ZMA Moll.141431). HONG KONG: E Peng Chou, dead, 3 m (1 v, ZMA Moll.140541). —PHILIPPINE ISLANDS: Cebu, Mactan, Magellan Bay, alive, 120–180 m (2 pr, ZMA Moll.145520); Davao, Talikud Island, alive, 80–200 m (1 pr, ZMA Moll.144234). GUAM: off Orote Cliffs, alive, 21–25 m (5 pr, ZMA Moll.142918). —MARSHALL ISLANDS: Kwajalein Island, alive, 6 m (1 pr, ZMA Moll.142933); Majuro Atoll, alive, 2–5 m (1 pr, ZMA Moll.139736). CORAL SEA: North East Herald Cay, 16°56'S 149°11'E, dead, beach (8 v, C.331904). —NEW CALEDONIA: Nouméa, Channel Ilot Maître, alive, 20 m (1 pr, ZMA Moll.141322); Baie de Citron, alive, 1 m (1 pr, ZMA Moll.141454). —PAPUA NEW GUINEA: off Port Moresby, alive, 1–2 m (2 pr, ZMA Moll.142914). —SOLOMON ISLANDS: W Honiara, alive, 26–32 m (4 pr, ZMA Moll.142909); Russell Group, Pavuvu Island, Samata, alive, 6–12 m (1 pr, ZMA Moll.142907). —FIJI ISLANDS: Viti Levu, Beqa Island, alive, 9 m (2 pr, ZMA Moll.142930). —SAMOA ISLANDS: Tutuila Island, Fagasy Bay, dead, 22 m (1 pr, ZMA Moll.142932). —LINE ISLANDS: Christmas Island, Bay of Wrecks, alive, 10–18 m (1 pr, ZMA Moll.142925); Cook Isle, alive, 12 m (1 pr + 1 v, ZMA Moll.142927). —SOCIETY ISLANDS: Tahiti, alive, 32 m (1 pr, ZMA Moll.144604). —TUAMOTU ISLANDS: Hao Island, alive (1 pr, ZMA Moll.144615).

**Description.** Shell up to c. 30 mm high, most specimens to about 20 mm; solid, circular to slightly oblong, inequivalve, right valve more convex than left, equilateral, auricles unequal to almost equal in size, umbonal angle c. 90°; plicae unpigmented or pinkish, with brown maculations, interspaces paler, umbones tinted red; many specimens with prominent pink and brown maculations on alternate plicae; right valve paler; interior white.

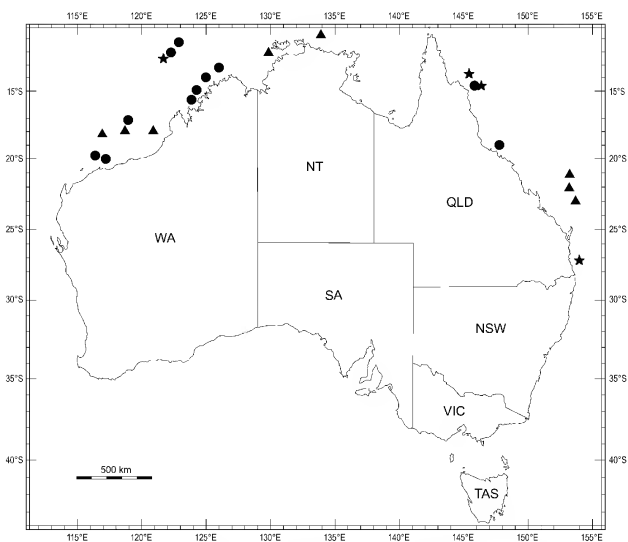
Both valves sculptured with c. 12 variable high plicae with rounded crests, bearing strongly developed recurved squamae; radial grooves with intercalated radial riblets commencing at about 10 mm shell height, increasing in prominence to ventral margin, subdividing plicae into bifid or trifid groups after about 20 mm shell height. Microsculpture of closely spaced commarginal lamellae on plicae and interspaces, weak on anterior auricle of left valve. Auricles with 4–10 radial costae (anterior 4–9, posterior 4–10), more prominent on dorsal areas than on lower areas of auricles near disc, crossed by prominent commarginal folds. Byssal notch





**Figure 38.** *A, C*, *Decatopecten radula* (Linnaeus), specimen in Fig. 36A, C; lv exterior (A), rv interior (C). *B, D, H, J*, *Glorichlamys quadriltrata* (Lischke) (B, D) specimen in Fig. 36B, E; rv interior (B), lv exterior (D); (H, J) pair, NTM P018368, Mandorah jetty, Cox Peninsula, W side Darwin Harbour, NT, 12°26.584'S 130°46.088'E, 9 m; lv exterior (H), rv interior (J). *E, F*, *Excellichlamys spectabilis* (Reeve), specimen in Fig. 36D, F; lv exterior (E), rv interior (F). *G, I*, *Glorichlamys elegantissima* (Deshayes), specimen in Fig. 36G–I; lv exterior (G), rv interior (I). Scale bars represent 50 mm (A, C), 10 mm (B, E, G–J), 20 mm (E, F).





**Figure 39.** Distribution of *Excellichlamys spectabilis* (Reeve) (circles), *Glorichlamys elegantissima* (Deshayes) (stars) and *G. quadrilirata* (Lischke) (triangles).

moderately deep, byssal fasciole rather wide, functional ctenolium with 3–5 teeth. Hinge teeth very weak or lacking. Hinge surface with minute, irregularly formed, transverse grooves. Internal plicae with carinate edges near margin.

**Dimensions.** Illustrated specimen: WA, N end of Flying Foam Passage, Dampier Archipelago, MV *Davena* (WAM S43979): H 30.7, L 32.5 mm.

**Habitat.** Living in the intertidal zone and on the continental shelf, byssally attached to undersides of coral slabs or amongst coral rubble on soft sediment (sand or muddy sand).

**Distribution.** Throughout the tropical Indo-West Pacific, from southern Japan to northern Australia, westwards into the Indian Ocean to Mauritius and Réunion, and eastwards across the central Pacific to the Tuamotu Archipelago. Red Sea, 4–15 m (Dijkstra & Knudsen, 1998: 58); Mauritius; Japan, 18 m; Philippines, 18–83 m (dead); Indonesia, Papua, 25–45 m; New Caledonia, 0.3–1.5 m; Fiji Islands; Palau Islands, 1–6 m; Marshall Islands; Tuamotu Archipelago (Waller, 1972: 249–250). Philippines, 19–90 m (Dijkstra, 2013: 38); Indonesia, 6–57 m (Dijkstra, 1991: 44); Papua New Guinea, 10–52 m (Dijkstra, 1998a: 20). Maximum depth range of live-taken specimens from the intertidal zone to c. 200 m. Present specimens from Australia alive at 27 m, dead at 5–30 m.

**Remarks.** Iredale (1939: 366) mentioned this species from the Great Barrier Reef, but did not specify the locality. Cotton

(1964: 10) listed a valve from Yirrkalla (NT). However, no live records are known from that region. The present material from Queensland and Western Australia resembles the holotype, although the auricles of Australian specimens are more unequal (typically almost equal in size) and they have more prominent intercostal radial riblets (typically almost without secondary riblets). Auricles and secondary interstitial radial riblets are highly variable in this species and intermediate variants are also observed.

Wang (1985: 504) described a species from Jinqing Island (China), *Semipallium (Excellichlamys) xishaensis*, which resembles *E. spectabilis* but has strongly unequal auricles (the posterior ones are rudimentary) and fewer primary radial plicae. This form is identical to the French Polynesian morph, *Pecten parvus* G. B. Sowerby I, 1835 (preoccupied by Da Costa (1778: 153), renamed by Dijkstra (1998b: 247) as *Excellichlamys sowerbyi*.

The tropical western Pacific species *Excellichlamys histrionica* (Gmelin, 1791) differs from *E. spectabilis* in lacking costae in the interspaces between plicae or in developing them weakly in the late growth stage. The plicae of most specimens are narrower and of even amplitude, and the interspaces are broader than in *E. spectabilis*.

### *Glorichlamys* Dijkstra, 1991

*Glorichlamys* Dijkstra, 1991: 45. Type species (by original designation): *Pecten elegantissimus* Deshayes in Maillard, 1863; Recent, Réunion.

**Diagnosis.** Small Decatopectinini, elongate to subcircular, with evenly to unevenly spaced radial plicae, undivided to quadripartite; widely spaced interstitial commarginal macrosculpture (microsculpture almost lacking), auricles very unequal in size, with antimarginal and commarginal sculpture; weak resilial hinge teeth present (dorsal and/or intermediate teeth absent); byssal notch deep, ctenolium well-developed. Internal plicae present; rib carinae almost absent, very short around ventral margin of some specimens.

**Distribution.** Miocene (Cox, 1927) to Recent. Tropical Indo-West Pacific, living in the littoral zone to on the continental shelf amongst coral rubble on soft sediment.

**Discussion.** For comparison of the present genus with *Gloripallium* Iredale, 1939, *Excellichlamys* Iredale, 1939, and *Bractechlamys* Iredale, 1939 see Dijkstra (1991: 45). The characters of the adult macrosculpture of *Glorichlamys* indicate a position in Decatopectinini. T. R. Waller (pers. comm. 2017) indicated to us that the microsculpture in early ontogeny suggests a position in Palliolinae, but we prefer to retain *Glorichlamys* in Decatopectinini.

### Key to species of *Glorichlamys* from Australia

- 1 Shell c. 20 mm high, circular to oblong, flattened to weakly inflated, 9–13 radial costae, 1–3 intercalated radial riblets, interstitial commarginal lamellae, byssal notch deep, byssal fasciole broad ..... *G. elegantissima*
- Shell with quadripartite radial costae ..... 2
- 2 Shell c. 25 mm high, subcircular to oblong, valves weakly inflated, radial costae quadripartite, byssal notch shallow, byssal fasciole narrow ..... *G. quadrilirata*

*Glorichlamys elegantissima*  
(Deshayes in Maillard, 1863)

Figs 36G–I, 38G,I, 39

- Pecten elegantissimus* Deshayes in Maillard, 1863: 32, pl. 4, figs 11–12.  
*Pecten (Chlamys) elegantissimus* Deshayes.–Bavay, 1903: 403, pl. 8, figs 5–7.  
*Pecten cooperi* E. A. Smith, 1903: 621, pl. 36, figs 15–18.  
 “*Chlamys*” *elegantissima* (Deshayes).–Dijkstra, (1983–1989) 1989: 12, figs; Carless, 1998: 7, figs.  
*Chlamys* s.l. *elegantissima* (Deshayes).–Dijkstra, Drivas & Jay, 1998: 6, fig. 4.  
*Chlamys (Chlamys) elegantissima* (Deshayes).–Rombouts, 1991: 11, pl. 24, fig. 1; Lamprell & Healy, 1998: 238, fig. 710.  
*Glorichlamys elegantissima* (Deshayes).–Dijkstra, 1991: 45, fig. 91; Dijkstra, (1983–1994) 1992: 6, 22, figs; Dijkstra, 1998a: 20, pl. 2, figs 5–6; Dijkstra & Kilburn, 2001: 279; Raines & Poppe, 2006: 116–117, upper figs; pl. 68, figs 1–3, 6–7; Dijkstra & Maestrati, 2010: 353, fig. 5E; Huber, 2010: 199, central fig.; Raines, 2010: 606, pl. 994, figs 5–6; Dijkstra, 2013: 39, pl. 10, figs 1a–d, 4a–b, pl. 26, figs 3a–b; Dijkstra & Maestrati, 2013a: 372.

**Type data.** *Pecten elegantissimus* Deshayes: repository of type material unknown; not in MNHN (P. Bouchet, pers. comm.) or in Université Lyon-1, where most of Deshayes’s collection is located. Type locality: Réunion. The specimen in ZMA (now in NBC) from Cap la Houssaie, Réunion, alive, 46 m (ZMA Moll.142222) is here designated the neotype of *Pecten elegantissimus* Deshayes, 1863.

*Pecten cooperi* Smith: Holotype (pr) NHMUK1903.9.17.47. Type locality: Maldives, Felidu Atoll, 1–35 fathoms [2–64 m].

**Additional material examined.** —AUSTRALIA: QUEENSLAND: No. 9 Ribbon Reef, SW end, 14°57'S 145°42.5'E, dead, 11 m (1 v, C.165154); No. 5 Ribbon Reef, 15°21'S 145°46'E, dead, 6 m (1 v, C.165155); Moreton Island, N of Cape Moreton, off NE side of Flinders Reef, 27°01'S 153°43'E, alive, 12–15 m (1 pr, NTM P054288). WESTERN AUSTRALIA: Serangapatam, NE corner, 13°38'S 122°05'E, dead, 20–25 m (1 v, ZMA Moll.146224); Serangapatam, NE corner, outside of reef, 13°37'S 122°05'E, dead, 16 m (1 v, ZMA Moll.146225). —MADAGASCAR: Tuléar, taphocoenose, alive, 26 m (1 pr, ZMA Moll.143631). —REUNION: Cap la Houssaie, alive, 46 m (1 pr, ZMA Moll.142222). —THAILAND: S of Phuket Island, Kho Raya Ya, alive, 26–40 m (9 pr, ZMA Moll.143692); Phuket Island, off Rawai, alive, 28–30 m (2 pr, ZMA Moll.139655). —JAPAN: Okinawa, Seragaki, alive, 45–60 m (2 pr, ZMA Moll.141482). —NEW CALEDONIA: Koumac, alive, 82–120 m (1 pr, 2 v, ZMA Moll.139676). —FIJI ISLANDS: Viti Levu, Mbengga Island, alive, 36 m (1 pr, ZMA Moll.143970). —LINE ISLANDS: Christmas Island, Cook Isle, alive, 12 m (1 pr, 1 v, ZMA Moll.142224). —SOCIETY ISLANDS: Tahiti, Tiarei, outside of lagoon, alive, 20 m (1 pr, ZMA Moll.144605). —TUAMOTU ISLANDS: Mataiva Island, outside of reef, alive, 24 m (1 pr, ZMA Moll.144616).

**Description.** Shell up to c. 20 mm high, most specimens moderately flattened, some specimens more inflated, with curved ventral margin, almost circular to oblong, inequivalve (ribbing of valves discrepant), inequilateral, auricles very unequal in shape and size, umbonal angle c. 90°; cream with pink or brown maculations, right valve paler.

Left valve with 9–13 prominent radial plicae and 1–3 intercalated secondary riblets, one of which is dominant, in each radial interspace. Plicae bearing irregular lamellae, slightly noduliferous on some specimens. Interspaces bearing commarginal lamellae. Anterior auricle much larger than posterior (c. 3:1), sculptured with 4–6 lamellate, noduliferous radial costae; posterior auricle almost smooth.

Right valve with 9–13 prominent radial plicae, subdivided into 3–4 lamellate secondary costae, interspaces each narrower than one costa, commarginal lamellate. Anterior

auricle with 5–7 noduliferous and/or lamellate radial riblets, less prominent than on left valve. Posterior auricle nodulous. Dorsal margin straight. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium with 3–5 teeth. Resilifer narrowly triangular, somewhat oblique. Very short, weak, internal rib carinae around ventral margin of some specimens.

**Dimensions.** Illustrated specimen: QLD, Moreton Island, N of Cape Moreton, off NE side of Flinders Reef, 27°01'S 153°43'E, 12–15 m (NTM P054288): H 16.8, L 14.7, D 5.6 mm.

**Habitat.** Living in the intertidal zone to on the continental shelf, byssally attached to undersides of coral slabs amongst live coral or amongst coral rubble on sand, most specimens covered with sponges, which match the sponges under the slabs.

**Distribution.** Throughout the tropical Indo-West Pacific, from the Ryukyu Islands, southern Japan, to northern Australia, westwards into the Indian Ocean to South Africa and Mozambique, and eastwards across the central Pacific to the Tuamotu Archipelago and the Austral Islands (Raines & Poppe, 2006: 116). South Africa, 8–250 m, dead; Mozambique, beach, dead; Réunion, 8–17 m, alive (Dijkstra & Kilburn, 2001: 279). Philippines, 12–19 m, 30–50 m (alive), 5–410 m (dead) (Raines, 2010: 606; Dijkstra, 2013: 39, 41); Indonesia, Borneo (Huber, 2010: 199), Flores Sea, 130–155 m, dead (Dijkstra, 1991: 45). Papua New Guinea, 30–35 m, dead (Dijkstra, 1998a: 21); New Caledonia, littoral to sublittoral (Dijkstra, 1992c: 7, 22); Vanuatu, 4–7 m (Dijkstra & Maestrati, 2012: 405); Tuamotu Archipelago, 285–890 m, dead (Dijkstra & Maestrati, 2013a: 373); Austral Islands, 212–470, dead (Dijkstra & Maestrati, 2010: 353). Maximum depth range of live-taken specimens is 4–120 m (unpublished data, HHD). Present specimens from Australia alive at 12–15 m.

**Remarks.** The present material closely resembles topotype specimens from Réunion (MNHN, HD), although the sculpture is more delicate (typical material has c. 10 prominent primary radial costae, present material 13) with more divided secondary radial riblets. Examined material from the Indo-West Pacific is strongly variable and intermediate variations are observed (MNHN, HD).

Smith (1903: 621) described the new species *Pecten cooperi* from the Maldives, but it is indistinguishable from *Glorichlamys elegantissima*. He probably overlooked Deshayes’s description of the right valve and Bavay’s subsequent description of the left valve, some time before his description of *Pecten cooperi*.

The following species, *Glorichlamys quadrilirata* (Lischke, 1870), is closely similar, with a similar distribution. It differs from *Glorichlamys elegantissima* in its quadri- or tripartite radial costae and more delicate commarginal sculpture.

*Glorichlamys quadrilirata* (Lischke, 1870)

Figs 36B,E, 38B,D,H,J, 39, 40A,E,G

- Pecten quadriliratus* Lischke, 1870: 29; Lischke, 1871: 158, pl. 9, figs 5–6; Dunker, 1882: 240; Küster & Kobelt, 1888: 136, pl. 37, figs 6–7; Paetel, 1890: 233; Pilsbry, 1895: 144; Yokoyama, 1924: 57, pl. 4, fig. 10.

*Pecten (Chlamys) quadriliratus* Lischke.—Dautzenberg & Bavay, 1912: 4.

*Chlamys quadrilirata* (Lischke).—Kuroda, 1932: 93; Lamy, 1935: 307; Kira, 1967: 136, pl. 49, fig. 6; Dharma, 2005, p. 248, pl. 99, fig. 8.

*Chlamys (Chlamys) quadrilirata* (Lischke).—Habe, 1951: 74; Azuma, 1960: 75.

*Bractechlamys quadrilirata* (Lischke).—Habe, 1977: 83; Wang, 1983b: 531, 533, pl. 1, figs 8–10; Hayami, 2000: 903, pl. 449, fig. 30; Xu & Zhang, 2008: 85, fig. 238.

“*Chlamys*” *quadrilirata* (Lischke).—Dijkstra, (1983–1989) 1989: 14, figs.

*Glorichlamys quadrilirata* (Lischke).—Dijkstra, 1991: 45; Dijkstra, (1983–1994) 1993: 10, figs; Dijkstra & Knudsen, 1998: 60, pl. 10, figs 46–47; Wang, 2002: 195; Raines & Poppe, 2006: 116–117, lower figs; pl. 68, figs 4–5; Dijkstra, 2013: 40, pl. 10, figs 2a–d, pl. 26, figs 4a–b.

*Glorichlamys elegantissima* (Deshayes in Maillard).—Huber, 2010: 199 (left and right figures; misidentification).

**Type data.** Repository of type material unknown (not found in the Löbbecke Museum and Aquazoo, Düsseldorf; Cosel, 1998: 28). Type locality: Nagasaki, Japan. The specimen in ZMA (now in NBC) from off Kyushu, Japan, alive, 85 m (1 pr, ZMA Moll.142768) is here designated the neotype of *Pecten quadriliratus* Lischke, 1870.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, E of Swain Reefs, 21°43'S 152°51'E, dead, 113 m (4 v, C.375138); SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (many v, C.151493); E of Lady Musgrave Island, 23°52.5'S–23°51.9'S 152°42.7'E–152°41.7'E, dead, 296 m (1 v, C.310694). WESTERN AUSTRALIA: 72 n.ml NNW of Dampier, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, dead, 110 m (1 v, C.165153); 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (7 v, C.165151); 85 n.ml NNW of Port Hedland, 19°00.8'S 118°01.3'E, dead, 112 m (3 v, C.165152). NORTHERN TERRITORY: Arafura Sea, c. 100 ml N of Croker Island, 9°30'S 132°34'E, dead, 124 m (3 v, C. 375141); Arafura Sea, c. 45 ml N of Croker Island, 10°17'S 132°38'E, dead, 65 m (2 v, C.375139); Arafura Sea, c. 250 ml NE of Croker Island, 8°09'S 134°50'E, dead, 115 m (3 v, C.375142); Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (4 v, C.375137); Cox Peninsula, 2.5 km E of Mandorah, 12°26.6'S 130°46.8'E, dead, 17 m (2 v, NTM P16279); W side Darwin Harbour, Cox Peninsula, Mandorah jetty, 9 m, 12°26.584'S 130°46.088'E, (2 pr, NTM P018368); Darwin, 12°27'S 130°50'E, dead (1 v, C.375140); Darwin area, Cullen Bay, dead (1 v, WAM12563, in part). —THAILAND: Phuket Island, Kho Raya Yai, alive, 25 m (1 pr, ZMA Moll.145611). —JAPAN: Kyushu, alive, 85 m (1 pr, ZMA Moll.142768). —CHINA: South China Sea, alive, 59 m (1 pr, ZMA Moll.142760). —PHILIPPINE ISLANDS: N Cebu, off Sogod, alive, 120–180 m (1 pr, ZMA Moll.142767). —INDONESIA: Banda Sea, off Ambon, alive, 80–92 m (1 pr, ZMA Moll.142755). —PAPUA NEW GUINEA: Milne Bay, dead, 24–32 m (1 v, ZMA Moll.142765). —NEW CALEDONIA: Pouébo, alive, 30–70 m (1 pr, ZMA Moll.142756). —FIJI ISLANDS: Viti Levu, Nadi Bay (Tomba Ko Nandi), 17°44'S 177°25'E, dead, 9–35 m (1 v, C.067848); Mbengga Island, alive, 37 m (1 pr, ZMA Moll.142758).

**Description.** Shell small, up to c. 25 mm high, subcircular (juveniles) to oblong (adult), inequivalve (ribbing discrepant), slightly inequilateral, both valves weakly inflated, interior plicate, umbonal angle c. 85–90°, auricles highly unequal in shape and size; left valve cream with purple or brown maculations, right valve paler or whitish.

Left valve sculptured with 8–10 prominent quadripartite (in mature individuals) radial plicae with rounded crests, with 1–3 intercalated radial riblets in each interspace. Microsculpture of closely spaced commarginal lamellae. Anterior auricle with 10–12 weakly to strongly developed radial riblets, lamellate and noduliferous on dorsal margin; posterior auricle very small, with few fine radial riblets.

Right valve with broad prominent quadripartite radial plicae, crests less rounded than on left valve; one interstitial radial riblet in each interspace. Microsculpture as on left valve. Anterior auricle with c. 10 squamose radial riblets. Byssal notch weak, byssal fasciole small, functional ctenolium with 4–6 teeth. Very weak, short, internal rib carinae present around ventral margin on some specimens.

**Dimensions.** Illustrated specimens: WA, northwest shelf, 80 nautical miles NNE of Port Hedland, 82 m, two unmatched valves (AM C.165151): rv: H 16.2, L 13.6 mm; lv: H 17.9, L 15.3 mm; NT, W side Darwin Harbour, Cox Peninsula, Mandorah jetty, 9 m, 12°26.584'S 130°46.088'E, pr (NTM P018368): H 22.4, L 17.8, D 6.8 mm.

**Habitat.** Living in the intertidal zone and on the continental shelf, amongst coral rubble on sand or muddy sand.

**Distribution.** Throughout the tropical Indo-West Pacific, from the Ryukyu Islands, southern Japan, to northern Australia, westwards into the Indian Ocean to the Red Sea and Malagasy Republic (MNHN), and eastwards into the central Pacific to Fiji (Raines & Poppe, 2006: 116); Japan, 5–50 m (Okutani, 2000: 903); Philippines, 25–30 (alive), 78–116 m (dead) (Dijkstra, 2013: 40); Vanuatu, 21–210 m, dead (Dijkstra & Maestrati, 2012: 405). Maximum depth range of live-taken specimens is 20–80 m (unpublished data, HHD). Present material from Australia alive at 9 m, dead at 17–296 m.

**Remarks.** The present material is indistinguishable from examined specimens from Japan (NSMT, HD) and from the original description by Lischke.

For comparison with the congeneric species *Glorichlamys elegantissima* see Dijkstra (1989: 12) and above. Both species seem to prefer a coral environment with a similar habitat, byssally attached to the underside of living coral or amongst dead coral rubble on sandy bottoms.

*Glorichlamys quadrilirata* is a new record for Australia.

## *Gloripallium* Iredale, 1939

*Gloripallium* Iredale, 1939: 357. Type species (by original designation): *Ostrea pallium* Linnaeus, 1758; Recent, Indonesia.

**Diagnosis.** Medium-sized Decatopectinini with 7–14 radial plicae; subcircular to circular; with prominent commarginal lamellae on plicae; secondary sculpture of radial riblets (lacking from some specimens); noduliferous radial macrosculpture on auricles, commarginal microsculpture on auricles and on disc in early growth stage of some specimens; internal rib carinae prominent; hinge with prominent dorsal teeth and weak resilial teeth; byssal notch deep, ctenolium well-developed.

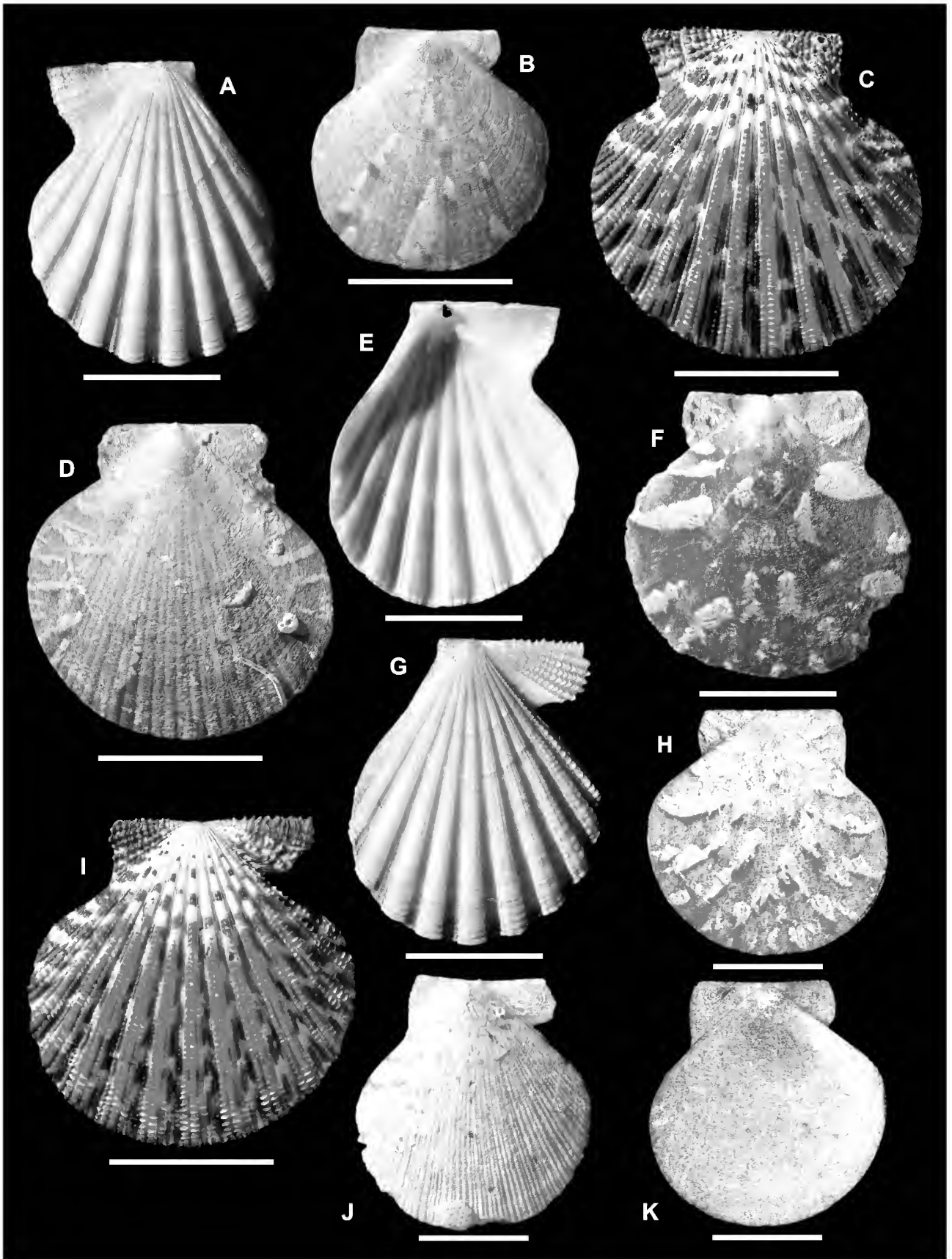
**Distribution.** Miocene–Recent (Hayami, 1989: 15). Tropical Indo-West Pacific, living in the littoral to sublittoral zones amongst coral on soft sediment.

**Discussion.** Hertlein (1969: N357) treated *Gloripallium* as a subjective junior synonym of *Cryptopecten* Dall, Bartsch & Rehder, 1938, a subgenus of *Chlamys* Röding, 1798, placed in the *Chlamys* group. Waller (1986: 40) recognized *Gloripallium* as a valid genus in Decatopectinini.

## *Gloripallium pallium* (Linnaeus, 1758)

Figs 40C,I, 41, 43A,C

*Ostrea pallium* Linnaeus, 1758: 697, no. 163; Linnaeus, 1764: 526, no. 107; Linnaeus, 1767: 1145, no. 193; Born, 1778: 84; Born, 1780: 101; Gmelin, 1791: 3322, no. 40; Dillwyn, 1817: 253; Dijkstra, 1999: 405, figs 2E–F, 3A–B [lectotype]; Dijkstra, 2016: 116, fig. 16.



**Figure 40.** *A, E, G*, *Glorichlamys quadrilvata* (Lischke), specimen in Fig. 38H, J, lv exterior (A), lv interior (E), rv exterior (G). *B, D, F, H, K*, *Juxtamusium coudeimi* (Bavay) (B, D) separate valves, AM C. 157660, NE of Cairns, GBR, QLD, 55 m, rv exterior (B), lv exterior (D); (F) lv only, AM C. 338776, Keeper Reef, off Townsville, GBR, QLD, 43 m, lv exterior; (H, K), pair, AM C. 075282, holotype of *Juxtamusium oblectatum* Iredale, Great Barrier Reef Exped. stn 16, 0.5 miles W of North Direction Isle, N QLD, 36.5 m, lv exterior (H), rv exterior (K). *C, I*, *Gloripallium pallium* (Linnaeus), pair, AM C. 132081, Low Isles, GBR, QLD; lv exterior (C), rv exterior (I). *J*, *Juxtamusium maldivense* (Smith), rv only, AM C. 165160, off S end of Fraser Island, QLD, 73 m, rv exterior. Scale bars represent 10 mm (A, B, D–H, J, K), 30 mm (C, I).

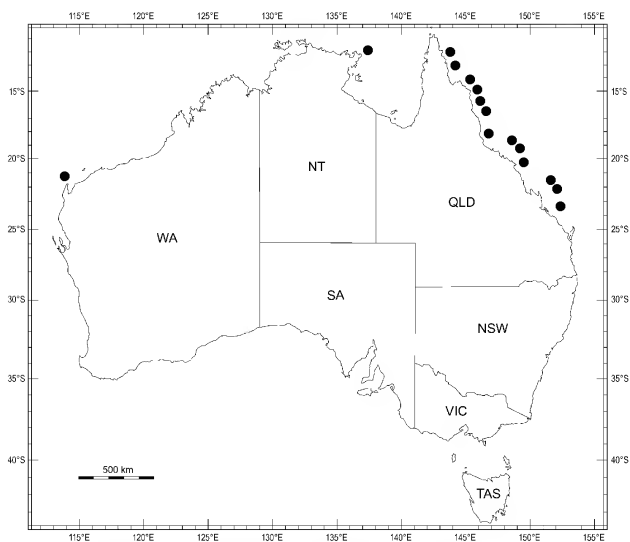


Figure 41. Distribution of *Gloripallium pallium* (Linnaeus).

*Pecten pallium* (Linnaeus).—Bruguière, 1797: pl. 210, figs 1a–b; Lamarck, 1819: 170; Bosc, 1824: 262; Defrance, 1825: 242; Deshayes, 1832a: 721, no. 18; G. B. Sowerby II, 1842: 73, pl. 17, figs 148–150; Chenu, 1843: 7, pl. 26, figs 1, 1a–c, 3–5c; Reeve, 1853: sp. 63, pl. 17, figs 63a–c; Küster & Kobelt, 1888: 39, 103, pl. 11, figs 1, 5, pl. 28, figs 7–8, pl. 29, fig. 1.

*Chlamys pallium* (Linnaeus).—Röding, 1798: 163, no. 102; Dautzenberg & Bouge, 1933: 427; Wells & Slack-Smith, 1986: 54.

*Pectinium pallium* (Linnaeus).—Link, 1807: 156.

*Pecten novaeguinae* Tenison Woods, 1878b: 267.

*Pecten (Aequipecten) pallium* (Linnaeus).—Dautzenberg & Bavay, 1912: 19; Oostingh, 1925: 254; Adam & Leloup, 1939: 59.

*Gloripallium pallium* (Linnaeus).—Iredale, 1939: 357; Kira, 1962: 140, pl. 50, fig. 10; Waller, 1972a: 239, pl. 3, figs 45–56; Mastaller, 1979: 140; Dijkstra, (1983–1994)1984: 17, figs; Springsteen & Leobrer, 1986: 328, pl. 93, fig. 9; Mastaller, 1987: 210; Dijkstra, 1989: 14, 18, figs; Dijkstra *et al.*, 1989: 24; Dijkstra *et al.*, 1990: 3; Rombouts, 1991: 42, pl. 15, figs 4–4a; Dharma, 1992: 84, pl. 20, fig. 18; Lamprell & Whitehead, 1992: [26], pl. 11, fig. 67; Bernard *et al.*, 1993: 50; Dijkstra, 1997: 316, 328, figs 28–31, 32; Dijkstra, Drivas & Jay, 1998: 7, fig. 9; Dijkstra & Knudsen, 1998: 63, pl. 10, figs 48–49; Hayami, 2000: 903, pl. 449, fig. 33; Wang, 2002: 218, pl. 4, fig. 1; Slack-Smith & Bryce, 2004: 237; Dharma, 2005: 250, 364, pl. 100, fig. 8; pl. 147, figs 11a–d; Raines & Poppe, 2006: 118–119, lower figs; pl. 70, figs 1–6; pl. 71, figs 1–6; pl. 72, figs 1–5; pl. 294, figs 1–5; Dijkstra & Moolenbeek, 2008: 23; Xu & Zhang, 2008: 89, fig. 249; Huber, 2010: 200; Raines, 2010: 608, pl. 995, figs 1–5; Dijkstra, 2013: 42, pl. 10, figs 3a–d, pl. 27, figs 1a–b.

*Chlamys (Cryptopecten) pallium* (Linnaeus).—Hertlein, 1969: N357, fig. C.79: 1c; Dijkstra, 1990a: 9, 12.

*Cryptopecten pallium* (Linnaeus).—Abbott & Dance, 1982: 309, fig.

*Gloripallium pallium pallium* (Linnaeus).—Dijkstra, 1991: 46; Dijkstra, 1998a: 21.

*Gloriapallium [sic] pallium* (Linnaeus).—Higo *et al.*, 1999: 445.

*Chlamys (Gloripallium) pallium* (Linnaeus).—Wells, Slack-Smith & Bryce, 2000: 42.

**Type data.** *Ostrea pallium* Linnaeus: lectotype (pr) LSL [not registered], 3 (lv + 2 rv) paralectotypes LSL [not registered], 2 (pr + rv) possible paralectotypes (pr) UUZM [not registered], paralectotype MSNP [not registered], designated by Dijkstra (1999: 406). Type locality: “Habitat in *O. australiore* & *Indico*”. Restricted to the Moluccas [Maluku], Indonesia, by Dijkstra (1999: 406).

*Pecten novaeguinae* Tenison Woods: holotype not traced in Tasmanian Museum and Art Gallery, Hobart [Kemp, pers. comm.]. Type locality: Pleistocene, Hall Sound, Papua New Guinea.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Darnley Island, 9°35'S 143°46'E, dead (1 v, C.051519); Torres Strait, Yorke Island, 9°44'S 143°25'E, dead, beach (1 v, C.104431); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (4 v, C.029791); GBR, Eel Reef, N end, 12°24'S 143°22'E, dead, 4–8 m (5 v, C.138390); GBR, No. 8 Sand Cay, N side, 13°21'S 143°57'E, dead, 15 m (1 v, C.157600); No 8. Sand Cay, N side, 13°21'S 143°57'E, dead, 4–21 m (4 v, C.336911); Reef 13-074, N end, 13°28'S 144°02'E, dead, 4–14 m (1 pr, C.133576); Reef 13-074, 13°29'S 144°02'E, dead, 7–10 m (3 v, C.336910); Reef 13-119, NW-tl, 13°40'S 144°09'E, dead, 3–6 m (1 pr, C.336912); No. 5 Sandbank Reef (13-120), SW end, 13°45'S 144°16'E, dead, 8–10 m (1 v, C.138338); Jewell Reef, 14°24'S 145°24'E, dead, 15–16 m (1 v, C.153304); Lizard Island, Granite Bluff, 14°39'S 145°27'E, dead, 15 m (4 v, C.338426); Lizard Island, North Point, 14°39'S 145°27'E, alive, 1.5–7.5 m (3 pr, C.344031); Lizard Island, off Crystal Beach point, 14°39'S 145°28'E, alive, 0–9 m (1 pr, C.338425); Macgillivray Cay, NW side, 14°39'S 145°29'E, dead, 9–15 m (7 v, C.138398); Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29'E, dead, 6–17 m (2 v, C.336913); Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29'E, dead, 1–2 m (1 v, C.336918); Lizard Island, Rocky Point, 14°40'S 145°26'E, dead, 6–9 m (1 pr, C.105505); Lizard Island, off Pebble Beach, 14°40'S 145°26'E, dead, 1–8 m (1 pr, C.108946); Lizard Island, Watsons Bay, N end, 14°40'S 145°27'E, alive, 0–2 m (1 pr, C.344027); Lizard Island, 14°40'S 145°28'E, dead (2 v, C.008624; 1 v, C.008625; 2 v, C.041562); GBR, No Name Reef, SW end, 14°40'S 145°39'E, dead, 15–20 m (2 v, C.153125); Lizard Island, between Palfrey Island & Freshwater Beach, 14°41'S 145°27'E, dead, 1 m (1 v, C.338427); Lizard Island, Bommie No. 2, 14°41'S 145°28'E, lagoon, dead, 9–12 m (3 v, C.104433); Lizard Island, W & NW of Bird Islet, 14°41'S 145°28'E, dead, 2–14 m (1 v, C.338422); Lizard Island, Bird Islet, 14°41'S 145°28'E, dead, 0–24 m (3 v, C.338423); W of Lizard Island, Eyrie Reef, 14°42'S 145°23'E, dead, 3–11 m (1 v, C.338424); Lizard Island, South Island, 14°42'S 145°27'E, alive, 0.5–18 m (1 v, C.105191; 4 v, C.336917; 2 v, C.123339; 1 pr, C.344028); No. 10 Ribbon Reef, SW end, 14°56'S 145°42'E, dead, 8–10 m (1 v, C.138327); No. 7 Ribbon Reef, NW end, 15°08'S 145°44'E, alive, 6–15 m (1 pr, C.338428); Ruby Reef, NW side, 15°44'S 145°47'E, dead, 9–18 m (1 v, C.338429); N of Cairns, Opal Reef, 16°15'S 145°50'E, dead, 27 m (2 v, C.095925); Low Isles, 16°23'S 145°34'E, dead (2 v, C.119680); Low Isles, 16°23'S 145°34'E, alive (1 pr, C.132081); Michaelmas Cay, 16°36'S 145°59'E, dead (1 v, C.053650); Euston Reef, SW side, 16°40'S 146°13'E, dead, 21 m (1 v, C.336915); Euston Reef, SW side, 16°40'S 146°13'E, alive, 21–29 m (1 pr, C.344032); Green Island, 16°46'S 145°58'E, dead (1 v, C.336916); off Cairns, Fitzroy Island, 16°56'S 146°0'E, alive (1 pr, C.083779); Family Islands, Dunk Island, 17°57'S 146°10'E, dead (1 v, C.132083); Hinchinbrook Channel, 18°15'S 146°03'E, alive, 18 m (1 pr, C.097579); off Townsville, 18°30'–19°30'S 146°30'–147°30'E, alive (2 pr, C.303765); Palm Islands, Orpheus Island, 18°38'S 146°30'E, dead (1 v, C.132087); Palm Islands, 18°40'S 146°33'E, dead (2 v, C.010051); NE of Townsville, Wheeler Reef, N side, 18°46'S 147°31'E, alive, 11 m (1 pr, C.112042); Wheeler Reef, SE side, 18°46'S 147°31'E, dead (1 pr, C.338430); Wheeler Reef, 18°46'S 147°31'E, alive, subtidal (1 pr, C.338447); Wheeler Reef, 18°46'S 147°31'E, dead, subtidal (2 pr, C.338448); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, dead, sublittoral (2 pr, C.104781); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, subtidal (3 pr, alive, C.338435; 1 pr, dead, C.338438; 4 pr, alive, C.338439); Broadhurst Reef, 18°59'S 147°73.3'E, subtidal (1 pr, alive, C.338440; 1 pr, alive, C.338441; 1 pr, alive, C.338443; 1 pr, alive, C.338444; 1 pr, dead, C.338445); Broadhurst Reef, 18°59'S 147°73.3'E, alive, sublittoral (2 pr, C.338442); Bowden Reef, 19°02'S 147°56'E, alive, sublittoral (1 pr, C.338434); off Bowen, Holbourne Island, 19°44'S 148°22'E, dead (2 v, C.067153); Whitsunday Group, Daydream [West Molle] Island, 20°15'S 148°48'E, dead (2 v, C.336914); GBR, Creal Reef Cay, 20°32'S 150°22'E, dead, beach (2 v, C.203246); Creal Reef Cay, 20°32'S 150°22'E, dead (3 v, C.203247); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 4–10 m (1 v, C.161835; 1 pr, C.336904); Swain Reefs, Reef 21-182, 21°22'S 151°41'E, dead, 10 m (1 v, C.336905); Swain Reefs, Mystery Reef, 21°23'S 152°01'E, dead, 10 m (1 v, C.161819); Swain Reefs, Reef 21-189, 21°27'S 151°41'E, dead, 3 m (1 v, C.146429); Swain Reefs, Reef 21-189, 21°27'S 151°41'E, dead, 9–10 m (1 v, C.148131); Swain Reefs, Reef 21-468, NW side, 21°30'S 152°25'E, dead, 10–14 m (1 v, C.161811); Swain Reefs, Thomas Cay, 21°36'S 152°21'E, dead, intertidal (3 v, C.319185); Swain Reefs, 3 km NE of W side of Gillett Cay, 21°42'S 152°26'E, dead, 64–73 m (2 v, C.336906); Swain Reefs, Gillett Cay, 21°43'S 152°25'E, dead, intertidal (2 v, C.336909); Swain Reefs, Big Sandy Cay (21-465), 21°48'S 151°52'E, dead, 9 m (1 v, C.097575); Swain Reefs, Sanctuary Reef, 22°03'S 152°40'E, dead, 6–14 m (2 v, C.143896); Swain Reefs, Sanctuary Reef, 22°04'S 152°40'E, dead, 1 m (1 v, C.144120); Swain Reefs, Capre Cay, 22°09'S 152°46'E, dead, intertidal (1 v, C.336908); Swain Reefs, 22°12'S 152°37'E, dead, 7–19 m (1 v, C.143142); Swain Reefs, 22°12'S 152°37'E, alive, 7–19 m (1 pr, C.336907); Swain Reefs, Howards Patches, 22°23'S 152°37'E, dead, 9–12 m (1 v, C.142722); Capricorn Group, Tryon Island, 23°15'S



151°47'E, dead (3 v, C.103810); Capricorn Group, Wilson Island, 23°18'S 151°57'E, dead (1 v, C.119681); Capricorn Group, North West Island, 23°18'S 151°42'E, dead (3 v, C.132085); Capricorn Group, Masthead Island, 23°32'S 151°45'E, dead (1 v, C.018933); Bunker Group, Fairfax Island, 23°51'S 152°22'E, dead (26 v, C.319186). **WESTERN AUSTRALIA:** Exmouth, 21°56'S 114°09'E, alive, 5 m (1 pr, C.091991). **NORTHERN TERRITORY:** Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (4 v, C.061321). —**MARIANA ISLANDS:** Guam, Apra Harbour, 13°27'N 144°38'E, dead (7 v, C.338451). —**PAPUA NEW GUINEA:** New Ireland, Kavieng, 2°34'S 150°48'E, dead (1 v, C.102075); Trobriand Group, Kuia Island, 8°37'S 150°51'E, dead (2 v, C.321627); Samarai, 10°37'S 150°40'E, dead (8 v, C.338433). —**SOLOMON ISLANDS:** Choiseul Island, Wagina [= Vaghena] Island, 7°26'S 157°46'E, dead (1 v, C.095820); W coast Malaita Island, S of Aoki [= Auki], Laulasi Island, 8°52'S 160°44'E, exposed reef flats, dead (2 v, C.321619); Guadalcanal, Honiara, beaches W of Point Cruz, 9°25'S 159°56'E, dead, beach (1 v, C.116254). **VANUATU:** Eromanga Island, 18°48'S 169°05'E, dead (2 v, C.005352). —**NEW CALEDONIA:** Loyalty Islands, Ouv'a, 20°35'S 166°35'E, dead (1 v, C.116808); Nouméa, Ile Ste. Marie, 22°18'S 166°29'E, alive (1 pr, C.321631). **CORAL SEA:** Holmes Reef, 16°30'S 147°47'E, dead (2 v, C.319189); North East Herald Cay, 16°56'S 149°11'E, dead (7 v, C.203248); North East Herald Cay, 16°56'S 149°11'E, dead (4 v, C.319188); E of Cairns, Lihou Reef, 17°25'S 151°40'E, dead, beach (1 v, C.319187); Marion Reef, Carola Cay, 19°07'S 152°23'E, dead (4 v, C.203245); North Bellona Shoals, 20°49'S 158°29'E, alive (1 pr, C.344029); Saumarez Reef, 21°50'S 153°39'E, dead, 12–15 m (1 pr, C.142148); Wreck Reef, West Island, 22°12'S 155°10'E, dead (1 v, C.141775). —**FJI ISLANDS:** Viti Levu, Nadi Bay, 16°57'S 178°47'E, dead, 9–35 m (1 pr, C.067576). —**REP. OF KIRIBATI:** Line Islands, Malden Island, 4°0'S 155°0'W, dead (1 pr, C.097578); Line Islands, Malden Island, 4°0'S 155°0'W, dead (7 pr, C.338453).

For other regional data see Waller (1972a: 242).

**Description.** Shell up to 90 mm high, most specimens c. 60 mm; solid, inflated, circular, equivalve, equilateral, auricles unequal in shape and size, umbonal angle c. 90–95°; vividly coloured with highly variable blotches and/or bands of red, yellow, purple, maroon or brown; interior whitish with orange or purple near margins and on auricles.

Both valves with 12–15 primary radial plicae, most specimens with 13 (somewhat narrower on left valve than on right), and 2–4 secondary riblets on crests of plicae (3 on most specimens; lacking near anterior and posterior margins) and in radial interspaces. Commarginal lamellae on plicae in early growth stages (also in adult stage of *G. speciosum* form), plicae becoming more tripartite near ventral margin. Auricles with 3–6 squamous or nodulous radial costae. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium with 3–6 teeth. Resilifer narrowly triangular. Marginal auricular gape present between auricular crura. Resilial teeth weak, dorsal and intermediate teeth prominent. Inner surface plicate, with short, prominent internal rib carinae around ventral margin.

**Dimensions.** Illustrated specimen: QLD, GBR, Low Isles (AM C.132081): rv and lv both H 59.7, L 60.3 mm; D 23.0 mm.

**Habitat.** Living in the intertidal to the outer continental shelf, byssally attached to coral slabs or to rubble under slabs, a few specimens found amongst small rocks and rubble on steep slopes. Adults appear to be able to move to the open water area at night to feed and then move back into the rubble pile during the day.

**Distribution.** Throughout the tropical Indo-West Pacific (except the Red Sea and the Hawaiian Islands) from southern Japan to northern Australia, westwards into the Indian Ocean to South Africa and Mozambique, and eastwards into the eastern central Pacific to the Marquesas Islands and Tuamotu Archipelago (Waller, 1972: 242–243; Raines & Poppe, 2006: 118); Mozambique, South Africa, 60–75 m (dead) (Dijkstra & Kilburn, 2001: 280–281); Red Sea to Japan, 1–45 m (Huber, 2010: 200); Philippines, 4–100 m (alive, minimum depth range) (Dijkstra, 2013: 43); Indonesia, 6–25 m (Dijkstra, 1991: 46–47); Papua New Guinea,

20–25 m (Dijkstra, 1998a: 21); Vanuatu, 3–60 m (Dijkstra & Maestrati, 2012: 405–406); Society Islands, 385–830 m, dead (Dijkstra & Maestrati, 2013a: 373). Maximum depth range of live-taken specimens is from the intertidal zone to c. 150 m (unpublished data, HHD). Present specimens from Australia alive from the intertidal zone to 29 m.

**Remarks.** The present specimens are indistinguishable from the type material and the sculpture is rather constant, except for the lamellae on the radial plicae. Most deep-water specimens have undivided plicae and strongly developed commarginal lamellae in the adult stage (*speciosum* morph), treated by Waller (1972a: 241) as an intrapopulation variant, whereas shallow-water specimens have delicate, subdivided lamellae in late ontogeny (*pallium* morph) (see Dijkstra & Kilburn, 2001: 281). We here follow Raines & Poppe (2006: 118–123) and Dijkstra (2013: 42–43), who maintained the *pallium* and *speciosum* forms as separate species.

*Gloripallium speciosum* (Reeve, 1853), known from throughout the tropical Indo-West Pacific (except the Red Sea and the Hawaiian Islands) differs from the present species mainly by having strongly developed, undivided commarginal lamellae on the radial ribs (divided into three rows of lamellae on each radial rib in *G. pallium*), by having more prominent nodules and lamellae and fewer riblets on the auricles, by having generally slightly fewer ribs (*G. speciosum* 10–11, *G. pallium* 12–13), and in size (*G. speciosum* up to 60 mm, *G. pallium* up to 90 mm in height). We have not seen specimens from Australia.

For comparison with *Gloripallium spiniferum* (G. B. Sowerby I, 1835) from French Polynesia and *Gloripallium maculosum* (Forsskål, 1775) from the Red Sea, see Dijkstra & Kilburn (2001: 281).

## *Juxtamusium* Iredale, 1939

*Juxtamusium* Iredale, 1939: 368. Type species (by original designation): *Juxtamusium oblectatum* Iredale, 1939 (= *Pecten (Chlamys) coudeini* Bavay, 1903); Recent, 0.5 miles W of North Direction Isle, QLD, in 20 fathoms [37 m].

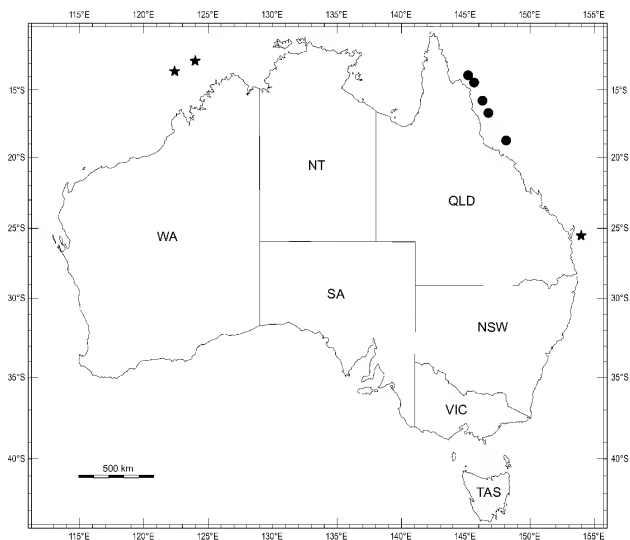
**Diagnosis.** Small, thin-shelled, subcircular to circular Decatopectinini with depressed, unevenly to evenly spaced, low radial costae; narrowly spaced, delicate commarginal microsculpture throughout ontogeny; resilifer oblique, strongly erect on one side, strong internal hinge ligament, hinge plate very flat, lacking crura or denticles; ctenolium on both valves (see Waller, 1984: 211), byssal notch shallow.

**Distribution.** Early Miocene–Recent [*Juxtamusium pseudojamviniensis* (Eames & Cox, 1956: 41), early Miocene, Zanzibar; Waller (2006a) agreed that this belongs in *Juxtamusium*]. Tropical Indo-West Pacific, living in the littoral to sublittoral zones amongst coral rubble on soft sediment.

**Discussion.** Hertlein (1969: N357) treated *Juxtamusium* as a subgenus of *Chlamys* Röding, 1798 in the *Chlamys* group. Waller (1986: 40) raised *Juxtamusium* to a genus in Decatopectinini.

**Key to species of *Juxtamusium* from Australia**

- 1 Shell c. 32 mm high, circular, thin, lv almost flat, rv weakly inflated, auricles subequal, obsolete evenly spaced radial lirae, byssal notch and fasciole lacking ..... *J. coudeini*
- Shell with unevenly spaced radial riblets ..... 2
- 2 Shell c. 25 mm high, circular, thin, lv almost flat, delicate unevenly spaced numerous radial riblets, byssal notch and fasciole weak or lacking ..... *J. maldivense*



**Figure 42.** Distribution of *Juxtamusium coudeini* (Bavay) (circles) and *J. maldivense* (Smith) (stars).

***Juxtamusium coudeini* (Bavay, 1903)**

Figs 40B,D,F,H,K, 42, 43B,E–F,H

*Pecten (Chlamys) coudeini* Bavay, 1903: 401, pl. 8, figs 3–4; Bavay, 1904a: 206; Dautzenberg & Bavay, 1912: 17.

*Juxtamusium oblectatum* Iredale, 1939: 368, pl. 5, figs 27–27a; Waller, 1972a: 250, 252, 254, pl. 8, figs 128–133, 135.

*Chlamys (Juxtamusium) oblectata* (Iredale).—Hertlein, 1969: N357, fig. C. 80.4a–b.

*Juxtamusium coudeini* (Bavay).—Waller, 1984: 211; Dijkstra, (1983–1989) 1984: 8, figs; Dijkstra, (1983–1994) 1985: 10, figs; Dijkstra, 1990: 3, figs; Dijkstra, 1998a: 22; Dharma, 2005: 250, pl. 100, fig. 9; Raines & Poppe, 2006: 124–125, lower figs; pl. 74, figs 2, 4, 6–7; Huber, 2010: 200; Raines, 2010: 608, pl. 995, figs 12, 14–15; Dijkstra, 2013: 44, pl. 11, figs 3a–d, pl. 27, figs 2a–b.

**Type data.** *Pecten (Chlamys) coudeini* Bavay: holotype (pr) KBIN IG10591. Type locality: New Caledonia.

*Juxtamusium oblectatum* Iredale: holotype (pr) AM C.075282 (Fig. 40H, K). Type locality: Australia, N QLD, 0.5 miles W of North Direction Isle, 36.5 m (Great Barrier Reef Expedition stn 16).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, E of Snake Reef, 14°29'S 145°03'E, dead, 24 m (1 v, C.119793); Lizard Island, Granite Bluff, 14°39'S 145°27'E, dead, 23 m (3 v, C.338775); Lizard Island, Watsons Bay, 14°40'S 145°27'E, alive, 12 m (1 pr, C.343927); 0.5 ml SE of Lizard Island, 14°41'S 145°29'E, dead, 35 m (1 v, C.157730); 05. ml W of North Direction Isle, 14°45'S 145°30'E, 36 m (1 pr, alive, C.075282; 3 v, dead, C.157731); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (7 v, C.027533); N of Cairns, 16°33'S 146°09'–146°09.6'E, dead, 55 m (3 v, C.157660); Michaelmas Cay, 16°36'S 145°59'E, dead (4 v, C.119792); off Townsville, 6–7 mls E of Keeper Reef, 18°45'S 147°23'E, dead, 43 m (1 v, C.338776). —PHILIPPINE ISLANDS: Bohol, Calituban Island, alive, 20–30 m (1 pr, ZMA Moll.139895). —INDONESIA:

Moluccas, Ambon, alive, 23 m (1 pr, ZMA Moll.142178). —PAPUA NEW GUINEA: New Britain, Rabaul Harbour, Matupi Island, 4°14'S 152°12'E, subfossil beach grit, dead (1 v, C.338777). CORAL SEA: Chesterfield Islands, alive, 62 m (2 pr, ZMA Moll.142175). —NEW CALEDONIA: Daomboui Island, Poum Bay, 20°09'S 163°59'E, alive, 0–3 m (1 pr, C.344033); off Nouméa, Ile Signal, 22°21'S 166°26'E, alive, 3 m (1 pr, C.303780). VANUATU: Efate Island, Vila Harbour, 17°44'S 168°18'E, alive (3 pr, C.097421); off Aneityum Island, 20°17'S 169°48'E, alive, 55–75 m (1 pr, C.343928). —FIJI ISLANDS: Viti Levu, Nadi Bay [Tomba Ko Nandi], 17°44'S 177°25'E, alive, 9–35 m (1 pr, C.338778).

For other locality data see Waller (1972a: 254 [as *Juxtamusium oblectatum*]).

**Description.** Shell small, up to 32 mm high, most specimens c. 20 mm; rather thin, circular to ovate, flattened (left valve almost flat, right valve weakly inflated), inequivalve, almost equilateral, auricles unequal in shape and size, umbonal angle c. 85–95°; left valve brightly coloured with white, red, yellowish or brown blotches, right valve paler.

Both valves sculptured with almost obsolete, evenly spaced radial costae and minute, closely spaced commarginal striae continuing across costae throughout. Auricles with only commarginal microsculpture, as on disc. Weak internal expressions of external radial costae with sharply raised edges near ventral margin, but not carinate. Functional right and left ctenolia very weak or even lacking. Byssal notch and fasciole absent. Resilium oblong and oblique.

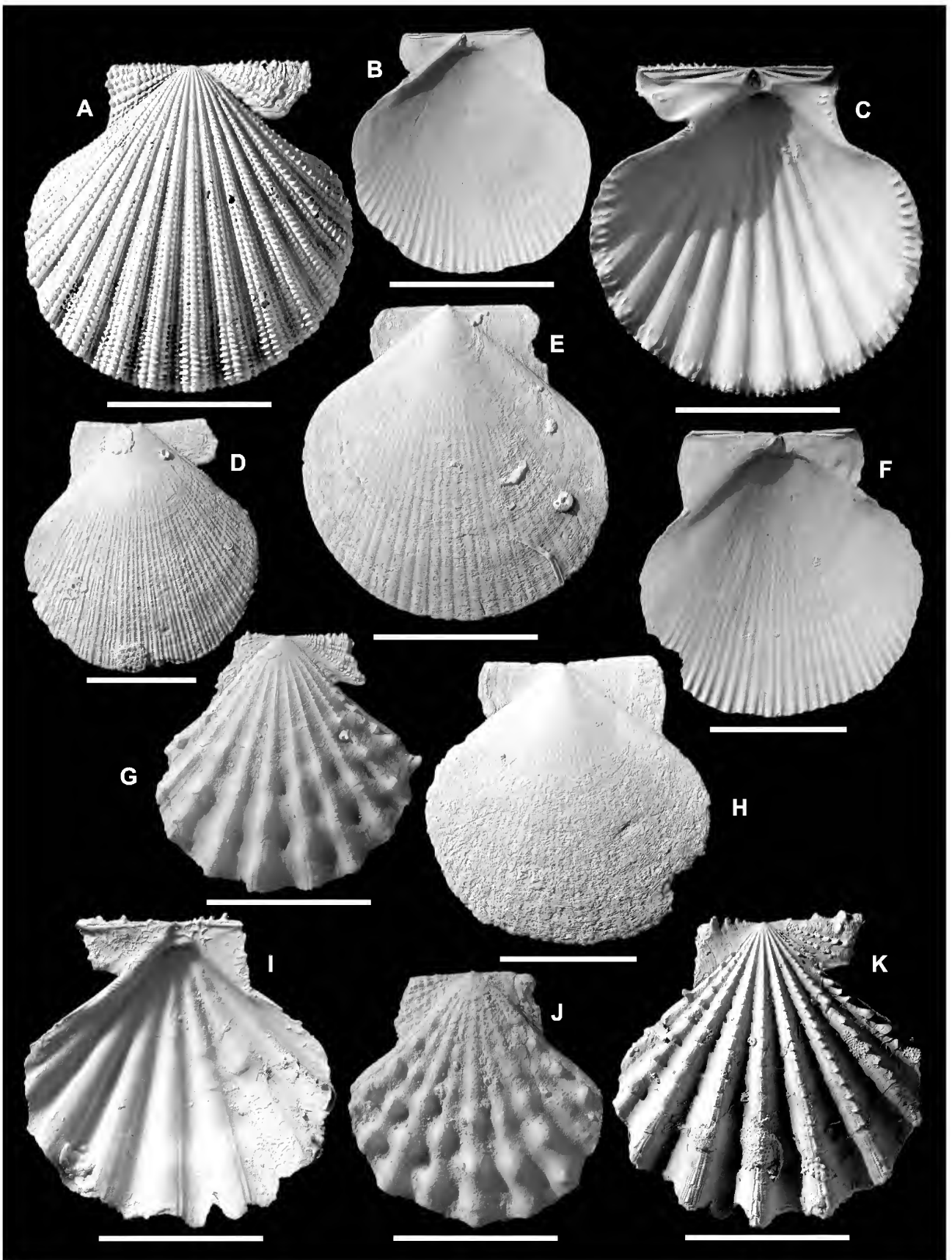
**Dimensions.** Illustrated specimens: QLD, GBR, NE of Cairns, 55 m, two unmatched valves (AM C.157660): rv: H 14.8, L 14.5 mm; lv: H 19.3, L 18.5 mm; QLD, GBR, Keeper Reef, off Townsville, 43 m (AM C.338776): lv: H 20.6, L 20.8 mm. Iredale (1939: 368) stated the dimensions of the holotype of *Juxtamusium oblectatum* as H 22.5, L 22, D 6 mm.

**Habitat.** Living in the intertidal to sublittoral zones amongst coral rubble or algae on flat sandy bottoms.

**Distribution.** Throughout the tropical Indo-West Pacific from the Philippines to northern Australia and westwards to the central Indian Ocean (not recorded from the western Indian Ocean), and eastwards to the Fiji Islands (Raines & Poppe, 2006: 126); Philippines, 20–80 m (Raines, 2010: 608); Philippines, 12–20 m; Marshall Islands, 45–54 m; Indonesia, Papua, 2 m; New Caledonia, 7–22 m, Palau Islands, 45–54 m (Waller, 1972: 254 [as *Juxtamusium oblectatum*]; Papua New Guinea, 20–35 m (Dijkstra, 1998a: 22). Maximum depth range of live-taken specimens is from the intertidal zone to 75 m. Present specimens from Australia alive at 12–36 m.

**Remarks.** The present specimens are indistinguishable from the type material of *Juxtamusium coudeini*. The closely related, smaller congener *Juxtamusium maldivense* (Smith, 1903) differs somewhat in having more prominent radial sculpture, which is more unevenly spaced, and in having more persistent ctenolia.

For information on functional morphology (in particular, of the left and right ctenolia and oblique resilium) see Waller (1972a: 253) and Thayer (1975: 447).



**Figure 43** *A, C*, *Gloripallium pallium* (Linnaeus), specimen in Fig. 40C, I, rv exterior (A), rv interior (C). *B, E, F, H*, *Juxtamustum coudeimi* (Bavay), (B) specimen in Fig. 40B, rv interior, (E) specimen in Fig. 40D, lv exterior; (F, H) specimen in Fig. 40F, lv interior (F), lv exterior (H). *D*, *Juxtamustum maldivense* (Smith), specimen in Fig. 40J, rv exterior. *G, J*, *Mirapecten moluccensis* Dijkstra, pair, WAM S43978, SE side Scott Reef, WA, 10 m; rv exterior (G), lv exterior (J). *I, K*, *Mirapecten rastellum* (Lamarck), rv only, AM C.153123, No Name Reef, GBR, QLD, 15–20 m; rv interior (I), rv exterior (K). Scale bars represent 30 mm (A, C), 10 mm (B, D–H, J), 20 mm (I, K).

***Juxtamusium maldivense* (E.A. Smith, 1903)**

Figs 40J, 42, 43D

*Pecten maldivensis* E.A. Smith, 1903: 622, pl. 36, figs 19–20; Melvill & Standen, 1907: 809; Hedley, 1909: 423; Melvill, 1909: 126; Waller, 1972a: 250, pl. 7, figs 111–112 [lectotype].

*Amusium scrobiculatum* Schepman, 1908: 201, pl. 13, figs 4–4a [syn. nov.]

*Chlamys maldivensis* (Smith)–Lamy, 1935: 311; Viader, 1937: 61; Oliver, 1982: 10.

*Juxtamusium maldivense* (Smith)–Iredale, 1939: 368; Waller, 1972a: 250, pl. 7, figs 111–127, pl. 8, fig. 134; Thayer, 1975: 447–449, 3 figs; Abbott & Dance, 1982: 315, fig; Dijkstra, (1983–1989) 1984: 8, figs; Sharabati, 1984: pl. 44, figs 4–4a; Waller, 1984: 211; Dijkstra, 1990: 4, figs; Dijkstra, (1983–1994) 1992: 24, figs; Dijkstra, 1998a: 23, pl. 3, figs 1–3; Dijkstra, Drivas & Jay, 1998: 7, fig. 11; Dijkstra & Knudsen, 1998: 64, pl. 5, fig. 22; Hayami, 2000: 901, pl. 447, fig. 17; Dijkstra & Kilburn, 2001: 281, figs 14–15; Raines & Poppe, 2006: 127–128, pl. 74, figs 1, 3; pl. 75, figs 1–7; Huber, 2010: 200; Raines, 2010: 608, pl. 995, figs 6–11, 13; Dijkstra, 2013: 46, pl. 11, figs 2a–d, pl. 13, figs 2a–b, pl. 27, figs 3a–b.

*Chlamys (Juxtamusium) maldivensis* (Smith)–Oliver, 1992: 71, 76, pl. 12, figs 5a–b, text-figs 10a–b.

**Type data.** *Pecten maldivensis* Smith: lectotype [second-largest pr] NHMUK 1903.9.17.49, designated and refigured by Waller (1972a: 250, pl. 7, figs 111–112), 4 paralectotypes (pr) NHMUK 1903.9.17.50–53. Type locality: Indian Ocean, Maldive Islands, 1–44 fathoms [2–80 m].

*Amusium scrobiculatum* Schepman: holotype (lv) RGM107619. Type locality: Indonesia, Sulawesi, Manado, Kaju Ragi (Pleistocene).

**Comments on type data.** Although Smith (1903: 622) recorded three localities for *Juxtamusium maldivense*, viz. II. Suvadiva Atoll (5–44 fathoms), IV. Kolumadulu Atoll (1–40 fathoms), and VI. Mulaku Atoll (1–40 fathoms) of the Maldive Islands, the types have not been segregated into these separate localities.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Fraser Island, off S end, 25°48'S 153°46'E, dead, 73 m (1 v, C.165160). WESTERN AUSTRALIA: Cartier Island, N side, alive, 50–70 m (1 pr, 1 v, ZMA Moll.146422); Timor Sea, Sahul Banks, 11°50'S 125°50'E, dead, 27 m (1 v, C.161001; 1 v, C.161002; 1 v, C.161003). —RED SEA: Gulf of Aqaba, off Eilat, alive, 6–10 m (2 pr, ZMA Moll.141484); off Wadi Murach, alive, 73–82 m (3 pr, ZMA Moll.142619). —REUNION: S Chaude, dead, 58 m (3 v, ZMA Moll.142610). —THAILAND: Andaman Sea, off Phuket Island, alive, 24 m (1 pr, ZMA Moll.143689). —PHILIPPINE ISLANDS: Cebu, Punta Engano, alive, 140–160 m (1 pr, ZMA Moll.140957); Bohol, off Panglao Island, alive, 80–200 m (1 pr, ZMA Moll.144212); Bohol, Balicasag Island, alive, 80–180 m (1 pr, ZMA Moll.146105); Calituban Island, alive, 15–20 m (2 pr, ZMA Moll.146229).

For other locality data see Waller (1972a: 254).

**Description.** Shell small, up to 35 mm high (Hayami, 2000; Huber, 2010), most specimens c. 15 mm; flattened (left valve almost flat, right valve weakly inflated), thin, circular to ovate, slightly higher than wide, inequivalve, almost equilateral, auricles unequal in shape and size, umbonal angle c. 85–90°; cream to pink, with shades of red or brown, and paler and darker blotches, interior purple or reddish, right valve paler.

Both valves sculptured with numerous fine, unevenly spaced radial riblets of angular section (with narrow crests), increasing by bifurcation and/or intercalation, and very closely spaced, microscopic commarginal lamellae. Posterior auricle larger than anterior, with c. 3–7 radial riblets, riblets

very weak on some specimens. Byssal notch and fasciole weak to almost lacking. Functional left and right ctenolia with a few teeth, lacking from some specimens. Resilifer oblong, oblique. Internal expressions of external radial riblets with sharply raised edges, but not carinate. Hinge teeth weak.

**Dimensions.** Illustrated specimen: QLD, off S end Fraser Island, 73 m, rv only (AM C.165160): H 11.4, L 10.7 mm.

**Habitat.** Living byssally attached to coral branches, under rocks or amongst coral rubble on sandy bottoms at littoral to uppermost bathyal depths.

**Distribution.** Throughout the tropical Indo-West Pacific, from southern Japan to northern Australia, westwards to South Africa and the Red Sea, eastwards to Wallis and Futuna Islands (MNHN, unpublished records; Raines & Poppe, 2006: 126); South Africa, 50–65 m (Dijkstra & Kilburn, 2001: 282); Red Sea, 6–82 m (Dijkstra & Knudsen, 1998: 66); Maldive Islands, 39 m, dead; Marshall Islands, 5–60 m (Waller, 1972: 254); Philippines, 20–90 m (Raines, 2010: 608; Dijkstra, 2013: 46); Indonesia, 34–305 m, dead (Dijkstra, 1991: 47); Papua New Guinea, 25–30 m (Dijkstra, 1998a: 23); Vanuatu, 6–114 m, dead (Dijkstra & Maestrati, 2012: 406). Maximum depth range of live-taken specimens is 5–200 m. Present specimens from Australia alive at 50–70 m.

**Remarks.** The present specimens are indistinguishable from the type material and *Juxtamusium maldivense* is a **new record** for Australia.

***Mirapecten* Dall, Bartsch & Rehder, 1938**

*Mirapecten* Dall, Bartsch & Rehder, 1938: 84, pl. 21, figs 7–8. Type species (by original designation): *Mirapecten thaanumi* Dall, Bartsch & Rehder, 1938 (= *Pecten mirificus* Reeve, 1853); Recent, off south coast of Molokai, Hawaii, in 70–99 fathoms [128–181 m].

*Somalipecten* Waller, 1986: 41. Type species (by original designation): *Somalipecten crammerorum* Waller, 1986; Recent, off Somalia.

**Diagnosis.** Medium-sized Decatopectinini with from 5–7 evenly spaced primary squamous plicae to 7–11 unevenly spaced primary and secondary plicae, squamous on most specimens, noduliferous or smooth on others; valves flattened, subcircular to circular, right valve slightly more convex than left, inequivalve, inequilateral to equilateral, auricles unequal in size; microsculpture of closely spaced commarginal lamellae; internal rib carinae present. Hinge with prominent dorsal teeth and weak resilial teeth, intermediate teeth lacking; byssal notch moderately deep, byssal fasciole rather narrow, ctenolium well-developed.

**Distribution.** Miocene–Recent (Hayami, 1989: 16). Tropical Indo-West Pacific, living in the littoral to sublittoral zones amongst coral or coral rubble on soft sediment.

**Discussion.** Hertlein (1969: N366) treated *Mirapecten* as a subgenus of *Semipallium* [Jousseau] Lamy, 1928 and placed it in the suprageneric group of *Decatopecten*. Waller (1986: 40), followed by Vaught (1989: 119), considered *Mirapecten* to be a full genus in the tribe Decatopectinini. For comparison with *Somalipecten* Waller, 1986, see Dijkstra & Kilburn (2001: 283).

### Key to species of *Mirapecten* from Australia

- 1 Shell c. 40 mm high, roundly triangular, thin, posteriorly oblique, lv almost flat, rv inflated, 4–5 distinct unevenly spaced radial plicae (obsolete on some specimens) with variable scales on lv, 7–9 (4 bifurcated) radial plicae with variable scales (or lacking scales) on rv ..... *M. mirificus*
- Shell with nodulous radial plicae ..... 2
- 2 Shell c. 35 mm high, subcircular, radially undulated, weakly inflated, almost equivalve and equilateral, valves with 8–9 nodulous radial plicae, secondary radial riblets in interspaces ..... *M. moluccensis*
- Shell with evenly spaced radial plicae ..... 3
- 3 Shell c. 40 mm high, subcircular, lv flattened, rv more inflated, almost equivalve and equilateral, valves with 7–9 evenly spaced radial plicae, obsolete or with widely spaced curved scales ..... *M. rastellum*

#### *Mirapecten mirificus* (Reeve, 1853)

*Pecten mirificus* Reeve, 1853: sp. 104, pl. 26, fig. 104.

*Mirapecten thaamumi* Dall, Bartsch & Rehder, 1938: 84, pl. 21, figs 7–8.

*Chlamys (Mirapecten) mirifica* (Reeve).—Springsteen & Leobrera, 1986: 329, pl. 93, fig. 17; Rombouts, 1991: 31, pl. 12, figs 3–3a.

*Mirapecten mirificus* (Reeve).—Kay, 1979: 526, figs 158B, 169A–B; Dijkstra, 1991: 48; Dijkstra, (1983–1994) 1994: 8, figs 1–4; Dijkstra, Drivas & Jay, 1998: 7, fig. 12; Hayami, 2000: 903, pl. 449, fig. 28 (rv only, lv is *M. rastellum*); Raines & Poppe, 2006: 130–131, upper figs; pl. 77, figs 1–7; pl. 78, figs 1–7; pl. 79, figs 1–7; Dijkstra & Maestrati, 2010: 354, figs 5G–H; Huber, 2010: 199; Raines, 2010: 610, pl. 996, figs 1–8; Dijkstra, 2013: 47, pl. 12, figs 1a–d, pl. 13, figs 3a–b.

**Type data.** *Pecten mirificus* Reeve: holotype (pr) NHMUK 1950.11.14.46. Type locality: “Amboyna” [Ambon, Indonesia].

*Mirapecten thaamumi* Dall, Bartsch & Rehder: holotype (lv) USNM 173195. Type locality: Hawaiian Islands, off the south coast of Molokai, 21°08'N 157°0'W, 70–99 fathoms [128–181 m] (*Albatross* stn 3819).

**Extralimital material examined.** —THAILAND: Phuket Island, Kho Raya Noi, alive, 30–40 m (1 pr, ZMA Moll.145489). —JAPAN: Okinawa, Horseshoe, alive, 40 m (1 pr, ZMA Moll.140201); off Zampa, alive, 46 m (2 pr, ZMA Moll.142606). —PHILIPPINE ISLANDS: Cebu, off Punta Engano, alive, 60–80 m (1 pr, ZMA Moll.140288); Bohol, off Panglao, alive, 100–150 m (3 pr, ZMA Moll.145848); Mindanao, Balut Island, alive, 128–146 m (2 pr, ZMA Moll.140800). —MALAYSIA: N Sabah, off Balahac Strait, alive, 145 m (1 pr, ZMA Moll.142598). —INDONESIA: off N Sulawesi, alive, 101–110 m (1 pr, ZMA Moll.141280). CORAL SEA: Chesterfield Island, alive, 52 m (1 pr, ZMA Moll.142609); Lansdowne-Fairway Banks, alive, 60 m (2 pr, ZMA Moll.139786). HAWAIIAN ISLANDS: Oahu, Sand Island, alive, 76 m (1 pr, ZMA Moll.144043). —SOLOMON ISLANDS: Guadalcanal, Bonegi, alive, 30 m (9 pr, ZMA Moll.142603). —FIJI ISLANDS: Viti Levu, Yanuca Island, dead, 34 m (1 v, ZMA Moll.143982).

**Description.** Shell up to 40 mm high, most specimens to c. 30 mm; rather thin, somewhat posteriorly oblique and roundly triangular, strongly inequivalve, inequilateral, left valve almost flat, right valve inflated, auricles somewhat unequal in shape and size, umbonal angle c. 90°; internal rib carinae present around ventral margin; colour highly variable, cream, yellow, red, purple, brownish to almost black, some specimens mottled; interior porcelanous,

somewhat paler than exterior; resilial teeth weak or lacking, dorsal teeth prominent.

Left valve sculptured with 4–5 distinct primary radial plicae, one secondary costa intercalated in each interspace on most specimens, very weak or lacking on some. Primary plicae bearing widely spaced, thorn-like, curled scales, variable in prominence; lacking on secondary costae. Plicae and costae unevenly spaced. Very closely spaced, fine commarginal microsculpture throughout. Posterior auricle somewhat larger than anterior, with one scaly radial costa; costa weaker on anterior auricle. Dorsal margin straight.

Right valve with 7–9 unevenly spaced radial plicae (4 main plicae more or less bifurcated); secondary costae lacking. Anterior auricle with 4–6 radial costae, lacking or very weak on posterior; dorsal margin scaly. Byssal notch moderately deep, byssal fasciole broad. Functional ctenolium with 4–6 well-developed teeth.

**Habitat.** Living byssally attached to hard substrates or amongst coral rubble on sandy bottoms, in the sublittoral zone and on the continental shelf.

**Distribution.** Tropical Indo-West Pacific and Hawaiian Islands, from southern Japan to Indonesia and the Coral Sea (not recorded from Australia), westward to Thailand and eastward to the Fiji Islands and Austral Islands (partly MNHN and NBC, unpublished records; Raines & Poppe, 2006: 130); East Africa to the Hawaii Islands, 5–181 m (Huber, 2010: 199); Philippines, 62–90 m (unpublished data, HHD); Indonesia, 70 m, dead (Dijkstra, 1991: 48); Papua New Guinea, 25–57 m, dead (Dijkstra, 1998a: 23–24); Vanuatu, 1–92 m, dead (Dijkstra & Maestrati, 2012: 406). Maximum depth range of live-taken specimens is 30–150 m.

**Remarks.** For comparison with congeneric species see Dijkstra & Kilburn (2001: 285).

*Mirapecten mirificus* is not recorded from the continental shelf or slope of Australia, but records are known from the Coral Sea (MNHN, HD). It is quite possible that this species also occurs on the Great Barrier Reef, because *Mirapecten rastellum* (Lamarck, 1819), which lives in a similar habitat to the present species, was recently found there.



*Mirapecten moluccensis* Dijkstra, 1988

Figs 43G,J, 44, 45E–F

*Mirapecten moluccensis* Dijkstra, 1988: 12, figs; Pearson, 1991: 4, figs; Raines & Poppe, 2006: 130–131, lower figs; pl. 80, figs 1–8; Huber, 2010: 199; Raines, 2010: 612, pl. 997, figs 1–3; Dijkstra, 2013: 47, pl. 12, figs 2a–d, pl. 13, figs 5a–b.

**Type data.** Holotype (pr) ZMA Moll.3.88.034, 10 paratypes (8 pr & 2 v), 1 (pr) MNHN Moll21159, 9 ZMA Moll.3.88.035–36, 3.88.062–65. Type locality: Indonesia, Moluccas [Maluku].

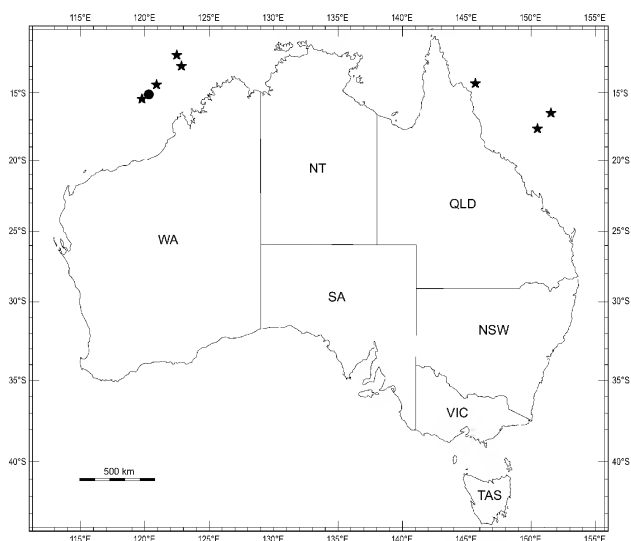
**Additional material examined.** —AUSTRALIA: WESTERN AUSTRALIA: Scott Reef, SE corner, 14°03'55.9"S 121°58'17"E, dead, 10 m (1 pr, WAM S43978); Scott Reef, NE corner of northern reef, 13°53'S 121°53'E, dead, 18 m (1 v, HM colln). —PHILIPPINE ISLANDS: Cebu, Olanga Island, alive, 25 m (3 pr, ZMA Moll.146355); Bohol, Calituban Island, alive, 30–35 m (1 pr, ZMA Moll.146357). —VIETNAM: Hon Tam Island, alive, 10 m (4 pr, ZMA Moll.146539).

**Description.** Shell up to c. 35 mm high, subcircular, radially undulated, almost equivalve and equilateral, right valve somewhat more inflated than left, auricles unequal in shape and size, umbonal angle c. 90°; internal costae with weak rib carinae, particularly near ventral margin; hinge teeth weak; left valve cream or whitish with red, black or white spots, or uniform whitish; right valve cream or whitish without maculations; interior ventral margin reddish on most specimens.

Left valve sculptured with 8–9 prominent, nodulous radial plicae, with evenly and closely spaced secondary radial riblets on plicae and in interspaces. Very closely spaced, fine commarginal microsculpture throughout. Anterior auricle with 7–9 radial riblets, each bearing small nodules, more prominent dorsally.

Right valve with similar sculpture to left, but nodules on radial plicae weaker and costae on disc ends more spinose than on left valve. Auricles somewhat declined laterally, with scaly dorsal margins. Byssal notch moderately deep, byssal fasciole rather broad. Functional ctenolium with about 5 prominent teeth.

**Dimensions.** Illustrated specimen: WA, SE side Scott Reef, 10 m (WAM S43978): H 15.5, L 15.5 mm.



**Figure 44.** Distribution of *Mirapecten moluccensis* Dijkstra (circle) and *M. rastellum* (Lamarck) (stars).

**Habitat.** Living in the littoral to sublittoral zones, byssally attached on the undersides of coral boulders or amongst coral rubble on sandy bottoms.

**Distribution.** Western and southwestern Pacific from the Philippines southwards to northern Australia, and eastwards to the Marshall Islands, Solomon Islands and Loyalty Islands (unpublished data, HHD; Raines & Poppe, 2006: 132); Philippines, 4–80 m (Dijkstra, 2013: 49). Maximum depth range of live-taken specimens is 4–80 m. Present specimens from Australia dead at 10–18 m.

**Remarks.** The few valves dredged from Australia are indistinguishable from the type material. *Mirapecten moluccensis* is a **new record** for Australia. For comparison with congeneric species see Dijkstra & Kilburn (2001: 285).

*Mirapecten rastellum* (Lamarck, 1819)

Figs 43I,K, 44, 45A

*Pecten rastellum* Lamarck, 1819: 166; Delessert, 1841: pl. 16, figs 2a–b [holotype]; Chenu, 1845: pl. 15, figs 2–2b [holotype]; Dijkstra, 1994: 474, pl. 6, figs 17–20 [holotype].

*Pecten amaliae* Kobelt, 1887: 84, 198, pl. 53, figs 5–6.

*Pecten* (*Chlamys*) *squamatus* (Gmelin).—Dautzenberg & Bavay, 1912: 9 (misidentification).

*Chlamys* (*Mirapecten*) *rastellum* (Lamarck).—Springsteen & Leobrera, 1986: 329, pl. 93, fig. 20; Rombouts, 1991: 31, pl. 12, figs 4–4b.

*Mirapecten rastellum* (Lamarck).—Dijkstra, (1983–94) 1991: 22, figs; Dijkstra, 1991: 48; Lamprell & Whitehead, 1992: [32], pl. 14, fig. 82; Dijkstra, 1998a: 24, pl. 3, figs 7–8; Raines & Poppe, 2006: 132–133, upper figs; pl. 81, figs 1–6; pl. 82, figs 1–6; Dijkstra & Moolenbeek, 2008: 23; Huber, 2010: 199; Raines, 2010: 612, pl. 997, figs 4–8; Dijkstra, 2013: 49, pl. 12, figs 3a–d, pl. 13, figs 4a–b.

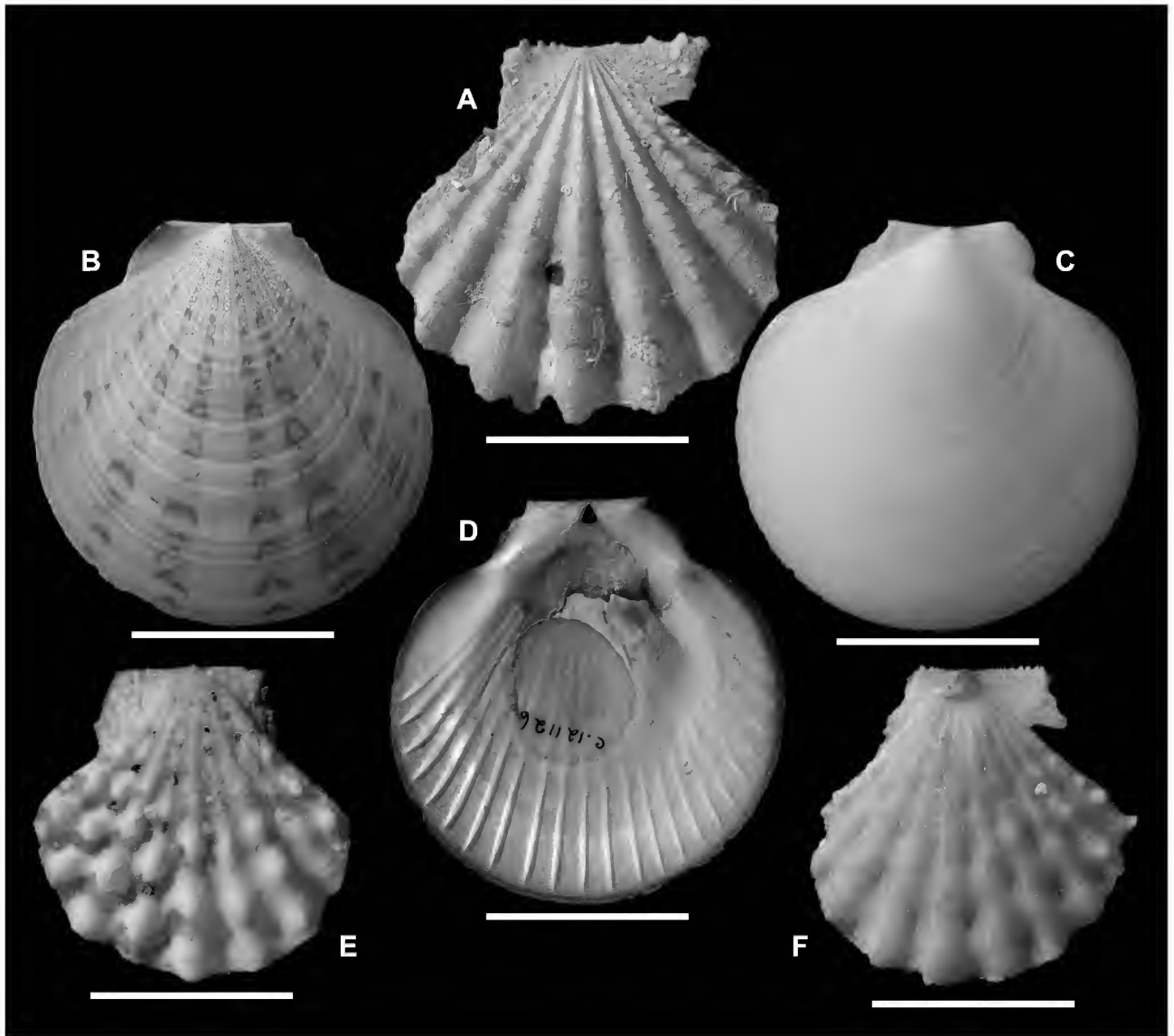
**Type data.** *Pecten rastellum* Lamarck: holotype (pr) MHNG1088/24. Type locality: “Habite les mers du Nord” [error]. A new type locality was designated by Dijkstra (1994: 474): off Punta Engaño, Mactan Island, Cebu, Philippine Islands.

*Pecten amaliae* Kobelt: lectotype (lv) LMAD [not registered], herein designated. Type locality: “Amboyna?”. It is likely that the type specimen was found in the Moluccas. Similar material from eastern Indonesia has been examined (RMNH).

**Comments on type data.** For nomenclatural notes on *Pecten rastellum* var. “beta” see Dijkstra (1994: 474).

The first author traced only the left valve (Kobelt’s fig. 5) of an articulated specimen (see Kobelt, 1887: pl. 53, figs 5–6) of *Pecten amaliae* in the LMAD collection.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, No Name Reef, SW end, 14°40'S 145°39'E, dead, 15–20 m (1 v, C.153123); North East Herald Cay, 16°56'S 149°11'E, dead (14 v, C.331909; 3 v, C.331910); Flinders Reef, 17°44'S 148°27'E, dead, beach (1 v, C.147354). WESTERN AUSTRALIA: Scott Reef, SW side, 14°05'S 121°50'E, dead, 10 m (1 pr, ZMA Moll.146193); Scott Reef, SE corner, approx. 14°0'S 121°45'E, dead, 34 m (1 v, WAM); Scott Reef, N of North Entrance, approx. 14°0'S 121°45'E, dead, 42 m (1 pr + 1 v, WAM); Seringapatam Reef, 13°40'S 122°05'E, NE corner, dead, 20 m (1 pr + 3 v, WAM); Cartier Island, N side, 12°31'S 123°29'E, dead, 10–20 m (3 v, WAM); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 24 m (6 v, WAM); Ashmore Reef, 12°17'S 123°02'E, dead, 20 m (7 v, WAM); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 5–24 m (1 v, WAM524; 1 v, WAM); Ashmore Reef, NW corner, 12°17'S 123°02'E, dead, 8 m (1 v, WAM); Hibernia Reef, 11°58'S 123°19'E, dead (3 v, WAM); Hibernia Reef, 11°58'S 123°19'E, dead, 5–8 m (1 v, WAM); Hibernia Reef, 11°58'S 123°19'E, dead (2 pr + 1 v, WAM); Hibernia Reef, N side, 11°58'S 123°19'E, dead, 25 m (1 pr, ZMA Moll.146194). —JAPAN: Okinawa, Bolo Point, alive, 27 m (1 pr, ZMA Moll.140198). —PHILIPPINE ISLANDS: Cebu, Punta



**Figure 45.** *A*, *Mirapecten rastellum* (Lamarck), specimen in Fig. 43I, K; rv exterior. *B–D*, *Amusium pleuronectes* (Linnaeus), pair, AM C.121126, W of Nassau River, E Gulf of Carpentaria, QLD, 11 m; lv exterior (*B*), rv exterior (*C*), lv interior (*D*). *E*, *F*, *Mirapecten moluccensis* Dijkstra, specimen in Fig. 43G, J; lv exterior (*E*), rv exterior (*F*). Scale bars represent 20 mm (*A*), 30 mm (*B–D*), 10 mm (*E*, *F*).

Engano, 10°19'N 124°01'E, dead, 90–145 m (9 v, C.331911); Bohol, Panglao, alive, 110–150 m (7 pr, ZMA Moll.142772); Mindanao, Samal Island, Matanos, alive, 165 m (19 pr, ZMA Moll.145091). GUAM: Orote Point, alive, 23 m (2 pr, ZMA Moll.139641). —MARSHALL ISLANDS: Kwajalein Atoll, Carlson Island, outside lagoon, alive, 12 m (1 pr, ZMA Moll.142753); Johnston Atoll, outside lagoon, alive, 30 m (2 pr, 1 v, ZMA Moll.142782). —INDONESIA: Malacca Strait, off Balikpapan, alive, 51 m (3 pr, ZMA Moll.142789). —PAPUA NEW GUINEA: Port Moresby, Quayles Reef, alive, 20 m (1 pr, ZMA Moll.142792). —SOLOMON ISLANDS: Uepi Island, Morovo Lagoon, 8°25'S 157°56'E, alive, 15–45 m (2 pr, C.303795); Guadalcanal, Bonegi, alive, 28–32 m (5 pr, ZMA Moll.142830); Guadalcanal, W of Honiara, alive, 30–35 m (3 pr, ZMA Moll.144009). CORAL SEA: Chesterfield Islands, 19°41'S 158°22'E, alive, 45 m (1 pr, ZMA Moll.142787). —NEW CALEDONIA: 21°0'S 165°0'E, dead (1 v, C.047356); 21°0'S 165°0'E, dead (3 v, C.119742). —FIJI ISLANDS: Viti Levu, Nadi Bay, 16°57'S 178°47'E, dead, 9–35 m (1 v, C.067851); Viti Levu, Mbenga Island (Beqa Island), alive, 36 m (3 pr, ZMA Moll.142777).

**Description.** Shell up to 53 mm high (Huber, 2010), most specimens to c. 25 mm; subcircular, left valve flattened, right valve more inflated, slightly inequivalve and equilateral, auricles somewhat unequal in shape and size, umbonal angle about 85–90°; internal plicae with weak, moderately long rib carinae around ventral margin in most specimens (lacking in a few); hinge teeth weak; colour highly variable, white, cream, yellow, red, purple, brownish, uniform or mottled.

Both valves sculptured with 7–9 evenly spaced radial plicae, with widely spaced curved scales (larger on left valve than on right), more prominent marginally. Plicae and interstices equal in width. Auricles with very closely spaced commarginal microsculpture (almost lacking on disc), macrosculpture lacking except for 2–3 radial riblets on anterior auricle of right valve; dorsal margin spinose. Byssal notch moderately deep, byssal fasciole rather broad. Functional ctenolium with 5–8 prominent teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, No Name Reef, 15–20 m, single rv (AM C.153123): H 37.4, L 37.8 mm.

**Habitat.** Living in the littoral zone and on the continental shelf, amongst coral rubble on sandy bottoms. In Western Australia on offshore islands and reefs with clean conditions.

**Distribution.** Tropical Indo-West and central Pacific from southern Japan to northern Australia, eastwards to the Line Islands (not recorded from the Hawaiian Islands or French

Polynesia) (Raines & Poppe, 2006: 132); Philippines, 27–120 m (Dijkstra, 2013: 50); Indonesia, 34 m and 285–305 m, dead (Dijkstra, 1991: 48); Papua New Guinea, 10–58 m (Dijkstra, 1998a: 24); Vanuatu, 13–80 m (Dijkstra & Maestrati, 2012: 406). Maximum depth range of live-taken specimens is 12–165 m. This species is not found along Australian shores, but recorded only from offshore reefs.

**Remarks.** The present specimens are indistinguishable from the type material. For comparison with congeneric species see Dijkstra & Kilburn (2001: 285).

**Amusiini Thiele, 1934**

[emend. Waller, 2006a]

**Diagnosis.** Pectininae with weak radial macrosculpture or smooth, internal rib carinae present, disc microsculpture of closely spaced commarginal lamellae, hinge teeth well-developed, consisting of resilial and dorsal teeth, intermediate teeth weak or lacking, auricular crura prominent.

**Remarks.** Waller (2006a: 22–27, fig. 1.3) separated the *Amusium* and *Pecten* groups into their own tribes for the first time because of phylogenetic separation. He considered that *Amusium*, *Euvola* Dall, 1898 and *Leopecten* Masuda, 1971 all evolved from *Amussiopecten* Sacco, 1897 (all included in Amusiini), whereas *Annachlamys* Iredale, 1939 and *Pecten* evolved from *Gigantopecten* Rovereto, 1899 (all included in Pectinini).

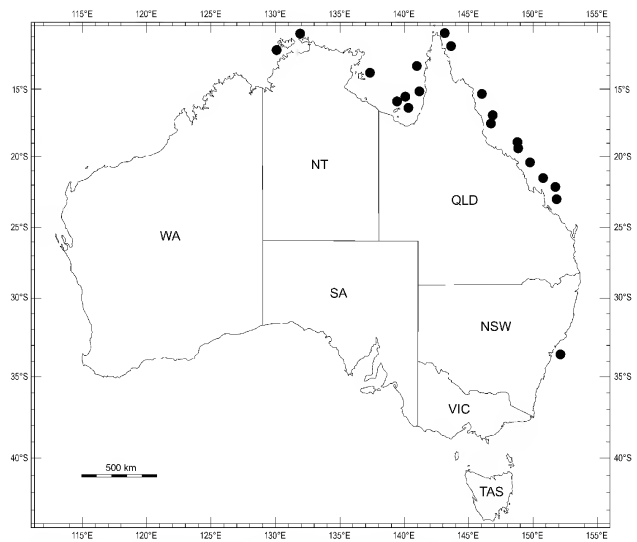
There has been continuing confusion over the relative priority of *Macrochlamys* Sacco, 1897 and *Gigantopecten*, but following Waller & Bongrain (2006), the International Commission on Zoological Nomenclature (2008) accepted that *Macrochlamys* Sacco, 1897 is a junior homonym of *Macrochlamys* Benson, 1832, and adopted *Gigantopecten* as the valid name.

The tribe name has usually been attributed to Habe (1977), but Waller (2011: 93) attributed it to Thiele (1934: 805). Waller (2007, 2011) further discussed the evolution of weakly sculptured to smooth scallops resembling *Pecten* and *Amusium*, pointing out the complex origins of the living taxa, and adding the new genus *Zamorapecten* Waller, 2011 in Amusiini.

**Amusium Röding, 1798**

*Amusium* Röding, 1798: 165. Type species (by subsequent designation, Herrmannsen, 1846): *Ostrea pleuronectes* Linnaeus, 1758; Recent, Indonesia.

*Pleuronectia* Swainson, 1840: 388. Type species (by monotypy): *Pleuronectia laevigata* Swainson, 1840 (= *Ostrea pleuronectes* Linnaeus, 1758); Recent, Indo-West Pacific.



**Figure 46.** Distribution of *Amusium pleuronectes* (Linnaeus).

**Diagnosis.** Amusiini with (sub)circular shape, up to c. 100 mm high, very weakly inflated, both valves slightly convex; umbonal angle c. 120°; exterior surface of disc and auricles smooth, interior with c. 22–34 narrow, prominent radial riblets clearly arranged in pairs; auricles equal in length, intermediate hinge teeth absent, byssal notch and ctenolium weak in early ontogeny, absent later.

**Distribution.** Late Oligocene?–Recent. Tropical and subtropical Indo-West Pacific, living in the littoral zone. *Amusium subcostatum* Beu & Darragh (2001: 174, figs 63B, D, E, 64D, E) (Australian Junjukian and Longfordian Stages, late Oligocene and early Miocene) is doubtfully referred to *Amusium* (*sensu stricto*); it is a thick-shelled species with wide auricles and faint radial ribbing, gradational with *Amussiopecten*.

**Discussion.** Hertlein (1969: N349) placed *Amusium* in the *Amusium* group, together with *Korobkovia* Glibert & van der Poel, 1965 (Miocene) and *Propeamussium* de Gregorio, 1884 (Jurassic to Recent) and stated that these “genera may have been derived from different groups”. *Propeamussium* is currently included in family Propeamussiidae.

Waller (1991: 38) suggested that true *Amusium* evolved from *Amussiopecten* Sacco, 1897a during the Oligocene within the Pacific region, and placed *Amusium* in the *Pecten* group, and subsequently in Pectinini (Waller, 1993). Most recently, Waller (2006a) subdivided Pectinini, and transferred *Amusium* to the new tribe Amusiini.

Dijkstra (1990b) introduced *Dentamussium* as a new subgenus of *Amusium*. *Amusium* (*Dentamussium*) differs from *Amusium* *sensu stricto* by having a well-developed byssal notch (weak in *Amusium*) and a functional ctenolium (absent at least in late ontogeny of *Amusium*).

**Key to species of Amusium-like pectinids from Australia**

- 1 Shell c. 100 mm high, with 22–34 internal carinae clearly arranged in pairs ..... *Amusium pleuronectes*
- Shell with 42–54 internal carinae ..... 2
- 2 Shell c. 140 mm high, with 42–54 internal carinae vaguely arranged in pairs ..... *Ylistrum balloti*

Mynhardt *et al.* (2014) introduced the genus *Ylistrum* for “*Amusium*” *balloti* (Bernardi, 1861) and “*A.*” *japonicum* (Gmelin, 1791), demonstrating from molecular sequences that these species do not belong in *Amusium*, but are possibly related to Decatopectinini [*Anguipecten*, *Bractechlamys*, *Decatopecten*, *Gloripallium* and *Mirapecten* included in the study by Mynhardt *et al.* (2014)]. In contrast, *Amusium pleuronectes* was shown to be most nearly related to Pectinini [*Pecten*, *Euvola* and *Nodipecten* included by Mynhardt *et al.* (2014)]. We prefer to retain *Ylistrum* in Amusiini until a more final molecular phylogeny of Pectinidae is based on a greater number of taxa.

### *Amusium pleuronectes* (Linnaeus, 1758)

Figs 45B–D, 46, 47F

*Ostrea pleuronectes* Linnaeus, 1758: 696, no. 159; Linnaeus, 1764: 524, no. 103; Linnaeus, 1767: 1144, no. 189; Born, 1778: 82, no. 4; Born, 1780: 99; Gmelin, 1791: 3317, no. 6; Bruguière, 1797: pl. 208, fig. 3; Cuvier, 1798: 420, no. 3; Dillwyn, 1817: 250, no. 6; Dijkstra, 1999: 399, figs 1C–F [lectotype]; Dijkstra, 2016: 114, fig. 5.

*Pecten pleuronectes* (Linnaeus).—Bosc, 1802: 260; Lamarck, 1819: 164, no. 7; Bosc, 1824: 255; DeFrance, 1825: 239; Deshayes, 1832a: 717, no. 6; Deshayes, 1836: 132, no. 7; G. B. Sowerby II, 1842: 55, no. 30, pl. 16, figs 127–128, 135–136; Chenu, 1843: 4, pl. 11, figs 1–3; Reeve, 1853: sp. 48, pl. 13, fig. 48; Küster & Kobelt, 1888: 49, no. 15, pl. 13, fig. 4.

*Amusium pleuronectes* (Linnaeus).—Röding, 1798: 165, no. 124; Oyama, 1951: 84, text-fig. 4; Kira, 1962: 138, pl. 49, fig. 16; Morton, 1980: 375–404; Abbott & Dance, 1982: 303, fig.; Grecchi, 1983: 7–9, figs; Dijkstra, 1990a: 9–10; Rombouts, 1991: 4, pl. 3, fig. 3; Dharma, 1992: 84, pl. 20, fig. 1; Bernard *et al.*, 1993: 52; Dijkstra, 1997: 319; Taylor & Glover, 2004: 262; Raines & Poppe, 2006: 138–139, lower figs; pl. 87, figs 1–5; Huber, 2010: 197; Raines, 2010: 614, pl. 998, figs 1–2; Dijkstra, 2013: 50, pl. 11, figs 4a–b, pl. 13, figs 1a–d; Mynhardt *et al.*, 2014: 406, figs 1A–C.

*Amusium magneticum* Röding, 1798: 165.

*Pectinium pleuronectes* (Linnaeus).—Link, 1807: 156.

*Pleuronectia laevigata* Swainson, 1840: 388.

*Amusium* [sic] *pleuronectes* (Linnaeus).—Smith, 1884: 116, no. 75; Smith, 1885: 308; Lynge, 1909: 158.

*Pecten* (*Amusium*) *milneedwardsi* Gregorio, 1898: 6, pl. 1, figs 1, 6.

*Amusium pleuronectes pleuronectes* (Linnaeus).—Habe, 1964a: 2, pl. 1, figs 3–4; Matsukuma *et al.*, 1991: pl. 133, fig. 11; Dharma, 2005: 250, 364, pl. 100, fig. 18; pl. 147, figs 12a–b; Xu & Zhang, 2008: 78, fig. 218.

*Amusium pleuronectes australiae* Habe, 1964a: 2, pl. 1, figs 1–2; Dharma, 2005: 250, pl. 100, fig. 17.

*Amusium* (*Amusium*) *pleuronectes* (Linnaeus).—Dijkstra, 1990b: 52–53, figs; Dijkstra, 1997: 315, 319; Dijkstra, 1999: 400.

*Amusium pleuronectes nanshaensis* Wang & Chen, 1991: 152, 160, fig. 3.

**Comments on synonymy.** Röding (1798) introduced a new species name “species 126 *Amusium Magneticum*” for Gmelin’s “*Ostrea pleuronectes*” [after Linnaeus], which he also reported higher up the same page as “species 124 *Amusium Pleuronectes*”. *Amusium magneticum* is an objective junior synonym of *A. pleuronectes* (Linnaeus, 1758).

*Pleuronectia laevigata* Swainson, 1840, the type species of *Pleuronectia* Swainson, 1840, is based on a reference to Lamarck (1816: pl. 208, fig. 3), which clearly shows the present species.

Gregorio (1898) extensively described and figured a new species *Pecten* (*Amusium*) *milneedwardsi* from New Caledonia, which closely resembles the present species. This is a subjective junior synonym of *A. pleuronectes* (Linnaeus, 1758).

Habe (1964) described a new subspecies from the Arafura Sea, which differs in his opinion from *Amusium pleuronectes* by having fewer internal rib carinae (22–24, *A. pleuronectes* 26–34) and a somewhat different colour of the left valve. However, the number of internal carinae varies strongly and intermediates are also observed. Also the bluish radial lines and interstitial small pale dots are highly variable. In our opinion this subspecies falls within the range of variation of the present species.

Recently Wang & Chen (1991) introduced a new subspecies from China, which in their opinion can be distinguished from *Amusium pleuronectes* by “the shell (almost rounded), the radial lines (reddish) and by the white and brown spots”. These characters are also observed in other material of the present species from the Southwest Pacific.

**Type data.** *Ostrea pleuronectes* Linnaeus: lectotype (pr) LSL [not registered] designated by Dijkstra (1999: 400), paralectotype (lv) MSNP [not registered]. Type locality: “Habitat in Indiis” [= Indonesia].

*Amusium magneticum* Röding: type material lost. Type locality not indicated.

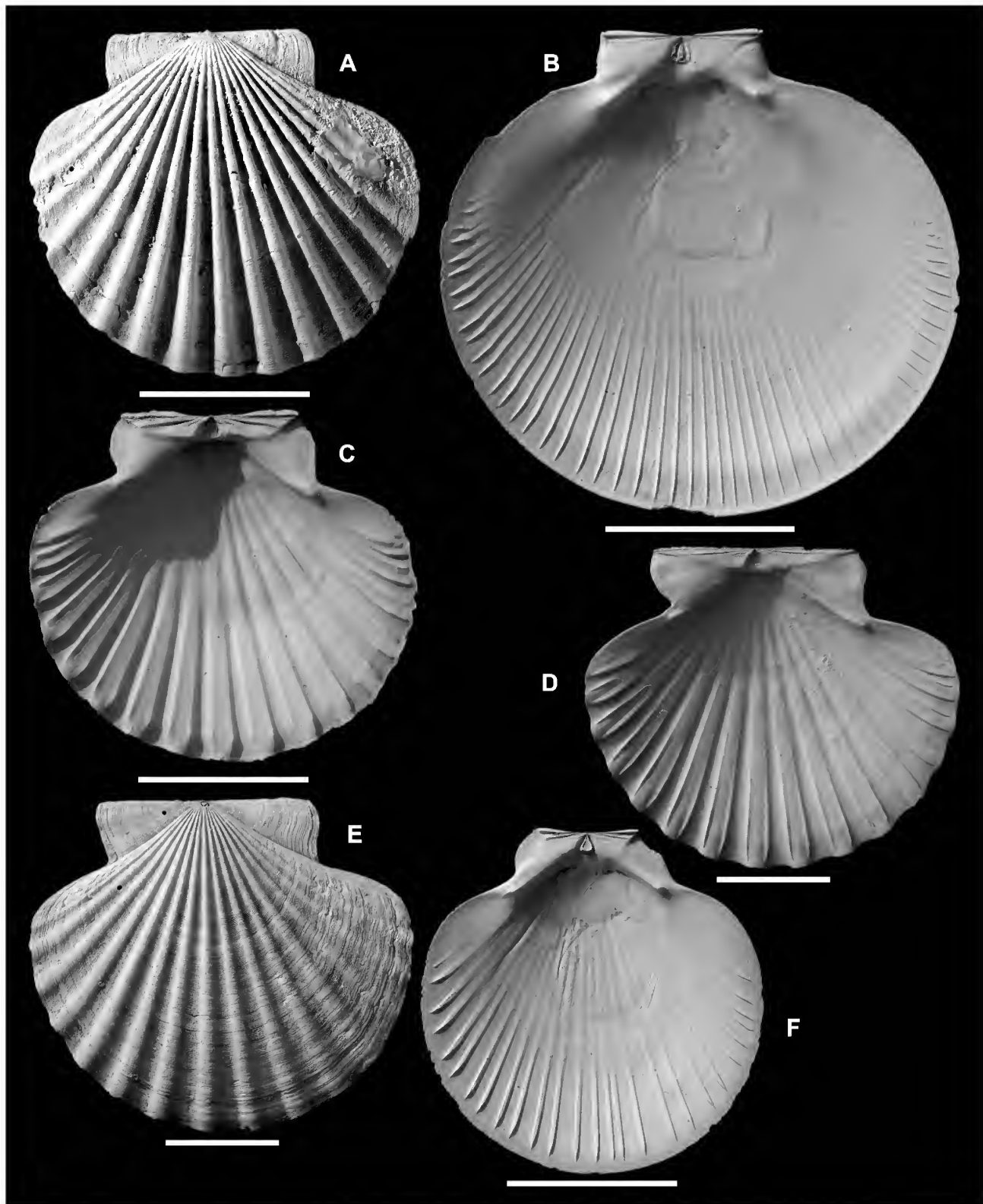
*Pleuronectia laevigata* Swainson: type material unknown, not in the Manchester Museum or in the Natural History Museum, London. Type locality not indicated.

*Pecten* (*Amusium*) *milneedwardsi* Gregorio: type material lost. Type locality: New Caledonia. We designate the lectotype of *Ostrea pleuronectes* Linnaeus as the neotype of *Amusium magneticum* Röding, 1798, the neotype of *Pleuronectia laevigata* Swainson, 1840 and the neotype of *Pecten* (*Amusium*) *milneedwardsi* Gregorio, 1898.

*Amusium pleuronectes australiae* Habe: holotype (pr) NSMT-Mo54544. Type locality: Arafura Sea.

*Amusium pleuronectes nanshaensis* Wang & Chen: holotype (pr) IOAS M11600. Type locality: China, Nansha Islands, 4°08'N 112°53'E, 62 m, muddy sand.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Nagir [Mt Ernest] Island, 10°15'S 142°29'E, alive (1 pr, C.097691); Cape York Peninsula, Albany Passage, 10°43'–10°45'S 142°34'–142°37'E, dead, 16–22 m (1 pr, C.093043); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (2 v, C.133516); 2 mls NE of Hannibal Island, 11°33'S 142°57'E, alive, 22–23 m (4 pr, C.338849); GBR, Raine Island, 11°35'S 144°01'E, alive (1 pr, C.093044); NE Gulf of Carpentaria, W of Weipa, 12°42'S 141°31'E, dead, 18 m (1 v, C.107106); GBR, near Cape Sidmouth, off Bow Reef, 13°20'S 143°40'E, dead, 19 m (2 v, C.002577); Gulf of Carpentaria, W of Holroyd River, 14°10'S 141°13'E, alive, 24 m (3 pr, C.109331); Gulf of Carpentaria, NW of Edward River, 14°31'S 141°19'E, dead, 18 m (1 pr, C.114116); GBR, 0.5 ml W of North Direction Isle, 14°45'S 145°30'E, dead, 36.5 m (1 v, C.093039); Gulf of Carpentaria, W of Edward River, 14°46'S 141°20'E, dead, 18 m (1 v, C.338471); off Cape Flattery, Decapolis Reef, 14°50'S 145°17'E, dead, 12–14 m (1 v, C.133561); Gulf of Carpentaria, W of Mitchell River, 15°09'S 141°09'E, dead, 22 m (1 v, C.111583); Gulf of Carpentaria, W of Mitchell River, 15°10'S 141°06'E, dead, 24 m (1 v, C.109308); between Cairns & Endeavour Reefs, 15°45'S 145°35'E, dead, 37 m (5 v, C.044613); E Gulf of Carpentaria, W of Nassau River, 15°89.2'S 141°23'E, alive, 11 m (1 pr, C.121126); Weary Bay, 15°54'S 145°23'E, dead, 15 m (1 v, C.029722); GBR, S of Cooktown, 16°01'S 145°29'E, alive, 20 m (4 pr + 1 v, C.130394); Gove Peninsula, Nhulunbuy town beach (1 v, C.133266); E Gulf of Carpentaria, SW of Nassau River, 16°06'S 140°44'E, alive, 22 m (1 pr, C.110629); SW of Nassau River, 16°08'S 140°52'E, alive, 18 m (1 pr, C.338851); GBR, Penguin Channel, 16°15'S 145°31'E, dead, 18–28.5 m (1 v, C.089680); 1.5 ml NW of Low Isles, 16°22'S 145°33'E, dead, 20 m (1 v, C.093041); Low Isles, 16°23'S 145°34'E, dead, 16–22 m (12 v, C.100703; 1 v, C.161019 [in part]; 1 v, C.338463); SE Gulf of Carpentaria, W of Staaten River, 16°25'S 140°17'E, alive, 25.6 m (5 pr, C.108355); inside Wentworth Reef, 16°31'S 145°31'E, alive, 13 m (1 pr, C.093040); Michaelmas Cay, 16°36'S 145°59'E, alive (1 pr, C.338474); SE Gulf of Carpentaria, W of Gilbert River, 16°41'S 140°09'E, alive, 18.3 m (2 pr, C.110625); off Cairns, 16°51'–16°51'S 146°01'–146°04'E, dead, 33–35 m (1 v, C.338464); Cairns Harbour, 16°53'S 145°48'E, dead (1 v, C.338486); Gulf of Carpentaria, 28 mls S of Sweers Island, 17°06'S 139°37'E, dead (2 v, C.338479);



**Figure 47.** *A, C*, *Annachlamys kuhnholzti* (Bernardi), pair, AM C.064359, off Burnett Heads, QLD, 46 m, lv exterior (A), rv interior (C). *B*, *Ylistrum balloti* (Bernardi), rv of pair, AM C.303800, trawled off North West Island, Capricorn Group, GBR, QLD; rv interior. *D, E*, *Annachlamys flabellata* (Lamarck), pair, AM C.069985, Rodds Harbour, Port Curtis, QLD; rv interior (D), lv exterior (E). *F*, *Amusium pleuronectes* (Linnaeus), specimen in Fig. 45B–D; rv interior. Scale bars represent 30 mm (A, C–F), 50 mm (B).

SE Gulf of Carpentaria, W of Fitzmaurice Point, 17°12'S 140°15'E, alive, 11 m (1 pr, C.107439); Gulf of Carpentaria, Karumba, 17°29'S 140°50'E, dead (18 v, C.338468); GBR, off Cardwell, 18°30'S 146°54'E, alive, 59 m (1 pr, C.337124), off Cardwell, 18°30'S 147°12'E, alive, 45 m (1 pr, C.337125); Palm Islands, 18°40'S 146°33'E, dead, 27 m (9 v, C.010260; 8 v, C.010261); off Palm Islands, 18°44'S 146°31'E, alive, 20 m (3 pr, C.338853); Great Palm Island, Challenger Bay, 18°44'S 146°34'E, dead, 12 m (1 v, C.338487); off Ingham, 19°03'S 148°07'E, alive, 65 m (1 pr, C.337123); Townsville,

Magnetic Island, 19°08'S 146°50'E, alive (1 pr, C.097586); S of Townsville, 19°17'S 147°32'E, alive, 24 m (7 pr, C.123886), off Bowen, 19°44'S 148°14'E, dead, 40 m (4 v, C.119573); E of Bowen, 19°45'S 148°19'E, dead, 46 m (many, C.120872); N of Bowen, off Abbot Point, 19°53'S 148°05'E, alive, 7–23.5 m (1 pr, C.308869; 1 pr, C.308870; 1 pr, C.308871; 1 pr, C.308872; 1 pr, C.308873; 1 pr, C.308874; 1 pr, C.308875; 1 pr, C.308876; 1 pr, C.308877; 1 pr, C.308878; 4 pr, C.308879; 1 pr, C.308880; 1 pr, C.308881; 2 pr, C.308882; 3 pr, C.308883; 1 pr, C.308884; 1 pr, C.308885; 2



pr, C.308886; 4 pr, C.308887; 3 pr, C.308888; 1 pr, C.308889; 2 pr, C.338871; 2 pr, C.338872; 4 pr, C.338873; W of Hayman Island, 20°03'S 148°50'E, dead, 33 m (many v, C.120137); Bowen Harbour (Port Denison), 20°04'S 148°22'E, alive (2 pr, C.080051); Gloucester Passage, 20°04'S 148°28'E, dead (1 pr, C.012174); Whitsunday Passage, 20°13'S 148°47'E, dead, 24 m (9 v, C.119601); Whitsunday Islands, Lindeman Island, 20°45'S 149°03.3'E, dead (2 v, C.058935); Whitsunday Passage, off Lindeman Island, 20°27'S 149°02'E, dead (1 pr, C.133264); N of Mackay, off Shaw Island, 20°29'S 149°05'E, alive, 37 m (4 pr, C.338833); Whitsunday Passage, 20°32'S 149°01'E, dead, 27 m (15 v, C.338485); Repulse Bay, off The Brothers Islands, 20°47'S 148°53'E, alive, 15 m (1 pr, C.093042); E of Mackay, 20°52'S 149°29'E, dead, 35 m (1 v, C.338481); N of Mackay, Seaforth, 20°54'S 148°58'E, dead (1 v, C.133265); E of Sarina, 21°27'S 150°08'E, alive, 42 m (1 pr, C.119589); E of Sarina, 21°28'S 150°08'E, dead, 40 m (15 v, C.338480); Swain Reefs, 3 km NE of W side of Gillett Cay, 21°42'S 152°26'E, dead, 64–73 m (2 v, C.338483); SE of Sarina, 21°47'S 150°34'E, alive, 59 m (3 pr + 1 v, C.116483); W of Swain Reefs, 22°0'S 151°30'E, alive, 73 m (3 pr, C.097584); Capricorn Channel, 22°30'–24°0'S 152°0'–153°0'E, dead (5 v, C.303799); 30 mls NE of Yeppon, 22°50'S 151°11'E, dead, 46–55 m (21 v, C.073927); E of Keppel Islands, 23°0'S–23°12'S 151°10'E–151°20'E, alive, 46–49 m (5 pr, C.338870); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, alive, 7 m (1 pr, C.338869); Capricorn Channel, E of North West Island, 23°15'S 152°24'E, dead, 284 m (1 v, C.119622). **NEW SOUTH WALES:** off Newcastle, 32°56'S 151°57'E, alive, 73–82 m (3 pr + 1 v, C.093038). **NORTHERN TERRITORY:** SE of Darwin, Tree Point, 14°01'S 129°36'E, dead (7 v, C.108739; pr, C.338475); Port Darwin, 12°28'S 130°50'E, dead (8 v, C.011349); Port Darwin, off Rail Pier, 12°28'S 130°50'E, dead (1 v, C.057350); Port Darwin, 12°28'S 130°50'E, alive, 10 m (1 pr, C.097587); Darwin, Casuarina Beach, 12°21'S 130°52'E, dead (3 v, C.060728); Arafura Sea, c. 110 mls N of Melville Island, 9°34'S 131°22'E, dead, 135 m (1 v, C.338489); Arafura Sea, 11°01'S 132°03'E, alive, 32–33 m (7 pr, C.338836); Cobourg Peninsula, off Port Essington, 11°02'S 132°04'E, alive, 31 m (many, C.077848); off Cobourg Peninsula, 11°16'S 132°09'E, alive (4 pr, C.084729); Arafura Sea, c. 45 mls N Croker Island, 10°17'S 132°38'E, dead, 65 m (many v, C.078866); Arafura Sea, 160 km N of Goulburn Island, 10°08'S 133°05'E, dead, 73 m (2 v, C.338484); Arafura Sea, 91 km N of Goulburn Island, 10°42'S 133°36'E, dead, 58 m (1 v, C.096291); Arafura Sea, 11°24'S 134°54'E, dead, 38–40 m (1 pr, C.126514); Gulf of Carpentaria, Groote Eylandt, 14°0'S 136°25'E, (1 v, dead, C.092402; 1 pr, alive, C.338476); N of Arnhem Land, 10°50'S 137°10'E, dead, 59 m (1 v, C.338488); N of Arnhem Land, 9°49'S 137°12'E, dead (1 v, C.338482). —INDIA: off Kilakarai, Tamilnadu, alive, 35 m (2 pr, ZMA Moll.143647). —THAILAND: S of Phuket, alive, 30–50 m (7 pr, ZMA Moll.143677). —JAPAN: Tosa Bay, Shikoku, alive, 73 m (2 pr, ZMA Moll.144272). —CHINA: Beibu Gulf, alive, 10–80 m (2 pr, ZMA Moll.145735). —VIETNAM: off Nha Trang, Hon Noi Island, alive, 65 m (3 pr, ZMA Moll.145833). —INDONESIA: Makassar Strait, 1°11'S 107°06'E, alive, 21 m (1 pr, ZMA Moll.141780); S Sumatera, Kuala Mesudji, Lampung, alive, 15 m (2 pr, ZMA Moll.143728). —PAPUA NEW GUINEA: Gulf of Papua, 1.5 ml SW of Yule Island, 8°51'S 146°30'E, dead, 22–23 m (10 v, C.338466); Gulf of Papua, Caution Bay, 9°20'S 146°57'E, alive (2 pr, C.093035); off Port Moresby, Manubada [Local] Island, 9°31'S 147°10'E, dead, 23 m (3 v, C.096418); off Port Moresby, Manubada [Local] Island, 9°31'S 147°10'E, dead, 18–22 m (1 v, C.338465). —SOLOMON ISLANDS: Russell Island, alive, 35 m (1 pr, ZMA Moll.141111).

**Description.** Shell (sub)circular, up to c. 100 mm high, most specimens smaller; rather thin, weakly inflated, right valve slightly more convex than left, gaping at anterior and posterior margins, somewhat higher (dorso-ventrally) than wide in adult stage, inequivalve, equilateral; auricles small, equal in size, umbonal angle c. 120°. Left valve variable in colour, cream, pinkish or brownish with variable bluish or reddish radial lines and intermediate minute paler and darker dots; right valve and interior of most specimens white. Outer surface of both valves smooth and glossy, inner surface with 20–34 rib carinae, clearly arranged in pairs. Dorsal margin straight, byssal notch shallow, ctenolium lacking in adult stage.

**Dimensions.** Illustrated specimen: QLD, W of Nassau River, E Gulf of Carpentaria, trawled 11 m (AM C.121126): rv: H 60.2, L 59.8 mm; lv: H 59.9, L 59.2 mm; D 12.6 mm.

**Habitat.** Living free in shallow water on clean sand with silt and shell rubble, partially buried.

**Distribution.** Recorded throughout the western and southwestern Pacific, from southern Japan southwards to northern and northeastern Australia (as far south as northern New South Wales), westwards to southern India and eastwards to the Solomon Islands (Raines & Poppe, 2006: 138); Philippines, 26–160 m (Dijkstra, 2013: 51). Maximum depth range of live-taken specimens is 7–160 m. Present specimens from Australia alive at 7–82 m.

**Remarks.** Morton (1980) observed that specimens of *Amusium pleuronectes* swim with an average speed of 37–45

cm s<sup>-1</sup>. He suggested that swimming is not a response to predation, but apparently related to a seasonal migration, probably linked to reproduction. However, Brand (2016: 502) stated that “Scallops swim primarily to escape predators”, and it is likely that both predator avoidance and seasonal migrations occur in *A. pleuronectes*. Swimming in scallops was described in detail by Guderley & Tremblay (2016), summarising a huge amount of research in this field. This phenomenon was also observed in *A. pleuronectes* by Rumphius (1705). Del Norte (1988) reported that the major spawning season for the Lingayen Gulf (northern Philippine Islands) is in February and another minor one takes place from July to September.

## *Ylistrum* Mynhardt & Alejandrino, 2014

*Ylistrum* Mynhardt & Alejandrino in Mynhardt *et al.*, 2014: 407. Type species (by original designation): *Pecten balloti* Bernardi, 1861; Pliocene to living, Southwest Pacific.

**Diagnosis.** Amusiini with (sub)circular shape, up to c. 140 mm high, very weakly inflated, both valves slightly convex; umbonal angle c. 140°; exterior surface of disc and auricles smooth, interior with c. 42–54 narrow, prominent radial riblets arranged irregularly or in vaguely discernable pairs; auricles equal in length, intermediate hinge teeth absent, byssal notch and ctenolium weak in early ontogeny, absent later.

**Distribution.** Middle Miocene–Recent. The earliest species referable to *Ylistrum* seems to be *Amusium morganense* Beu & Darragh (2001: 175, figs 64A, F, 65A–E), from Morgan Limestone (Balcombian Australian local stage, middle Miocene), River Murray cliffs near Blanchetown, South Australia, and Nullarbor Limestone (also Balcombian), Nullarbor Plain, southern Western Australia. *Ylistrum morganense* is smaller and has larger auricles and much more closely paired internal rib carinae than *Y. balloti*. Tropical and subtropical Indo-West Pacific, living littorally.

**Discussion.** As discussed under *Annachlamys* and *Amusium*, we retain *Ylistrum* in Amusiini at present, awaiting a more final molecular phylogeny of Pectinidae.

## *Ylistrum balloti* (Bernardi, 1861)

Figs 47B, 48, 49A,C–D

*Pecten balloti* Bernardi, 1861: 46, pl. 1, fig. 1; Lischke, 1869: 165.

*Amusium* [sic] *balloti* (Bernardi)–Angas, 1877: 293; Slack-Smith & Bryce, 2004: 236.

*Pecten lucens* Tate, 1886: 115 (in part).

*Pecten* (*Amusium*) [sic] *balloti* Bernardi.–Küster & Kobelt, 1888: 179, pl. 50, fig. 1; Gregorio, 1898: 7, pl. 1, figs 3–4, 7; pl. 4, fig. 4.

*Pecten* (*Amusium*) [sic] *tatei* Gregorio, 1883: 133; Gregorio, 1898: 39 (unnecessary replacement name for *Pecten lucens* Tate, 1886, not preoccupied by *Pecten* (*Pleuronectia*) *lucidus* Jeffreys, 1872 (*nomen nudum*) (Crosse & Fischer, 1872) = *Pleuronectia lucida* Jeffreys in Thomson, 1873).

*Amusium lucens* (Tate)–Tate, 1899: 272 (in part).

*Amusium japonicum* (Gmelin)–Hedley, 1918a: M9 (misidentification).

*Amusium balloti* (Bernardi)–Iredale, 1939: 369; Allan, 1950: 282, pl. 31, fig. 15; Rippingale & McMichael, 1961: 173, pl. 24, fig. 8; Iredale & McMichael, 1962: 11; Coleman,

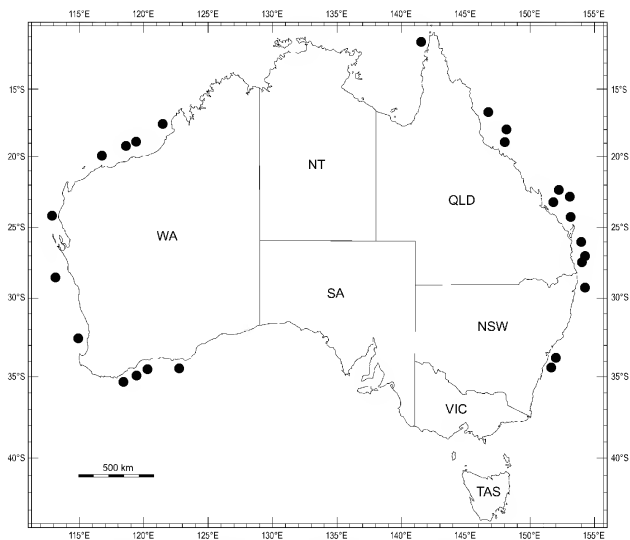


Figure 48. Distribution of *Ylustrum balloti* (Bernardi).

1975: 261, fig. 712; Dijkstra, (1983–1994) 1988: 3, figs; Wells & Bryce, 1985: 158, pl. 60, fig. 579; Dijkstra *et al.*, 1989: 24; Dijkstra, 1990a: 3, figs; Dijkstra, 1991: 25; Rombouts, 1991: 3, pl. 2, figs 5-5a; Lamprell & Whitehead, 1992: [18], pl. 7, fig. 38; Dijkstra & Marshall, 1997: 95; Beu & Darragh, 2001: 179, figs 63A, C, 64 B–C, 66A–H; Raines & Poppe, 2006: 136–137, upper figs; pl. 84, figs 1–3; Huber, 2010: 197.

*Amusium balloti* [sic] (Bernardi)–Garrard, 1961: 5.

*Amusium japonicum balloti* (Bernardi)–Habe, 1964a: 4, pl. 1, fig. 5; pl. 2, fig. 6; Abbott & Dance, 1982: 303, fig.; Wang, 1984b: 250, fig. 6; Waller, 1991: 18, 37, pl. 8, figs 5, 8.

*Ylustrum balloti* (Bernardi)–Mynhardt *et al.*, 2014: 407, figs 1G–L.

**Type data.** *Pecten balloti* Bernardi, 1861: three syntypes (pr) MNHN Moll21185. Type locality: New Caledonia.

*Pecten lucens* Tate, 1886: lectotype (pr) SAM T969B, designated by Beu & Darragh (2001: 181, figs 63A, C, 64B–C). Type locality: “oyster beds, Aldinga Bay” [i.e., Hallett Cove Sandstone, late Pliocene, coast SW of Adelaide, South Australia; Beu & Darragh (2001: 181)].

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Gulf of Carpentaria, Mapoon, 11°58'S 141°53'E, dead (4 v, C.338790); GBR, off Cairns, 16°51'S 146°01'E–146°04'E, dead, 33–35 m (many, C.138333); off Cairns, 16°52'–16°53'S 146°06'E, dead, 37–38 m (3 v, C.138267); off Townsville, 6–7 mls E of Keeper Reef, 18°45'S 147°23'E, dead, 43 m (10 v, C.131710); Townsville, Cape Bowling Green, 19°17'S 147°25'E, alive, 31–33 m (3 pr, C.072999); E of Broad Sound, 21°58'S 150°45'E, dead, 57 m (6 v, C.338795); W of Swain Reefs, 22°0'S 151°30'E, dead, 73 m (1 v, C.097585); off Broad Sound, 22°06'S 150°49'E, dead, 53 m (3 v, C.116495); inside Swain Reefs, 22°14'S 152°27'E, alive, 60 m (5 pr, QM MO.33653); SE of Swain Reefs, 22°31'S 152°32'E, dead, 100 m (8 v, C.151494); Port Clinton, 22°34.35'S 150°44.57'E, S arm channel, alive, 11 m (1 pr, C.300337); off Yeppoon, 22°40'S 151°16'E, dead, 58 m (1 v, C.338787); 30 mls NE of Yeppoon, 22°50'S 151°11'E, alive, 46–55 m, scallop beds (many, C.338793); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, dead (1 pr, C.086829); Keppel Bay, off Yeppoon, 23°07'S 150°46'E, alive (3 pr, C.076938); Keppel Bay, off Yeppoon, 23°07'S 150°46'E, alive (many, C.093047); Keppel Bay, between Outer Rock & Man & Wife, NE of South Keppel Island, 23°08'S 150°56'E, dead, 24–26 m (3 pr, C.070780); Keppel Bay, 1.5 ml NW of South Keppel Island, 23°09'S 150°57'E, dead, 13–20 m (3 pr, C.070779); Keppel Bay, Roslyn Bay, Double Point, 23°10'S 150°47'E, dead, (2 v, C.100490); GBR, Capricorn Group, off North West Island, 23°18'S 151°42'E, (4 pr, alive, C.303800; 1 v, dead, C.338794); Keppel Bay, 23°25'S 150°55'E, dead (1 pr, C.086828); Capricorn Group, Heron Island, 23°26'S 151°57'E, dead (1 v, C.072664; 1 pr, C.093020); Capricorn Group, One Tree Island, 23°30'S 152°05'E, dead, 55 m (3 v, C.338786); Gladstone Harbour, 23°51'S 151°16'E, alive (1 pr, C.093046); off Burnett Heads, 24°46'S 152°24'E, dead, 46–55 m (17 v, C.064355); Bargara, 24°49'S 152°28'E, alive (6 pr, C.080460; 1 pr, C.097660); off Bundaberg, 24°52'S 152°23'E, alive (1 pr, C.080071; 1 pr, C.081192); Hervey Bay, 25°06'S 152°49'E, dead (3 v, C.094770); off S end Frazer Island, 25°48'S 153°46'E, alive, 73 m (1 pr + 4 v, C.111356); off Wide Bay, 25°50'S 153°27'E, dead, 55 m (2 pr, C.097590); 25 mls SE of Double Island Point,

26°13'S 153°22'E, dead, 60 m (7 v, C.031277); Caloundra, 26°49'S 153°10'E, dead (1 v, C.012847; 1 v, C.012849); Moreton Bay, 27°15'S 153°15'E, dead (1 pr, C.012171); S Moreton Bay, off Jacobs Well, 27°27'S 153°33'E, alive, 49 m (3 pr, C.103412); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, dead, 5–7 m (7 v, C.093045); off S end of Stradbroke Island, 27°43'S 152°35'E, alive, 48–59 m (7 pr, C.070454); off Southport, 27°58'S 153°25'E, alive, 18–36 m (2 pr, C.338791). **NEW SOUTH WALES:** off Tweed Heads, 28°10'S 153°42'E, alive, 54 m (6 pr, C.097591); off Tweed Heads, 28°17'S 153°44'E, dead, 73 m (1 v, C.117648); off Ballina, 28°52'S 153°37'E, dead (1 pr, C.093030); N of North Solitary Island, 29°52'–29°48'S 153°25'–153°26'E, dead, 64 m (1 v, C.338792); off Red Head, 32°04'S 152°43'E, dead, 64 m (1 pr, C.093026); Port Stephens, 32°42'S 152°05'E, dead (2 pr, C.093029); off Newcastle, 32°56'S 151°57'E, dead, 73–82 m (10 v, C.093025); off Broken Bay, 33°32'S 151°26'E, alive, 49–64 m (2 pr, C.093028; 1 pr, C.302854); Sydney Harbour, Mosman Bay, 33°50'S 151°13'E, alive (1 pr, C.012176); Sydney, Port Jackson, 33°51'S 151°14'E, dead (4 v, C.086831; 9 v, C.093027; 4 v, C.151423); Sydney S, Cronulla, 34°03'S 151°09'E, dead (1 v, C.338796). **WESTERN AUSTRALIA:** Sandy Hook Island, Esperance, 34°02'S 122°0'E, alive, 31–35 m (10 pr, WAM); Great Australian Bight, E of Hood Point, 34°21'S 121°16'E, dead, 82 m (3 v, C.338784); Doubtful Island Bay, mouth of Gordon Inlet, near Albany, 34°12'S 119°38'E, alive, 22–37 m (2 pr, WAM); E of Cheyne Bay, 34°55'S 119°0'E, dead, 71–76 m (2 v, C.338785); King George Sound, 35°03'S 117°58'E, dead (1 pr, C.069360); Hamelin Bay, 34°12'S 115°01'E, dead (1 v, C.093018); W of Rottnest Island, 32°42'S 115°13'E, alive, 43–46 m (4 pr, WAM); off Fremantle, 32°12'S 115°44'E, alive (1 pr, C.093017); Perth, W of City Beach, 31°56.8'S 115°34'E, dead, 27.4 m (1 v, WAM); Geraldton, 28°46'S 114°37'E, dead (1 pr, C.140196); Albrohros Islands, Goss Passage, 28°29'S 113°46'E, dead, 34 m (1 v, WAM); outside Wallabi Bay, Abrolhos Island, 28°25'S 113°33'E, dead (1 pr, C.093019); N of Dirk Hartog Island, 25°29'S 112°57'E, dead, 73 m (11 v, WAM); Carnarvon, 24°53'S 113°40'E, alive, 24 m (1 pr, WAM); 15 ml WSW of Carnarvon, 24°58'S 113°27'E, alive, 26 m (1 pr, WAM); off Carnarvon, 24°52'S 113°36'E, alive, 24 m (1 pr, C.106491); off Carnarvon, 24°52'S 113°36'E, alive (5 pr, C.133270); off Dampier, 20°40'S 116°43'E, alive, 13–15 m (3 pr, WAM); off Port Hedland, 20°18'S 118°53'E, alive, 22–26 m (2 pr, WAM); 26 mls NNE of Dampier, 20°14'S 116°50'E, alive, 40–41 m (1 pr, C.338825); North West Shelf, 44 mls NW of Port Hedland, 19°56'S 117°53'–117°53.4'E, alive, 40 m (4 pr, C.338827); 45 mls NNE of Port Hedland, 19°55'S 117°56'–117°55.6'E, alive, 40 m (1 pr, C.338828); North West Shelf, 52 mls NNE of Port Hedland, 19°30'–19°28'S 118°49'–118°55.4'E, alive, 36–37 m (4 pr + 1 v, C.148701); 74 mls NNE of Port Hedland, 19°05'–19°05.3'S 118°53'–118°54'E, alive, 80 m (1 pr, C.338822); 77 mls NNE of Port Hedland, 19°05'–19°04.9'S 118°58'–118°58.2'E, dead, 82 m (4 v, C.149341); 78 mls NNE of Port Hedland, 19°04'–19°04.2'S 119°04'–119°0.7'E, alive, 82 m (3 pr + 5 v, C.149961); 80 mls NNE of Port Hedland, 19°03'–19°03.4'S 119°03'–119°03.5'E, alive, 82 m (2 pr + 18 v, C.146782); 72 mls NW of Bedout Island, 18°51'S 118°19'E, dead, 46 m (1 v, WAM); off Broome, 17°58'S 122°14'E, alive, 37 m (2 pr, WAM). **CORAL SEA:** Chesterfield Islands, 20°21.2'S 160°58.6'E, alive, 74–75 m (1 pr, ZMA Moll.145184); Chesterfield Islands, 20°28'S 160°56'E, alive, 78 m (1 pr, ZMA Moll.145179).—**NEW CALEDONIA:** 19°29'S 163°49'E, alive, 40 m (4 pr, ZMA Moll.145195); 22°17'S 166°20'E, alive, 20 m (1 pr, ZMA Moll.145181). **NORFOLK ISLAND:** 29°02'S 167°57'E, dead (1 v, C.059877).

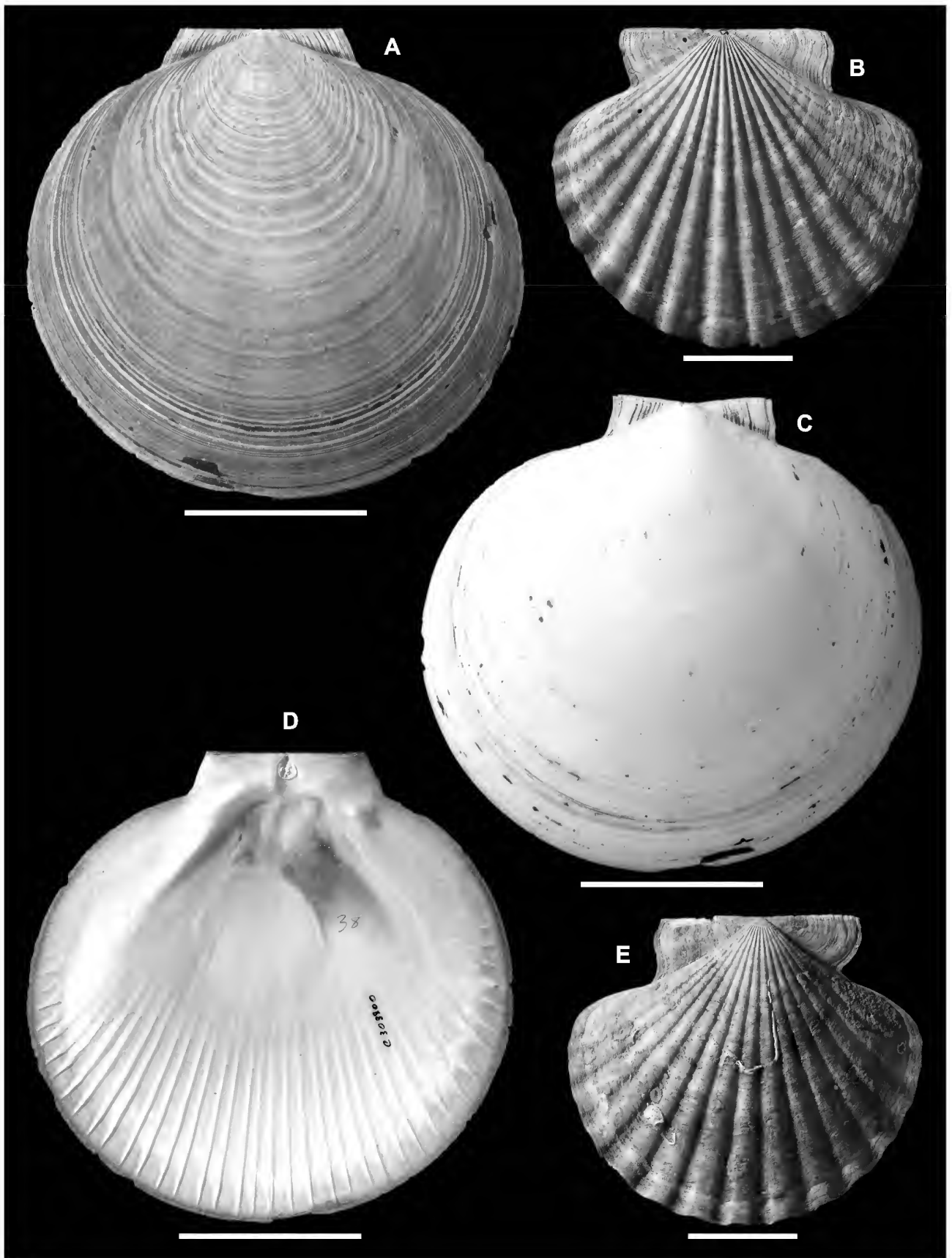
**Description.** Shell up to c. 140 mm high, circular, acline, almost equivalve, equilateral, valves weakly convex, equally inflated, auricles equal in size, umbonal angle c. 140°, left valve brownish or red-brownish with commarginal darker colour bands, right valve white with scattered brown spots; interior white.

Both valves almost smooth, glossy, with very weak, irregular commarginal corrugations only; a few delicate radial striae on some specimens. Posterior auricles and left anterior auricle smooth, symmetrical. Right anterior auricle with 6–7 closely spaced radial costae. Interior with 42–54 prominent radial carinae, arranged in vaguely recognisable pairs. Hinge weak, with delicate dorsal teeth. Byssal notch shallow; ctenolium functional only in juvenile stage, lacking in adult.

**Dimensions.** Illustrated specimen: QLD, GBR, Capricorn Group, trawled off North West Island (AM C.303800): rv: H 128.8, L 137.6 mm; lv: H 128.4, L 134.3 mm; D 29.2 mm.

**Habitat.** Littoral to sublittoral depths, living free on clean sand, partially buried with only the outline of the shell showing.

**Distribution.** Southwestern Australia from the Great Australian Bight to southern Western Australia, more rarely northwards to northern Australia; southeastern and eastern Australia from Jervis Bay (southern New South Wales) up to north Queensland. Populations are scarce in the Northern Territory and are absent from South Australia and Victoria. Also known from Indonesia, 145–155 m, dead (Dijkstra, 1991: 25), the Chesterfield Islands (Coral Sea), New Caledonia and Norfolk Island, 64–90 m, dead (Dijkstra &



**Figure 49.** *A, C, D, Ylistrum balloti* (Bernardi), pair, specimen in Fig. 47B; lv exterior (A), rv exterior (C), lv interior (D). *B, E, Annachlamys flabellata* (Lamarck), pair, specimen in Fig. 47D, E; lv exterior (B), rv exterior (E). Scale bars represent 50 mm (A, C, D), 30 mm (B, E).

Marshall, 1997: 95). Maximum depth range of live-taken specimens from Australia is 11–82 m.

**Remarks.** Specimens of *Ylistrum balloti* from western Australia are generally red-purplish, from eastern Australia brownish, from the Chesterfield Islands and Norfolk Island creamy, and from New Caledonia creamy to brownish. Other morphological characters are identical. The interior rib carinae are variable in number and spacing, but are arranged vaguely in pairs in many specimens.

Joll (1989) described swimming in *Ylistrum balloti*, which swims further and faster than *Amusium pleuronectes*; *Y. balloti* swims at 0.8–1.0 m s<sup>-1</sup>, with a maximum of 1.6 m s<sup>-1</sup> (3.1 knots) and swims for up to 23.1 m in one swimming event, achieving a maximum distance of 30.8 m in four swimming events. This species is trawled commercially in Queensland and Western Australia, and swimming has been studied in these areas because many specimens are able to swim away from the trawl (Dredge, 2006, and references therein).

### Pectinini Rafinesque, 1815

**Diagnosis.** Pectininae with undivided radial plicae, pre-radial area of left valve tall and smooth, internal rib carinae present, disc microsculpture of widely spaced commarginal lamellae, and hinge teeth well-developed, with dorsal, resilial and intermediate teeth.

**Remarks.** As pointed out under Amusiini, Waller (2006a: 22–27, fig. 1.3) demonstrated that tribes Amusiini and Pectinini deserve separation. He transferred *Annachlamys* from Decatopectinini to Pectinini, and we retain this position here.

### *Annachlamys* Iredale, 1939

*Annachlamys* Iredale, 1939: 358. Type species (by original designation): *Pecten leopardus* Reeve, 1853 (= *Pecten flabellatus* Lamarck, 1819); Recent, western, northern and eastern Australia.

**Diagnosis.** Pectinini with a sturdy, subcircular shell, up to c. 60 mm high and a few specimens up to >100 mm wide, with almost equally inflated valves, wider than high in late ontogeny, with numerous radial plicae (12–30), prominent widely spaced commarginal lamellae on disc and auricles of most adults (closely spaced in early ontogeny), auricles of most specimens without radial sculpture, internal rib carinae prominent. Hinge teeth weak. Byssal notch shallow; ctenolium obsolete or lacking in adult stage.

**Distribution.** Miocene–Recent (Beu & Darragh, 2001). Eurasia (Tethyan) (Hertlein, 1969), tropical western and southwestern Pacific, living in the littoral to sublittoral zones on soft sediment.

**Discussion.** Hertlein (1969: N355) treated *Annachlamys* as a subgenus of *Chlamys*, placed in the *Chlamys* group. Waller (1986: 40) considered *Annachlamys* to be a valid genus and placed it in tribe Decatopectinini. Following reconsideration of its phylogeny, Waller (2006a: 27, fig. 1.3) transferred *Annachlamys* to tribe Pectinini (as redefined by him, including *Pecten* and *Gigantopecten*) because of its change from close-set to far-set commarginal lamellae during ontogeny, and because it is most similar morphologically to *Gigantopecten*, a genus of Pectinini occurring in European Cenozoic rocks. The position of *Annachlamys* has varied

### Key to species of *Annachlamys* from Australia

- 1 Shell c. 100 mm high, subcircular, lv flattened, rv more inflated, almost equivalve and equilateral, auricles almost equal, valves with 16–20 evenly spaced radial plicae, commarginal microsculpture throughout disc, byssal notch shallow, byssal fasciole and ctenolium lacking in adults ..... *A. flabellata*
- Shell with 15–18 radial plicae with commarginal lamellae ..... 2
- 2 Shell c. 80 mm high, subcircular, almost equally convex, inequivalve and equilateral, auricles unequal, valves with 15–18 evenly spaced radial plicae with prominent commarginal lamellae, secondary radial riblets in interspaces in adults, byssal notch shallow, byssal fasciole narrow, ctenolium rudimentary or lacking ..... *A. iredalei*
- Shell with moderately inflated valves with 18–20 radial plicae ..... 3
- 3 Shell c. 100 mm high, subcircular, almost equally and moderately inflated, inequivalve and equilateral, auricles unequal, valves with 18–20 evenly spaced obsolete radial plicae, byssal notch shallow, byssal fasciole and ctenolium lacking in adults ..... *A. kuhnholtzi*
- Shell with 16–18 broad radial plicae and narrow interspaces ..... 4
- 4 Shell c. 60 mm high, subcircular, almost equally and moderately inflated, inequivalve and equilateral, auricles almost equal, valves with 16–18 evenly spaced broad radial plicae, interspaces narrow, byssal notch shallow, byssal fasciole and ctenolium lacking in adults ..... *A. reevei*

significantly since. Sherratt *et al.* (2016) included both *Annachlamys* and *Ylistrum* in a minor basal clade in Decatopectinini, whereas Serb (2016) included *Ylistrum* in a basal clade of Decatopectinini but placed *Annachlamys* in Chlamyidini (i.e., Pedini) between *Semipallium dringii* and *Equichlamys bifrons*. In our opinion the subfamily and tribe position of *Annachlamys* requires further molecular comparison. Here we retain it in Pectinini, awaiting a more final molecular phylogeny.

The living species of *Annachlamys* are: *Annachlamys flabellata* (Lamarck, 1819) from western, northern and eastern Australia and the adjacent Timor Sea and Coral Sea; *A. iredalei* (Powell, 1958) from the Coral Sea, New Caledonia, and southeastwards to the Kermadec Islands; *A. kuhnholtzi* (Bernardi, 1860) from Queensland, the Coral Sea and New Caledonia; *A. reevei* (A. Adams & Reeve, 1850) from the South China Sea, Indonesia to northern Australia; and *A. striatula* (Linnaeus, 1758) from the tropical western and southwestern Pacific to the eastern Indian Ocean (Dijkstra, 1999: 395). For fossil species of *Annachlamys* from southern Australia see Beu & Darragh (2001: 148).

### *Annachlamys flabellata* (Lamarck, 1819)

Figs 47D–E, 49B,E, 50, 51A–B

*Pecten flabellatus* Lamarck, 1819: no. 36; Dijkstra, 1994: 485, figs 83–86 (lectotype).

*Pecten leopardus* Reeve, 1853: sp. 145, pl. 32, fig. 145; E. A. Smith, 1884: 114 [in part]; Küster & Kobelt, 1888: 205, pl. 55, fig. 2; Hedley, 1906: 464; Thiele, 1930: 591.

*Pecten flabellatus* f. *leopardus* Reeve.—Bavay, 1904b: 364.

*Annachlamys leopardus* (Reeve).—Iredale, 1939: 358; Allan, 1950: 281; McMichael, 1960: 26.

*Annachlamys melica* Iredale, 1939: 359; Allan, 1950: 281, fig. 8.

*Chlamys leopardus* (Reeve).—Coleman, 1982: 32, fig. 70; Wells & Bryce, 1988: 160, pl. 60, fig. 587.

*Annachlamys flabellata* (Lamarck).—Dijkstra, 1991: 42; Lamprell & Whitehead, 1992: [26], 173, pl. 11, fig. 63 (in part); Slack-Smith & Bryce, 2004: 236 [as *Annachlamys flabellata*]; Taylor & Glover, 2004: 262; Raines & Poppe, 2006: 93–93, upper figs; pl. 26, figs 1, 4; pl. 27, figs 4–5; pl. 28, fig. 4; Huber, 2010: 197.

*Chlamys flabellata* (Lamarck).—Wells, Slack-Smith & Bryce, 2000: 42.

*Chlamys* (*Annachlamys*) *flabellata* (Lamarck).—Dharma, 2005: 248, pl. 99, fig. 14.

**Type data.** *Pecten flabellatus* Lamarck: lectotype (pr) MNHN Moll21192, designated by Dijkstra (1994: 485), paralectotype (pr) MNHN Moll21193; type locality: not indicated in original description; Australia, Western Australia, Shark Bay, restricted and designated by Dijkstra (1994: 485).

*Pecten leopardus* Reeve: two syntypes (pr) NHMUK 1950.11.14.1–2. Type locality: Australia, Queensland, Moreton Bay.

*Annachlamys melica* Iredale: holotype (pr) AM C.090372. Type locality: Australia, Western Australia, Broome, Entrance Point, between tide marks.

**Comments on type data.** For more information on the type data of *Pecten flabellatus* see Dijkstra (1994: 485, pl. 20, figs 83–86).

The type material of *Pecten leopardus* and *Annachlamys melica* falls within the range of variation of *Annachlamys flabellata* (see remarks below). It is not necessary to designate a lectotype of *P. leopardus* for nomenclatural stability.

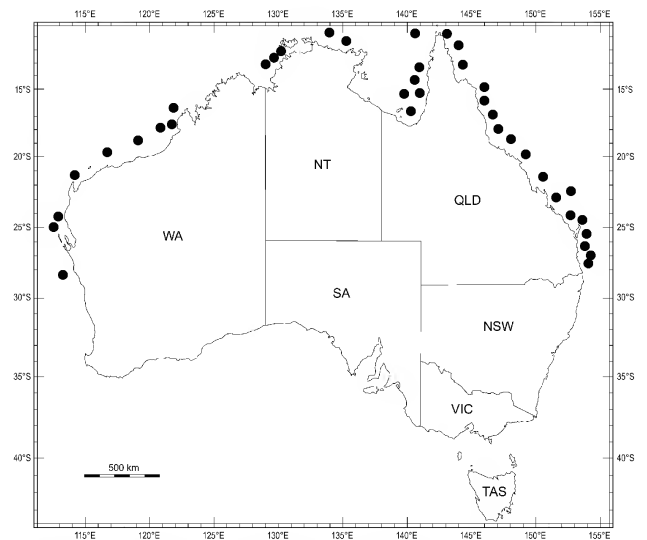
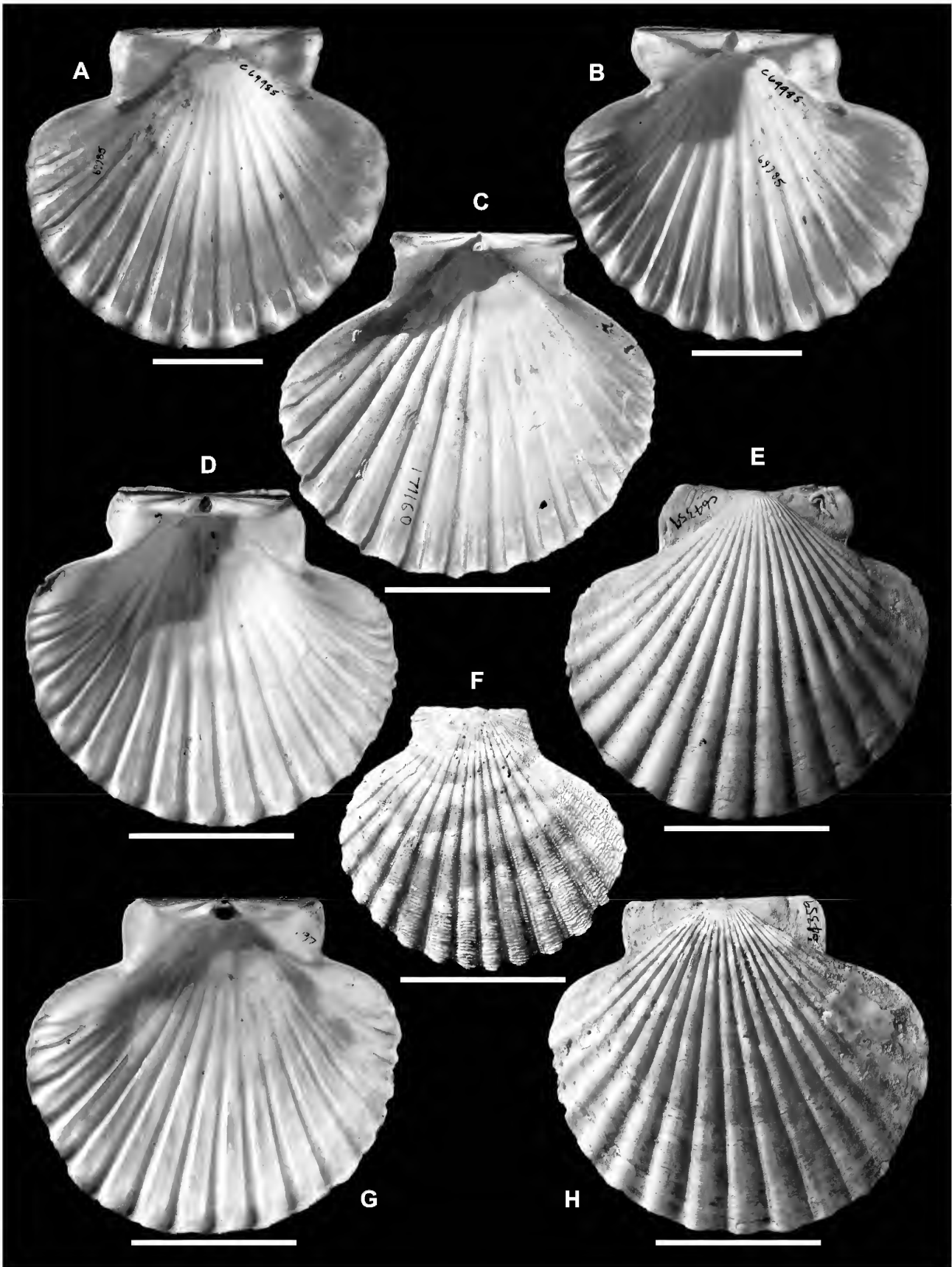


Figure 50. Distribution of *Annachlamys flabellata* (Lamarck).

### Additional material examined.

—AUSTRALIA: QUEENSLAND: Torres Strait, 10°06.6'S 141°36.66'E, alive, 15 m (1 pr, C.164909); Torres Strait, 10°22.48'S 141°03.36'E, alive, 17 m (1 pr, C.164907); Torres Strait, 10°28.05'S 141°45.21'E, alive, 16 m (1 pr, C.164908); Torres Strait, Thursday Island, 10°35'S 142°13'E, alive (2 pr, C.367540); Torres Strait, Friday Island, 10°36'S 142°10'E, dead (1 v, C.370369); Cape York Peninsula, 10°41.3'S 142°31.75'E, dead (14 v, C.097557); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, alive, 7–26 m (2 pr, C.132761; 4 v, C.055644; many v, C.036129); GBR, off Cape York, 3 ml E of Turtle Head Island, 10°56'S 143°46'E, alive, 18 m (1 pr, C.130085); 2 ml NE of Hannibal Island, 11°33'S 142°57'E, dead, 22–23 m (1 v, C.370370); Gulf of Carpentaria, 10 ml SW of Mapoon, 12°05'S 141°40'E, dead, 18 m (8 v, C.014078); Gulf of Carpentaria, W of Edward River, 14°46'S 141°20.7'E, dead, 18 m (1 v, C.367530); GBR, 0.5 ml W of Two Isles, 15°01'S 145°26'E, dead, 30 m (2 v, C.075239); Three Isles, N of Cooktown, 15°07'S 145°25'E, dead (1 v, C.370371); Gulf of Carpentaria, W of Mitchell River, 15°10'S 141°06'E, alive, 24 m (1 pr, C.367532); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (3 v, C.027530); E Gulf of Carpentaria, W of Nassau River, 15°51'S 140°54.2'E, alive, 22 m (8 pr, C.367536; 3 pr, C.109329); E Gulf of Carpentaria, W of Nassau River, 15°53.5'S 140°42'E, alive, 25.6 m (4 pr, C.367535); E of Carpentaria, W of Nassau River, 15°53.5'S 141°13.8'E, alive, 11 m (2 pr, C.114114); E Gulf of Carpentaria, SW of Nassau River, 16°08.5'S 140°52.6'E, alive, 18 m (1 pr, C.370390); Low Isles, 16°23'S 145°34'E, dead, 16–22 m (4 v, C.370372); SE Gulf of Carpentaria, W of Staaten River, 16°25.5'S 140°17.4'E, alive, 25.6 m (many, C.108356); SE Gulf of Carpentaria, off Karumba, 16°30'–17°30'S 140°0'–141°0'E, alive (1 pr, C.115072; 2 pr, C.117071; 1 pr, C.113278); GBR, off Cairns, 16°36.2'–16°35.9'S 146°15.4'–146°14.3'E, dead, 110–210 m (10 v, C.138268); E Gulf of Carpentaria, W of Gilbert River, 16°41.5'S 141°05.5'E, alive, 3.5–18.3 m (1 pr, C.370391; 1 v, C.367529); Gulf of Carpentaria, Forsyth Island, 16°50'S 139°06'E, dead (2 v, C.014850); GBR, off Cairns, 16°51.6'S–16°51'S 146°01.2'E–146°04'E, dead, 33–35 m (20 v, C.370366); SE Gulf of Carpentaria, W of Point Burrows, 16°57'S 140°16'E, dead, 18 m (18 v, C.367528); Gulf of Carpentaria, S of Sweers Island, 17°06'S 139°37'E, dead, 9–22 m (2 v, C.367533; 11 v, C.367534; many v, C.367537); E Gulf of Carpentaria, W of Fitzmaurice Point, 17°10.5'S 140°0'E, alive, 9–11 m (1 pr, C.370393); Gulf of Carpentaria, Karumba, 17°29'S 140°50'E, dead (2 v, C.367531); Palm Islands, 18°40'S 146°33'E, dead, 27 m (1 v, C.010256); off Townsville, 18°40'S 146°55'E, dead, 40–41 m (1 v, C.156018); Forrest Beach, S of Lucinda, 18°43'S 146°18'E, dead (2 v, C.371616); off Townsville, 19°0'S 147°0'E, alive (1 pr, C.133285); Magnetic Island, 19°08'S 146°50'E, dead (2 v, C.075242); S of Townsville, 19°17'S 147°32'E, dead, 24 m (1 v, C.370373); off Bowen, 19°44'S 148°14'E, dead, 40 m (1 v, C.119546); E of Bowen, 19°45.7'S 148°19'E, dead, 46 m (9 v, C.370367); off Abbot Point, 19°53'S 148°05'E, alive, 9–10 m (1 pr, C.309228); W of Hayman Island, 20°03'S 148°50'E, dead, 33 m (19 v, C.370468); Sinclair Bay, Cape Gloucester, 20°07'S 148°27'E, dead (3 v, C.097556); Whitsunday Passage, 20°13.5'S 148°47.5'E, dead, 24 m (12 v, C.119609); Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, dead (many v, C.058934); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (4 v, C.370452); Whitsunday Passage, 20°32.3'S 149°01.4'E, dead, 27 m (19 v, C.120178); E of Mackay, 20°52'S 149°29'E, dead, 35 m (12 v, C.116565); Seaforth, N of Mackay, 20°54'S 148°58'E, dead (1 v, C.059196); Mackay, 21°07'S 149°14'E, dead (1 v, C.370472); E of Sarina, 21°27.5'S 150°08'E, dead, 42 m (many v, C.119582); E of Sarina, 21°28'S 150°08.5'E, dead, 40 m (many v, C.370476); SE of Sarina, 21°47'S 150°34'E, dead, 59 m (11 v, C.370477); E of Broad Sound, 21°58.5'S 150°45'E, dead, 57 m (20 v, C.370481); off Broad Sound, 22°06'S 150°49'E, dead, 53 m (18 v, C.116493); inside Swain Reefs, 22°14'S 152°27'E, alive, 60 m (1 pr, QM MO.33652); SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (2 v, C.157663); off Yeppoon, 22°42'S 151°37.4'E, dead, 68 m (2 v, C.370492); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, alive (4 pr, C.132762); Keppel Bay, North Keppel Island, off SW end, 23°04'S 150°54'E, alive, 7 m (2 pr, C.071609); Keppel Bay, Yeppoon, 23°08'S 150°45'E, alive (2 pr, C.371710); Keppel Bay, between Outer Rock and Man & Wife, NE of South Keppel Island, 23°08'S 150°56'E, dead, 24–26 m (2 v, C.370496); Keppel Bay, 23°25'S 150°55'E, alive (1 pr, C.132763; 2 pr, C.119780);





**Figure 51.** *A, B*, *Annachlamys flabellata* (Lamarck), pair, specimen in Figs 47D, E, 49B, E, lv interior (A), rv interior (B). *C, F*, *Annachlamys iredalei* (Powell), separate valves, NMNZ M171160, NORFANZ stn 66, off Lord Howe Island, 31°45.73'S 159°20.93'E, 565–960 m, lv interior (C), lv exterior (F). *D, E, G, H*, *Annachlamys kuhnholti* (Bernardi), pair, specimen in Fig. 47A, C; rv interior (D), rv exterior (E), lv interior (G), lv exterior (H). Scale bars represent 30 mm.

Capricorn Group, Heron Island, 23°26'S 151°57'E, alive (1 pr, C.371633); Port Curtis, 23°55'S 151°23'E, dead (3 v, C.012167); Port Curtis, Rodds Harbour, 24°0'S 151°34'E, alive (1 pr, C.069985; 1 pr, C.080128); off Burnett Heads, 24°46'S 152°24'E, dead, 46 m (18 v, C.064358; 18 v, C.097560); Bargara, 24°49'S 152°28'E, dead (1 v, C.371705); Hervey Bay, 25°06'S 152°49'E, alive, 18–27 m (2 pr, C.132764; 3 v, C.080129); Hervey Bay, Point Vernon, 25°15'S 152°49'E, dead (1 v, C.070046); Hervey Bay, Torquay, 25°17'S 152°52'E, alive (1 pr, C.371706); Hervey Bay, Eli Creek, N of Pialba, 25°17'S 152°49'E, dead (1 v, C.070051); Hervey Bay, Dundowan, 25°18'S 152°46'E, dead (3 v, C.371703); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (4 pr, C.097559); S of Fraser Island, 25°28'S 153°0'E, alive (2 pr, C.070644); off Wide Bay, 25°50'S 153°27.4'E, alive, 55 m (2 pr, C.097558); off Tin Can Bay, 25°50'S 153°27.5'E, dead, 55 m (20 v, C.119782); south coast, 26°30'S 153°10'E, alive (1 pr, C.081221); off Mooloolaba, 26°40'S 153°36'E, alive, 55–146 m (1 pr, C.071555); Caloundra, 26°49'S 153°10'E, dead (1 v, C.012775); Moreton Bay, 27°15'S 153°15'E, alive (5 pr, C.115522); Moreton Bay, 27°15'S 153°15'E, dead, 3.5–11 m (3 v, C.119781); Moreton Bay, Redcliffe Peninsula, off Margate, King Street Reef, 27°15.5'S 153°07.3'E, dead, 8 m (1 v, C.371597); Moreton Bay, Green Island, 27°26'S 153°14'E, dead (1 v, C.370601); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, dead, 5–7 m (5 v, C.075252; 6 v, C.073040). **WESTERN AUSTRALIA:** Perth, Cottesloe Beach & nearby beaches, 31°59'S 115°45'E, dead (1 v, C.119772); Geraldton, 28°46'S 114°37'E, dead (1 v, C.069304); Abrolhos Islands, outside Wallabi Group, 28°25'S 113°33'E, alive (2 pr, C.119776); Shark Bay, 26°07'S 113°25'E, dead (3 v, C.119773); Shark Bay, off Denham, 25°56'S 113°31'E, dead (2 v, C.076945); Shark Bay, N end of Dirk Hartog Island, 25°29'S 112°57'E, alive, 18 m (5 pr, WAM); Rottnest Shelf, 25°17.96'S 112°59.13'E, dead, 100 m (1 v, WAM S12529); c.48 km S of Carnarvon, 25°10'S 114°39'E, alive, 15–18 m (3 pr, C.370404); off Carnarvon, 24°52'S 113°36'E, alive, 24 m (3 pr, C.370407); Exmouth Gulf, 22°15'S 114°15'E, alive, 20 m (2 pr, C.108906; 1 pr, C.119778; 1 v, C.365495); North West Cape, 21°49.05'S 114°14.56'E, dead, 23 m (1 v, C.365512); North West Cape, 21°44.5'S 114°19.6'E, dead, 12 m (1 v, C.365511); Onslow area, 21°38'S 115°07'E, dead (3 v, C.365491); North West Shelf, 26 n.ml NNE of Dampier, 20°14.6'S 116°50.9'E, alive, 40–41 m (1 pr, C.370395); North West Shelf, 19°55.2'–19°55.6'S 117°56'–117°55.6'E, dead, 40 m (1 v, C.149203); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30.9'–19°28.2'S 118°49.2'–118°55.4'E, alive, 36–37 m (2 pr + 7 v, C.148702); 72 n.ml NNW of Dampier, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, dead, 110 m (1 v, C.165178); Eighty [= Ninety] Mile Beach, near N end, 19°07'S 121°29'E, dead (1 v, C.057134); North West Shelf, 74 n.ml NNE of Port Hedland, 19°05.4'–19°05.3'S 118°53.9'–118°54'E, dead, 80 m (1 v, C.365510); North West Shelf, 77 n.ml NNE of Port Hedland, 19°05'–19°04.9'S 118°58'–118°58.2'E, dead, 82 m (7 v, C.149339); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04.6'–19°04.3'S 118°47.4'–118°47.6'E, dead, 82 m (1 v, C.149996); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04.4'–19°04.2'S 119°04.4'–119°00.7'E, dead, 82 m (7 v, C.149326); North West Shelf, 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (1 v, C.147419); 10–12 ml W of Lagrange Bay, 18°37'S 121°43'E, alive, 22–46 m (1 juv. pr [flat form], WAM447); Broome, Entrance Point, 18°01'S 122°12'E, alive (pr [holotype of *A. melica*], C.090372; 1 v [paratype of *A. melica*], C.119775); Broome, Roebuck Bay, Central Bank, 18°0'S 122°15'E, alive (4 pr, C.121366); Broome, Roebuck Bay, 18°0'S 122°15'E, alive (2 pr, C.132759); Broome, low tide, alive (2 pr, WAM); Broome, 17°58'S 122°14'E, dead (4 v, C.069100; 1 v, C.075236; 1 v, C.075238); off Lacepede Islands, 16°58'S 122°08'E, alive (1 pr, C.119777); Beagle Bay, 16°56'S 122°32'E, dead (many v, C.119774); Buccaneer Archipelago, 15°57'S 123°26'E, dead (1 v, C.042425); Timor Sea, South Sahul Bank, 12°03.6'–12°03.4'E, dead, 27 m (2 v + fragm., C.071457); Timor Sea, Sahul Banks, 11°30'S 125°30'E, dead, 27 m (1 fragm., C.365957). **NORTHERN TERRITORY:** Tree Point, SW of Darwin, 14°01'S 129°36'E, dead (10 v, C.365953; 4 v, C.365954); SW of Darwin, Peron Islands, W of North Peron Island, alive, 15 m (2 pr, NTM P003492); SW of Darwin, Peron Islands, NNW of North Peron Island, 13°0.90'S 129°58.92'E, alive, 14 m (5 pr, NTM P003574); Anson Bay, 13°20'S 130°10'E, dead (3 v, C.040802); SW of Darwin, Fog Bay, 1.5 n ml NW of Blaze Reef, 12°52.02'S 130°11.10'E, alive, 6 m (2 pr, NTM P003614); Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (5 v, C.365958); Darwin, N side East Point, 12°25'S 130°49'E, dead (1 v, C.140188); NE of Darwin, outer Shoal Bay, 12°06.90'S 130°49.92'E, alive, 18 m (1 pr, NTM P005808); Port Darwin, 12°28'S 130°50'E, dead (1 v, C.013917; 1 v, C.108320); Darwin, Casuarina Beach, 12°21'S 130°52'E, dead (3 v, C.060723; 1 v, C.077819); Darwin, middle section of Casuarina Beach, adjacent to outlet of Sandy Creek, Free Beach, 12°21'S 130°53.3'E, washed ashore, dead (1 pr, NTM P010564); Cobourg Peninsula, 11°16'S 132°09'E, dead (1 v, C.117574); Arafura Sea, 68 km NE of Croker Island, 10°39'S 133°05'E, dead, 62 m (1 v, C.365961); Arafura Sea, 91 km N of Goulburn Island, 10°42'S 133°36'E, dead, 58 m (1 v, C.365959); Arafura Sea, 41 km NE of Goulburn Island, 11°10.5'S 133°43'E, dead, 47 m (1 v, C.365960); 84 km NE of Goulburn Island, 10°48.5'S 133°48'E, dead, 60 m (1 v, C.160979); Arafura Sea, 10°13'S 133°58'E, alive, 72 m (2 pr, C.126519); Arafura Sea, 11°24'S 134°54'E, alive, 40 m (1 pr, C.370402); Arafura Sea, 10°25'–10°26'S 136°03'–136°07'E, dead, 25 m (1 v, C.135561); Gulf of Carpentaria, Grootte Eylandt, 14°0'S 136°25'E, dead (2 v, C.365956); Gulf of Carpentaria, alive, 9 m (2 pr, WAM); Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (2 v, C.365955). —PAPUA NEW GUINEA: Gulf of Papua, off Cape Possession, 8°37'S 146°20'E, dead, 27 m (1 v, C.370365); off Port Moresby, Manubada (Local) Island, off W end, 9°31'S 147°10'E, dead, 18–22 m (1 v, C.370368).

**Description.** Shell up to c. 100 mm high, solid, subcircular, weakly inflated, almost equally convex (right valve slightly more convex than left), somewhat wider than high, slightly inequivalve, equilateral, auricles almost equal in size, umbonal angle c. 115°; resiliial and dorsal teeth weak; colour of left valve variable (pinkish, yellowish or brownish) and patterned with dark pink or brown on plicae, with red or pink

maculations; right valve white. Interior of both valves with prominent orange-red coloration on white ground; occupying most of interior of LV, centre of disc white; more limited to internal carinae on outer area of disc in RV.

Both valves sculptured with 16–20 evenly arranged radial plicae, smaller and weaker at anterior and posterior ends of disc than in centre, with interspaces each equal in width to one plica on left valve, somewhat narrower on right. Microsculpture of very closely spaced, commarginal lamellae throughout (on disc and auricles). Auricles lacking macrosculpture, gaping laterally. Internal rib carinae strongly developed. Dorsal margin straight. Byssal notch shallow, functional ctenolium lacking in adults.

**Dimensions.** Illustrated specimen: QLD, Rodds Harbour, Port Curtis (AM C.069985): rv: H 84.9, L 98.3 mm; lv: H 87.4, L 100.0 mm; D 20.4 mm.

**Habitat.** Living free (not byssally attached to substrates) in the littoral to sublittoral zones in colonies on soft sediment (sand and/or mud) and rubble, partially buried.

**Distribution.** Western Australia, Northern Territory, Queensland and northern New South Wales, < 127 m (Lamprell & Whitehead, 1992: [26]). Herein extended to Papua New Guinea (dead only). Present material alive at 3.5–72 m.

**Remarks.** Most specimens from Western Australia have one or two fewer plicae than those from Queensland, and most are paler in colour externally and more reddish internally, but intermediate variations are also observed (AM, WAM) from both sides of Australia. The inflation of the left valve varies from almost flat (AM, HD, rarely observed) to weakly convex; the inflation of the right valve is rather constant.

Lamprell & Whitehead (1992: [26]) included *Annachlamys leopardus* Iredale, 1939, known from southern Queensland and northern New South Wales, in the synonymy of *A. flabellata*. In fact, it is a different species living in similar habitats to *A. flabellata*, and the name is here synonymized with *Annachlamys kuhnoltzi* (Bernardi, 1860). The two species do not interbreed and no intermediate specimens have been observed (AM, QM). Both species are trawled commercially around Bundaberg, southern Queensland, but are of minor commercial importance in comparison with *Ylistrum balloti* and *Pecten fumatus*.

### *Annachlamys iredalei* (Powell, 1958)

Figs 51C,F, 53A–B,D

*Aequipecten* (*Corymbichlamys*) *iredalei* Powell, 1958: 67, pl. 11, figs 1–2, text-fig. 2.

*Annachlamys iredalei* (Powell).—Dijkstra, (1983–1994) 1989: 19, figs; Dijkstra, 1990a: 8, 10, figs; Dijkstra *et al.*, 1989: 24; Lamprell & Whitehead, 1992: [26], pl. 11, fig. 64; Dijkstra & Marshall, 1997: 97, pl. 10, figs 1–7; Brook & Marshall, 1998: 212; Raines & Poppe, 2006: 92, 93, lower fig; pl. 28, figs 5–6; Dijkstra & Marshall, 2008: 47, figs 37G, I, 39; Spencer *et al.*, 2009: 198.

*Corymbichlamys iredalei* (Powell).—Rombouts, 1991: 36, pl. 13, fig. 6.

**Type data.** Holotype (pr) ZMUC BIV-37. Type Locality: Kermadec Islands, off Raoul Island, 29°13.5'S 177°57'W, alive, 58–60 m (*Galathea* stn 675).

**Comments on type data.** Powell (1958: 68) also listed a

left and right valve collected at *Galathea* stn 674, Kermadec Islands, off Raoul Island, 29°15'S 177°57'W, 75–85 m and valves from Norfolk Island, 0.5 miles east of Philip Island, 33 fathoms [60 m] deposited in NIWA, Wellington. According to the ICZN (1999: art. 72.4.1 and 72.4.5) these are all paratypes.

In the collection of SAM (D14593) there is also a paratype (lv) from *Galathea* stn 674 (“Powell, May, 1959. Exchange” on label), which is not the left valve mentioned by Powell (measurements differ). More paratypes were distributed to other institutions (e.g., AMNH105519, 5 v; Boyko & Sage, 1996: 11). Boyko & Sage (1996: 11) also recorded paratypes at Florida Museum of Natural History, FMNH118997.

**Extralimital material examined.** NORFOLK ISLAND: 29°02'S 167°57'E, dead (1 v, C.300229). —NEW ZEALAND: Kermadec Islands, off Raoul Island, 29°15'S 177°52'E, dead (2 v, C.081779); a further 8 lots were listed by Dijkstra & Marshall (2008: 47). TASMAN SEA: Lord Howe Island, 31°33'S 159°05'E, dead (1 v, C.059653); Lord Howe Rise, 30°25.5'S 159°05.6'E, dead, 49–51 m (10 v, C.123839); Lord Howe Rise, 31°34.9'S 159°00.3'E, alive, 73 m (5 v, C.123974); Lord Howe Rise, 31°37.1'S 159°13'E, dead, 51–55 m (many v, C.123844); Lord Howe Rise, 31°38.2'S 159°03.6'E, alive, 44 m (1 pr + many v, C.123718); off Ball's Pyramid, 31°45'S 159°15'E, dead, 91–183 m (1 v, C.300228); off Lord Howe Island, 31°45.73'S 159°20.93'E, 565–960 m, NORFANZ stn 66, dead (7 lv, NMNZ M171160).

**Description.** Shell up to c. 80 mm high, solid, subcircular, weakly inflated, almost equally convex (right valve slightly more convex than left), somewhat wider than high, inequivalve, almost equilateral (posterior suture longer than anterior); auricles rather small, unequal in size and shape; umbonal angle c. 115°; resilial, dorsal and intermediate teeth weak; left valve brightly coloured externally with salmon-pink patterned with paler dots and streaks, right valve paler than left valve, yellowish, interior yellowish to pink.

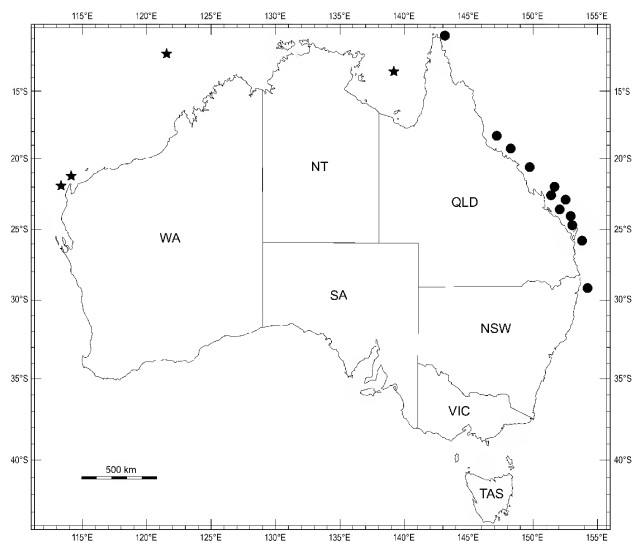
Both valves sculptured with 15–18 evenly spaced radial plicae, becoming narrower and weaker at anterior and posterior ends of disc than in centre, with each interspace somewhat narrower than one plica; 3–5 secondary radial riblets developing on plicae and in interspaces late in ontogeny. Commarginal lamellae on plicae and interspaces (subdivided into imbricate scales), more prominent on right valve than on left. Auricles with 6–12 unevenly spaced radial riblets covered with commarginal lamellae. Internal rib carinae prominent near ventral margin, weaker near muscle insertion. Hinge of left valve straight, of right valve somewhat raised, with scales along dorsal margin. Byssal notch shallow, byssal fasciole narrow or almost lacking, functional ctenolium with 3–5 teeth.

**Dimensions.** Illustrated specimens: off Lord Howe Island, 31°45.73'S 159°20.93'E, 565–960 m, NORFANZ stn 66, dead (7 faded lv, NMNZ M171160); largest: H 69.1, L 74.4 mm; medium-sized (interior illustrated in colour): H 63.3, L 68.4 mm; medium-sized (no secondary riblets): H 52.8, L 59.8 mm; small (with secondary riblets): H 48.0, L 52.1 mm.

**Habitat.** Living in the littoral to bathyal zones amongst rubble and coral sand.

**Distribution.** Coral Sea, New Caledonia, Lord Howe Island, Norfolk Island, and Kermadec Islands, 15–183 m, alive at 15–70 m (Dijkstra & Marshall, 1997: 97; 2008: 47). Present material alive at 44–73 m. Maximum living depth range is now extended to 15–73 m. *Annachlamys iredalei* is not recorded from the east coast of Australia.

**Remarks.** For comparison with *Annachlamys flabellata* (Lamarck, 1819) and *A. reevei* (A. Adams in Adams & Reeve, 1850) see Dijkstra & Marshall (1997: 97).



**Figure 52.** Distribution of *Annachlamys kuhnholtzi* (Bernardi) (circles) and *A. reevei* (A. Adams) (stars).

### *Annachlamys kuhnholtzi* (Bernardi, 1860)

Figs 47A,C, 51D–E,G–H, 52, 53C, 54A–B,D–E

*Pecten kuhnholtzi* Bernardi, 1860: 378, pl. 13, fig. 1; Küster & Kobelt, 1888: 140, pl. 40 fig. 1.

*Pecten leopardus* var. *kuhnholtzi* Bernardi.—E. A. Smith, 1884: 114; E.A. Smith, 1885: 299.

*Annachlamys leopardus rena* Iredale, 1939: 359.

*Annachlamys kuhnholtzi* (Bernardi).—Dijkstra, (1983–1994) 1986: 19, 21; Lamprell & Healy, 1998: 238, fig. 711; Dijkstra & Marshall, 1997: 99, pl. 11, figs 1–7; Raines & Poppe, 2006: 94–95, upper figs; pl. 26, figs 2–3, 5; pl. 27, figs 1–3; pl. 28, figs 1–3; Huber, 2010: 197.

*Annachlamys flabellata kuhnholtzi* (Bernardi).—Dijkstra *et al.*, 1990: 9–10, fig.

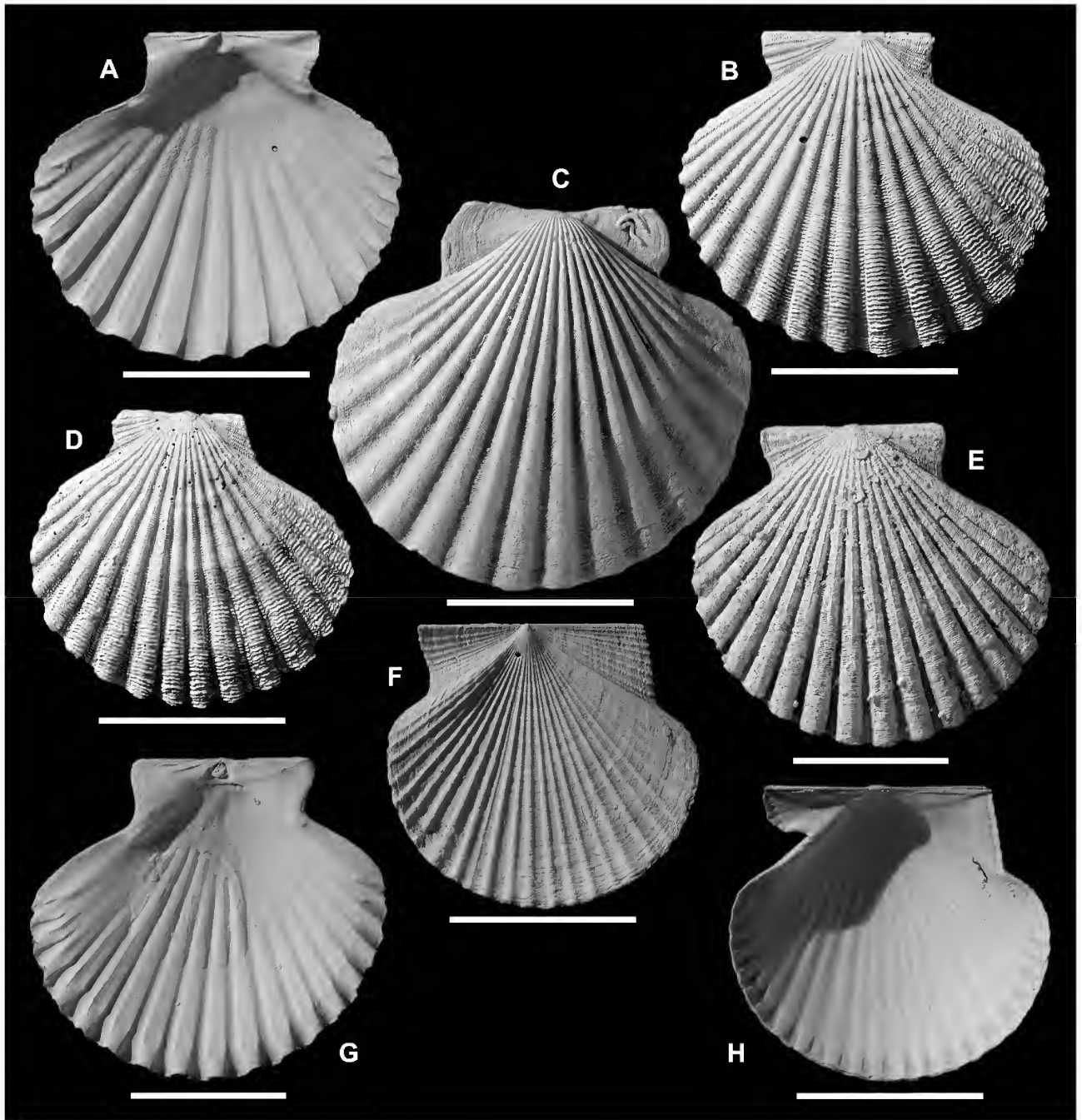
*Annachlamys flabellata* (Lamarck).—Lamprell & Whitehead, 1992: [26], pl. 11, fig. 63 (in part).

**Type data.** *Pecten kuhnholtzi* Bernardi: lectotype designated by “holotype” statement by Fischer-Piette (1950: 19) (ICZN, 1999: 83, Article 74.6), (pr) MNHN Moll.21202, the larger of the 2 syntypes, marked “fig’d” (Fig. 54A–B, D–E); paralectotype (pr) MNHN Moll.21203. Type locality: New Caledonia.

*Annachlamys leopardus rena* Iredale: lectotype designated here (pr) AM C.119783, paralectotypes (pr) AM C.170619, C.119633, C.058366. Type locality: Australia, QLD, GBR, Capricorn Group, North West Island, 23°18'S 151°42'E.

**Comments on type data.** The type data of *Pecten kuhnholtzi* are on a card file prepared by B. Métivier (MNHN). Fischer-Piette (1950: 19) designated the specimen figured by Bernardi (1860: pl. 13, fig. 1) as the holotype (that is, the lectotype).

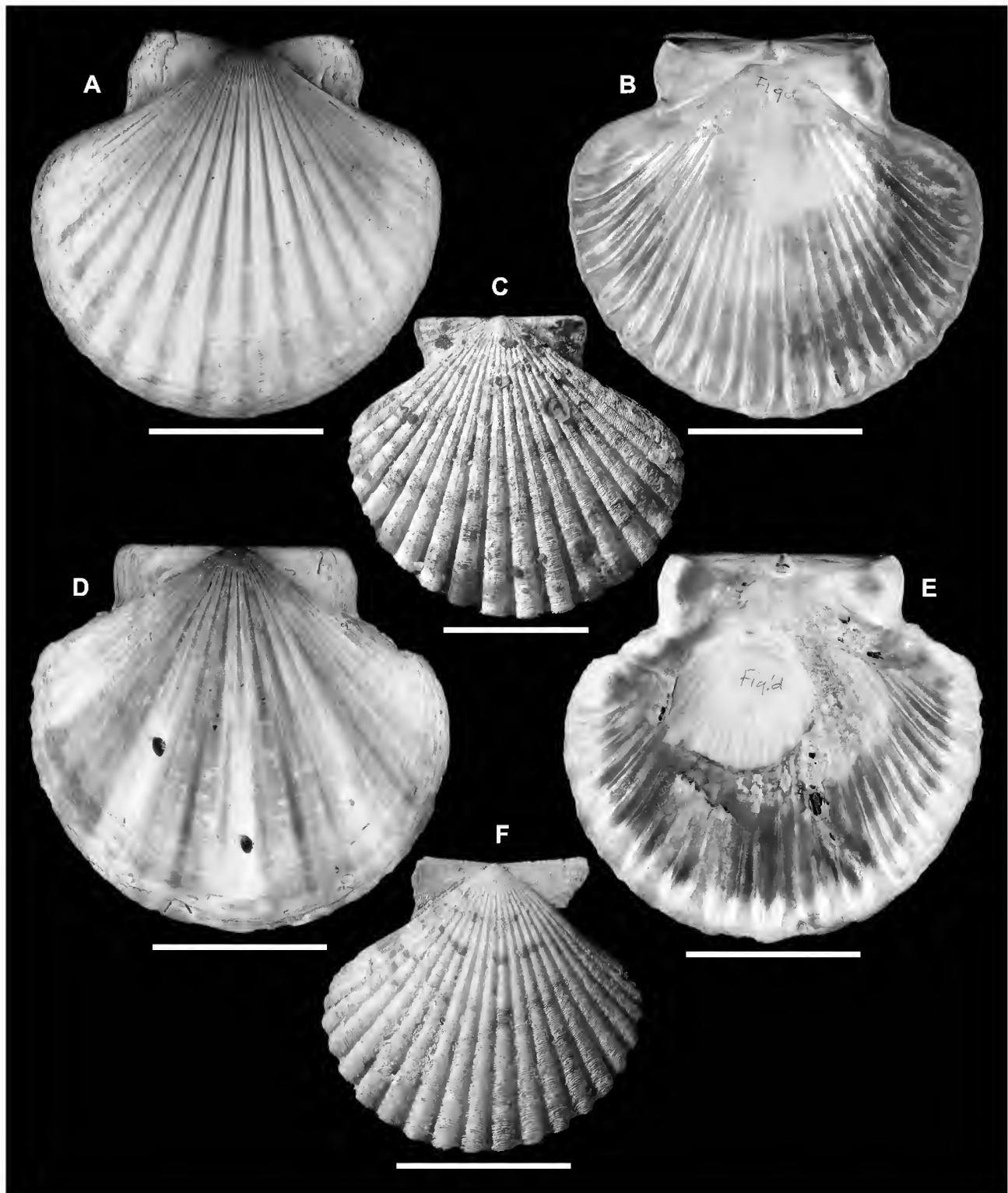
Iredale (1939: 358) did not clearly select a holotype of *Annachlamys leopardus rena*, although he mentioned “a perfect specimen measures 64 mm across and 58 mm in height, the ears being 34 mm across” (Iredale 1939: 359). This specimen was not figured and is difficult to recognize in the syntype series. Therefore, under ICZN (1999: 80, Recommendation 73F), “avoidance of assumption of holotype”, the type material consists of syntypes, and we designate a lectotype here.



**Figure 53.** *A, B, D, Annachlamys iredalei* (Powell), specimens in Fig. 51C, F; lv interior (A), lv exterior (B), lv exterior of specimen with secondary riblets (D). *C, Annachlamys kuhnholtzi* (Bernardi), specimen in Figs 47A, C, 51D, E, G, H; rv exterior (E), G, *Annachlamys reevei* (A. Adams), lv only, WAM S64891, off Cloates Reef, Ningaloo Marine Park, WA, 40–44 m; lv exterior (E), lv interior (G). *F, H, Minnivola pyxidata* (Born), pair, AM C.097546, S of Woody Island, Hervey Bay, QLD, 9 m; lv exterior (F), rv interior (H). Scale bars represent 20 mm (A, B, D–H), 30 mm (C).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Cape York Peninsula, Escape River mouth, 10°58'S 142°40'E, alive, 4–6 m (1 pr, C.365471); GBR, 0.5 ml SE of Lizard Island, 14°41'S 145°29'E, dead, 35 m (1 v, C.119779); off Cardwell, 18°29'S 147°01'E, alive, 58 m (1 pr, C.337122); 6–7 ml E of Keeper Reef, off Townsville, 18°45'S 147°23'E, dead, 43 m (4 v, C.105125; 11 v, C.131709); S of Townsville, 19°17'S 147°32'E, dead, 24 m (2 v, C.365231); off Abbot Point, N of Bowen, 19°53'S 148°05'E, alive, 10 m (1 pr, C.365472); E of Sarina, 21°27.5'S 150°08'E, alive, 42 m (1 pr, C.365468); Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, dead, 64–73 m (many v, C.365240); inside Swain Reefs, 22°14'S 152°27'E, alive, 60 m (2 pr, QM MO.33652); off Yeppoon, 22°30'S 151°26'E, dead, 55 m (1 v, C.365230); off Yeppoon, 22°40'S 151°16'E, dead, 58 m (2 v, C.365229); 30 ml NE of Yeppoon, 22°50'S 151°11'E, alive, 46–55 m (many, C.073246); off Yeppoon, off North Keppel Island, 23°02'S 151°10'E, alive, 51 m (2 pr, C.365465); 1.5 ml NW of South Keppel Island, 23°08'S 150°56'E, alive, 13–20 m (2 pr, C.365464); Capricorn Channel, 4 ml E of North Reef, 23°09'S 151°58'E, dead,

64 m (many v, C.116522); Keppel Bay, off Keppel Island, 23°09'S 150°56'E, dead (2 v, C.365234); GBR, Capricorn Group, North West Island, 23°18'S 151°42'E, alive (12 v [paralectotypes], C.119633; 1 pr [lectotype of *A. leopardus rena*], C.119783; 18 v [paralectotypes], C.170619, many juveniles [paralectotypes], C.058366; 1 v, C.365232); near Heron Island, 23°23.5'S 151°56.5'E, dead, 40 m (3 v, C.365236); Keppel Bay, 23°25'S 150°55'E, alive (2 pr, C.132766; 2 pr, C.133557); Capricorn Group, Heron Island, 23°26'S 151°57'E, alive (1 pr, C.097669); Capricorn Group, One Tree Island, 23°30'S 152°05'E, dead, 55 m (many v, C.124007); Capricorn Group, Masthead Island, 23°32'S 151°45'E, dead, 31–37 m (many v, C.018844); Capricorn Channel, E of Lady Musgrave Island, 23°50.10'S 152°32'10"E, dead, 132 m (4 v, C.148173); off Burnett Heads, 24°46'S 152°24'E, alive, 46 m (2 pr, C.064359); off Bundaberg, 24°50'S 153°21'E, dead, 27 m (1 v, C.365233); Hervey Bay, 25°06'S 152°49'E, alive, 18–27 m (3 pr, C.132765); Keppel Bay, between Outer Rock & Man & Wife, NE of South Keppel Island, 23°08'S 150°56'E, dead, 24–26 m (3 v, C.365239); off South (Great) Keppel Island, 23°12'S 150°58'E, alive,



**Figure 54.** *A, B, D, E*, *Annachlamys kuhnholtzi* (Bernardi), lectotype, pair, MNHN Moll.21203, New Caledonia; rv exterior (A), rv interior (B), lv exterior (D), lv interior (E) (MNHN photos by Barbara Buge). *C, F*, *Annachlamys reevei* (A. Adams), separate valves; (C) specimen in Fig. 53E, G; lv exterior; (F) WAM S64890, off Osprey Reef, Ningaloo Marine Park, WA, 59–58 m; rv exterior. Scale bars represent 30 mm (A, B, D, E), 20 mm (C, F).

9–15 m (2 pr, C.365463); off Frazer Island, 25°09.6'S 153°34'E, dead, 48 m (1 v, C.365235); off S end of Frazer Island, 25°28'S 153°0'E, alive (4 pr, C.365243); off S end of Frazer Island, 25°48'S 153°46'E, dead, 73 m (13 v, C.365238); off Wide Bay, 25°50'S 153°27.4'E, dead, 45 m (16 v, C.097555); off Tin Can Bay, 25°50'S 153°27.5'E, alive (2 pr, C.062477); off S end of Frazer Island, 25°57.9'S 153°34.4'E, dead, 58–60 m (16 v, C.365237); off Tin Can Bay, 26°09.5'S 153°18.5'E, dead, 56 m (2 v, C.101153); NE of Cape Moreton, 26°55.5'S 153°33.5'E, dead, 115–124 m (1 v, C.365244). **NEW SOUTH WALES:** off Tweed Heads, 28°17'S 153°44'E, dead,

73 m (23 v, C.117657; 1 v, C.123867); E of Brunswick Heads, 28°25'–28°29'S 153°48'–153°49'E, dead, 119 m (1 v, C.120395). **CORAL SEA:** Chesterfield Islands, alive, 65–68 m (1 pr, ZMA Moll.143175); Bancs Landsdowne-Fairway, alive, 86 m (1 pr, ZMA Moll.142259). —**NEW CALEDONIA:** Poux, Recif Baie, 20°13'S 164°03'E, alive, 0–4 m (1 pr, C.365467); 21°0'S 165°0'E, alive (1 pr, C.027879; 2 pr, C.365245). **TASMAN SEA:** Lord Howe Rise, 31°34.9'S 159°0.3'E, alive, 73 m (2 pr + 9 v, C.123973); Lord Howe Rise, 31°37.1'S 159°13'E, dead, 51–55 m (6 v, C.123846). See also Dijkstra & Marshall (1997: 99).



**Description.** Most specimens up to c. 50 mm high, a few specimens to c. 100 mm; solid, moderately inflated, juveniles circular, adults subcircular (wider than high), right valve slightly more convex than left, inequivalve, equilateral (juveniles) to more prosocline (adults), auricles of the two valves unequal, umbonal angle 105–120°. Left valve blotched with red or brown on cream background, some specimens with dark red or brown radial streaks on plicae. Right valve paler or whitish with yellow umbonally. Interior yellowish or reddish yellow.

Both valves sculptured with 18–20 evenly spaced radial plicae. Plicae of right valve somewhat broader and more rounded in cross-section than those of left valve. Interspaces of left valve wider than those of right valve. Commarginal microsculpture of closely spaced lamellae, polished where they cross plicae on most specimens. Posterior auricles somewhat larger than anterior auricles, with very weak radial costae in early growth stage, no costae present later. Delicate commarginal lamellae on both auricles. Dorsal margin of left valve straight, of right valve more declined. Internal rib carinae prominent near ventral margin, weaker near muscle insertion. Resilifer narrowly triangular. Hinge teeth prominent, consisting of one resilial tooth and one dorsal tooth on each side in right valve, and corresponding sockets in left valve. Byssal notch and ctenolium weak in juveniles, lacking in adults.

**Dimensions.** Illustrated specimens: QLD, off Burnett Heads, 46 m (AM C.064359): rv: H 61.0, L 66.5 mm; lv: H 60.1, L 68.2 mm; D 22.7 mm; lectotype of *Pecten kuhnholzti*, New Caledonia (MNHN Moll21203): lv: H 66.5, L 71.5 mm; D 24.7 mm.

**Habitat.** Living free (not byssally attached to substrate) in the littoral zone to on the continental shelf, in colonies on soft sediment (sand and/or mud).

**Distribution.** Eastern Australia, Coral Sea, New Caledonia and Lord Howe Island, alive at 10–69 m (Dijkstra & Marshall, 1997: 99). Maximum depth range 4–120 m (unpublished data HHD). Present material from northern Queensland (Cape York Peninsula) southwards to northern New South Wales (Brunswick Heads), living at 4–60 m.

**Remarks.** *Annachlamys kuhnholzti* is often treated as a geographical morph of *A. flabellata* (see also Lamprell & Whitehead, 1992). However, specimens of the two species do not interbreed and no intermediate variations have been observed.

Table 3 lists the characters distinguishing *Annachlamys kuhnholzti* from *A. flabellata*.

## *Annachlamys reevei*

(A. Adams in Adams & Reeve, 1850)

Figs 52, 53E,G, 54C,F

*Pecten reevei* A. Adams in Adams & Reeve, 1850: 73, pl. 21, figs 10a–b; Reeve, 1853: sp. 91, pl. 23, fig. 91; Küster & Kobelt, 1888: 208, pl. 56, figs 3–4.

*Pecten (Aequipecten) reevei* A. Adams in Adams & Reeve.—Dautzenberg & Bavay, 1912: 18, pl. 27, figs 3–4.

*Annachlamys reevei* (A. Adams in Adams & Reeve).—Kira, 1962: 211, pl. 72, fig. 7; Lan, 1979: 103, pl. 45, figs 105–107; Abbott & Dance, 1982: 306, fig.; Springsteen & Leobrera, 1986: 329, pl. 93, fig. 18; Okutani *et al.*, 1989: 63, fig. 43; Dijkstra, 1991: 43; Higo *et al.*, 1999: 445; Hayami, 2000: 905, pl. 450, fig. 37; Higo *et al.*, 2001: 157, fig. B469 (syntype); Wang, 2002: 200, fig. 84; Raines & Poppe, 2006: 94, 95, lower figs; pl. 29, figs 1–7; Xu & Zhang, 2008: 85, fig. 240; Raines, 2010: 598, pl. 990, fig. 1.

*Chlamys (Annachlamys) reevei* (A. Adams in Adams & Reeve).—Rombouts, 1991: 22, pl. 9, fig. 8.

**Type data.** Lectotype (pr: H 53 mm, W 58 mm) NHMUK 1950.11.14.58, figured by Adams & Reeve (1850: pl. 21 figs 10a–b), Reeve (1853: pl. 23 fig. 91), and Higo *et al.* (2001: fig. B469), herein designated. Two articulated paralectotypes (adult and juvenile) NHMUK 1950.11.14.59–60, not figured. Type locality: “China Sea” [South China Sea].

**Comments on type data.** In the type lot is another articulated specimen (largest) with the registered number NHMUK74.12.11.375 from the “China Sea” (ex Mrs T. Lombe Taylor), which possibly also belongs to the type series.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Gulf of Carpentaria, alive, 36 m (2 pr, ZMA Moll.142798). WESTERN AUSTRALIA: Ashmore Reef, NE corner, 12°15'S 123°07'E, dead, 20–25 m (1 v, WAM); Ningaloo Marine Park, off Osprey Reef, 22°10.156'–22°10.327'S 113°50.282'–113°50.228'E, 58.6–57.8 m, epibenthic sled, M. P. Salotti on AIMS *R/V Cape Ferguson*, 01 May 2006 (2 v, WAM S64890); Ningaloo Marine Park, off Cloates Reef, 22°29.298'–22°20.126'S 113°40.020'–113°40.023'E, 40.0–44.0 m, epibenthic sled, J. Colquhoun on AIMS *R/V Cape Ferguson*, 16 May 2006 (1 v, WAM S64891). —JAPAN: Okinawa, off Bolo Point, alive, 50 m (1 pr, ZMA Moll.144330). TAIWAN: off southern Taiwan, alive, 46 m (1 pr, ZMA Moll.139581). —PHILIPPINE ISLANDS: Siasi, off Laminusa Island, alive, 45–56 m (2 pr, ZMA Moll.142797).

**Description.** Shell up to c. 60 mm high, solid, weakly inflated, right valve slightly more convex than left, subcircular (somewhat wider than high), inequivalve, almost equilateral (posterior suture longer than anterior); auricles rather small, almost equal in size; umbonal angle 115–120°; left valve brightly coloured with red, yellow, pink, purple or orange maculations and streaks on a whitish or cream background, right valve less maculated, paler; reddish internally.

**Table 3.** Characters distinguishing *Annachlamys flabellata* (Lamarck) from *A. kuhnholzti* (Bernardi).

characters	<i>Annachlamys flabellata</i>	<i>Annachlamys kuhnholzti</i>
size	up to 100 mm high	up to 80 mm high
shape	lv more flattened, wider than high, nearly closed laterally	lv more inflated, circular, gaping laterally
auricles	larger, straighter laterally, nearly straight dorsally	smaller, rounded laterally, inclined dorsally
ribs	weaker	more prominent
colour	brighter; red or white interior	brownish maculated; yellow interior

**Table 4.** Characters distinguishing *Annachlamys iredalei* (Powell) from *A. reevei* (A. Adams).

characters	<i>Annachlamys iredalei</i>	<i>Annachlamys reevei</i>
size	up to 80 mm high	up to 60 mm high
shape	width almost equal to height, inflation less variable	wider than high, inflation more variable
auricles	smaller, radially sculptured	larger, nearly smooth
ribs	c. 14 prominent, more angulated, numerous secondary ribs	c. 16 prominent, more plicated, 1 or 2 secondary ribs
colour	paler; yellow-red interior	brighter; red or white interior

Both valves sculptured with 16–18 evenly spaced radial plicae (becoming smaller and weaker at anterior and posterior ends of disc than in centre), plicae broader than interspaces. Delicate, closely spaced commarginal lamellae in early growth stage, more prominent and more widely spaced in late ontogeny, subdivided by a secondary riblet on crest of plicae of some specimens. Auricles with 4–6 evenly spaced radial riblets covered with commarginal lamellae. Internal rib carinae prominent near ventral margin, weaker near muscle insertion. Dorsal margin of left valve straight, somewhat inclined in right valve. Hinge teeth prominent. Byssal notch shallow, byssal fasciole lacking, functional ctenolium with 3–5 teeth in juvenile stage, lacking in adult.

**Dimensions.** Illustrated specimens: WA, Ningaloo Marine Park, off Osprey Reef, 58.6–57.8 m (WAM S64890), rv only: H 33.2, L 36.5 mm; WA, Ningaloo Marine Park, off Cloates Reef, 40–44 m (WAM S64891), lv only: H 41.3, L 47.3 mm.

**Habitat.** Living free in adult stage, in the littoral zone and on the continental shelf, amongst rubble on soft sediment (generally sand).

**Distribution.** Sea of Enshunada and Izu Islands (Japan), southwards to tropical West Pacific, 10–50 m (Hayami, 2000: 905); Sulu Sea, Philippines, 5–10 m (Springsteen & Leobrera, 1986: 329; Raines, 2010: 598; Dijkstra, 2013: 53); Indonesia, 65–75 m, dead (Dijkstra, 1991: 43). Maximum depth range 10–150 m (Okutani *et al.*, 1989: 63). Distribution herein extended to northern Australia. Present specimens from Australia alive at 36 m.

**Remarks.** *Annachlamys reevei* is a **new record** for Australia. Specimens from the Gulf of Carpentaria and Ashmore Reef are indistinguishable from the type material.

*Annachlamys reevei* closely resembles *A. iredalei*, but differs in several characters, as shown in Table 4.

### *Annachlamys striatula* (Linnaeus, 1758)

*Ostrea striatula* Linnaeus, 1758: 696; Linnaeus, 1764: 523; Linnaeus, 1767: 1144; Dijkstra, 1999: 395, figs 10E–F (lectotype).

*Pecten striatulus* (Linnaeus).—Bosc, 1802: 260.

*Pecten solaris* (Born).—G. B. Sowerby II, 1842: 55, pl. 12, figs 7–8, 22; Philippi, 1845: 202, pl. 2, fig. 2; Reeve, 1853: sp. 92, pl. 23, fig. 92; Küster & Kobelt, 1888: 195, pl. 53, figs 1–2 (misidentification).

*Pecten macassarensis* Chenu, 1845: pl. 39, figs 4–4d; Hedley, 1918b: 265.

*Pecten leopardus* f. *solaris* (Sowerby).—E.A. Smith, 1884: 114 (misidentification).

*Pecten (Aequipecten) macassarensis* Chenu.—Dautzenberg & Bavay, 1912: 21.

*Annachlamys macassarensis* (Chenu).—Iredale, 1939: 358; Abbott & Dance, 1982: 306, fig.; Springsteen & Leobrera, 1986: 326, pl. 93, fig. 7; Wang, 1990: 16, pl. 2, fig. 6; Dijkstra, 1991: 42; Dharma, 1992: 84, pl. 20, figs 11–11a; Lamprell & Whitehead, 1992: [26], pl. 11, fig. 65; Bernard *et al.*, 1993: 50; Hayami, 2000: 905, pl. 450, fig. 36; Swennen *et al.*, 2001: 74, fig. 072; Wang, 2002: 198, text-fig. 13, pl. 3, fig. 5; Xu & Zhang, 2008: 85, fig. 239.

*Chlamys (Annachlamys) macassarensis* (Chenu).—Rom-bouts, 1991: 22, pl. 9, fig. 7; Dharma, 2005: 248, pl. 99, figs 15a–e.

*Annachlamys striatula* (Linnaeus).—Dijkstra, 1999: 397; Raines & Poppe, 2006: 96–97, upper figs; pl. 30, figs 1–9; pl. 31, figs 1–9; pl. 32, figs 1–9; Huber, 2010: 197; Raines, 2010: 598, pl. 990, figs 2–7.

**Type data.** *Ostrea striatula* Linnaeus: lectotype (pr: H 61 mm, W 65 mm) UUZM [not registered], designated by Dijkstra (1999: 396, figs 10E–F). Type locality: “O. Indico” [Indo-West Pacific].

*Pecten macassarensis* Chenu: lectotype (lv: H 41 mm, W 41 mm), illustrated by Chenu (1845: pl. 39, fig. 4c), herein designated. Type locality: Unknown.

**Comments on type data.** During visits by the first author in 1989 and 1991 to MNHG, Dr Y. Finet and he could not trace the type material of *Pecten macassarensis* in the Delessert collection. This material is probably lost. Unfortunately, a description of *P. macassarensis* was never published, but the figures are clear and determinable.

**Extralimital material examined.** —JAPAN: Wakayama Prefecture, Kushimoto, alive, 18–37 m (3 pr, ZMA Moll.142588). TAIWAN: off S Taiwan, alive (2 pr, ZMA Moll.140097). —CHINA: Hainan Island, alive, 31 m (1 pr, ZMA Moll.142589). —VIETNAM: Nha Trang, Hon Lon Island, alive, 8 m (1 pr, ZMA Moll.145828). —PHILIPPINE ISLANDS: Manila Bay, alive, 18 m (5 pr, ZMA Moll.140155); Sulu Sea, off Siasi, alive, 8 m (5 pr, ZMA Moll.140505). —MALAYSIA: Malacca Strait, alive (3 pr, ZMA Moll.140357). —THAILAND: Gulf of Siam, alive, 5–10 m (5 pr, ZMA Moll.143659); Phuket Island, alive, 6–12 m (3 pr, ZMA Moll.143658). —INDONESIA: E Sumatra, Singkep, alive, 50–60 m (3 pr, ZMA Moll.143714); NW Java, alive, 30 m (2 pr, ZMA Moll.142587); Moluccas, Ceram, off Aru Island, alive, 20 m (2 pr, ZMA Moll.142590); Kei Islands, alive, 35 m (3 pr, ZMA Moll.142586). —PAPUA NEW GUINEA: Hansa Bay, alive (1 pr, ZMA Moll.145657).

**Description.** Shell up to c. 50 mm high, solid, circular, moderately inflated, right valve slightly more convex than left, inequivalve, equilateral; auricles equal in shape and size on left valve, unequal in size and shape on right valve; umbonal angle 105–120°; colour highly variable, blotched with cream, red, brown, orange or pink and paler dots or streaks; right valve paler or whitish; interior yellowish or reddish yellow.

Both valves sculptured with 16–19 evenly spaced, low radial plicae, somewhat broader on right valve than on left. Interspaces and plicae of left valve equal in width; interspaces of right valve each narrower than one plica. Closely spaced commarginal lamellae on disc (more closely arranged in interspaces than on plicae) and auricles, radial

riblets very weak in early growth stage on auricles. Dorsal margin of left valve straight, of right valve more declined. Internal rib carinae prominent near ventral margin, weaker near muscle insertion. Resilifer narrowly triangular. Hinge teeth well-developed. Byssal notch shallow; ctenolium weak in juveniles, lacking in adults.

**Habitat.** Living free (not byssally attached to substrates) from the intertidal zone to 60 m on the continental shelf, in colonies on soft sediment (sand and/or mud).

**Distribution.** Amami Islands (Japan) southwards to tropical West Pacific, in 10–20 m (Hayami, 2000: 905); Philippine Islands, 20–25 m (Springsteen & Leobrera, 1986: 328), Raines (2010: 598); South China Sea, Sulawesi, Moluccas, intertidal–20 m (Bernard *et al.*, 1993: 50); Indonesia, offshore, common (Dharma, 1992: 84); Gulf of Thailand, 16–22 m (Swennen *et al.*, 2001: 74); northern Western Australia (Lamprell & Whitehead, 1992: [26]). Maximum depth range intertidal to 60 m.

**Remarks.** Hedley (1918b: 265) recorded a single valve of *Annachlamys striatula* (as *Pecten macassarensis*) from the Buccaneer Archipelago, northern Western Australia, and Lamprell & Whitehead (1992: [26]) repeated this distribution. Although this species is quite common throughout the tropical southwestern region of the West Pacific and suitable habitats for it occur in tropical northern Australia, we have not seen material of *Annachlamys striatula* from Australia.

***Pecten* Müller, 1776**

- Pecten* Müller, 1776: 248. Type species (by subsequent designation, Schmidt, 1818): *Ostrea maxima* Linnaeus, 1758; Pliocene to Recent, E Atlantic.
- Argus* Poli, 1791: 32 (junior homonym of *Argus* of Bohadsch, 1761, of Scopoli, 1763, and of Scopoli, 1777). Refers to the animal only; see Jukes-Brown (1908: 99–103) and Dall (1909: 251–252). Adopted by Gray (1847: 200) for *Pecten maximus*, but preoccupied.
- Argoderma* Poli, 1795: 254, 260 (proposed for the shell containing the animal of *Argus* Poli, 1791).
- Pallium* Schröter, 1802 (in 1801–1806): 135. Replacement name for *Pecten* Müller, 1776 (Rehder, 1944: 54).
- Pectinium* Link, 1807: 156. Proposed as a new generic name for the *Ostrea* species of Linnaeus, now referable to *Pecten sensu lato*. For a complete list, see Sherborn (1933: 802). Invalid emendation of *Pecten*.
- Pandora* Megerle von Mühlfeld, 1811: 59 (junior homonym of *Pandora* Bruguière, 1797). Type species (by monotypy): *Ostrea maxima* Linnaeus, 1758.
- Pectinites* Schlotheim, 1813: 92, 103, 112 (unavailable, ICZN (1999: 22, Article 20); junior homonym of *Pectinites* of Gesner, 1758, and of Gmelin, 1791).

- Janira* Schumacher, 1817: 40, 177 (junior homonym of *Janira* Leach, 1814). Type species (by monotypy): *Janira intermedia* Schumacher, 1817 (= *Ostrea maxima* Linnaeus, 1758).
- Janera* G. B. Sowerby II, 1839: 52 (incorrect subsequent spelling of *Janira* Schumacher, 1817).
- Vola* “Klein” Mörch, 1853: 59. Type species (by monotypy): *Ostrea maxima* Linnaeus, 1758.
- Oppenheimopecten* von Teppner, 1922: 87, 254. Type species (by original designation): *Pecten subbenedictus* Fontannes, 1878; Miocene, Europe and Algeria.
- Deperetia* von Teppner, 1922: 87, 259. Type species (by original designation): *Pecten cristatocostatus* Sacco, 1897a; Miocene, Turin, Italy.
- Heritschia* von Teppner, 1922: 87, 264. Type species (by original designation): *Pecten aduncus* von Eichwald, 1830; Miocene, NW Ukraine.
- Jaworskia* von Teppner, 1922: 87, 266. Type species (by original designation): *Pecten grandis* J. de C. Sowerby, 1828; Pliocene, Suffolk Crag, Great Britain.
- Notovola* Finlay, 1926: 451. Type species (by original designation): *Pecten novaezelandiae* Reeve, 1853; Pleistocene and Recent, New Zealand.
- Convexopecten* Tucker-Rowland, 1938: 82. Type species (by original designation): *Pecten josslingi* J. Smith, 1847; Miocene, Portugal and France (Cahuzac, 2005: 279, figs 3a–j, 4a–f).

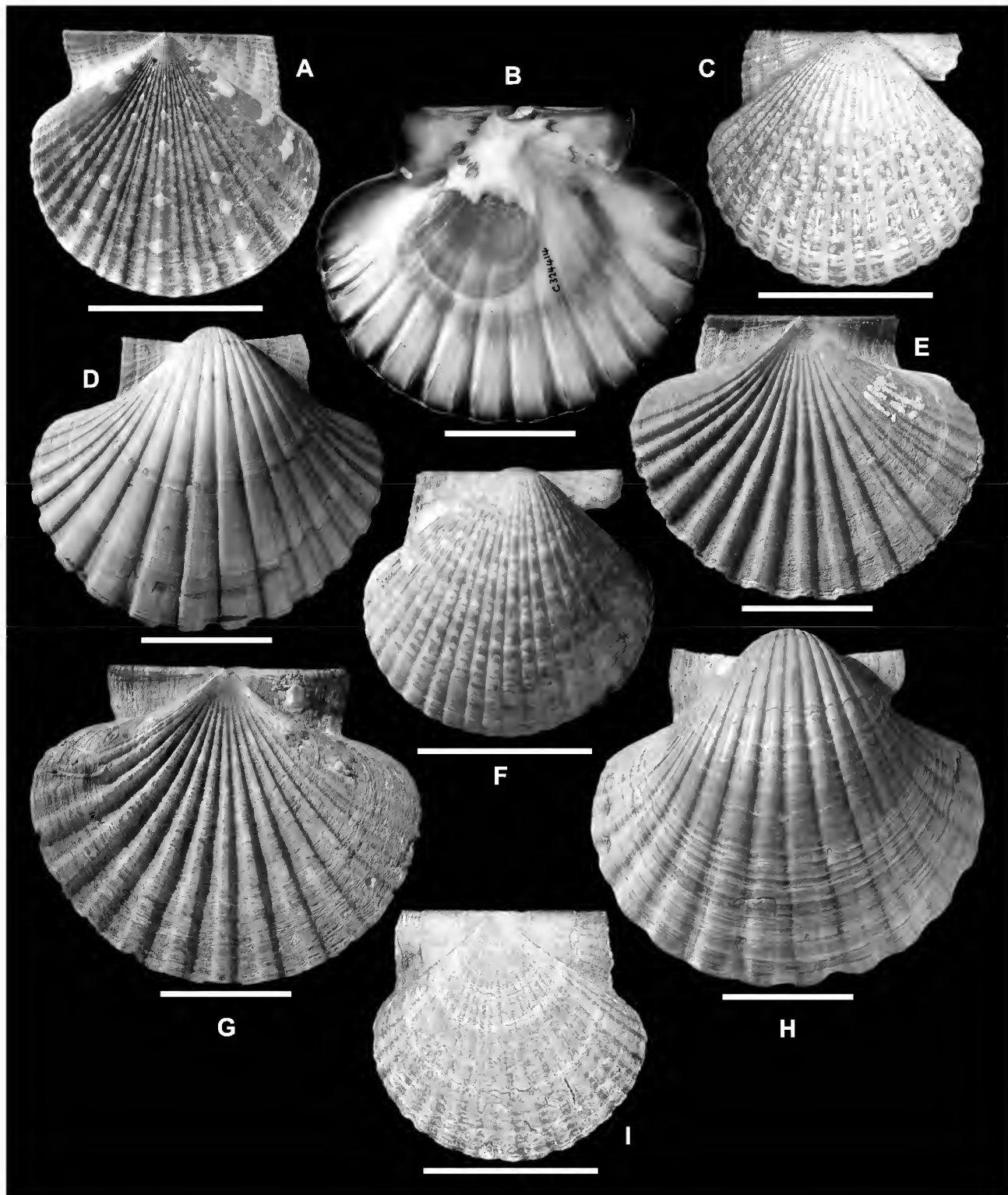
**Diagnosis.** Pectinini with a sturdy, subcircular shell, up to c. 150 mm in height, with almost flat to concave left valve and strong inflated right valve, both valves with radial macrosculpture and commarginal microsculpture. Auricles almost equal in size. Byssal notch shallow, ctenolium weak in juveniles and lacking in adult stage. Internal rib carinae prominent. Multiple, prominent intermediate hinge teeth between the dorsal and resilial teeth (Waller, 1991: 38, figs 6e–f). Pre-radial area of left valve unusually tall, up to 10 mm high, smooth.

**Distribution.** Early Miocene–Recent. The early Miocene species *Pecten beudanti* Basterot, 1825 is the “earliest true *Pecten*” according to Waller (2006a: 24); the Oligocene species “*Peten*” *arcuatus* (Brocchi, 1814) was included in *Gigantopecten* by Waller (2006a: 24). *Philippia* von Teppner (1922: 87, 221) (type species *Pecten arcuatus* Brocchi, 1814; junior homonym of *Philippia* Gray, 1847) therefore is a synonym of *Gigantopecten* rather than *Pecten*. *Pecten*: E Atlantic and Indo-West Pacific, living in the littoral zone, generally in colonies, with the convex right valve settled into soft sediment and the flat left valve lying at the sediment-water interface, most specimens camouflaged with a thin layer of sediment.

**Discussion.** Hertlein (1969: N366) placed *Pecten* in the *Pecten* (*Pecten*) subgroup, together with *Amussiopecten* Sacco, 1897, *Euvola* Dall, 1898, *Flabellipecten* Sacco, 1897,

**Key to species of *Pecten* from Australia**

- 1 Shell c. 150 mm high, (sub)circular, solid, lv flat or slightly concave, rv weakly to strongly inflated, radial macrosculpture prominent, simple, commarginal microsculpture closely spaced ..... *P. fumatus*
- Shell circular, thin, lv strongly concave, rv strongly inflated ..... 2
- 2 Shell c. 55 mm high, circular, thin, lv strongly concave, rv strongly inflated, radial macrosculpture very weak, commarginal microsculpture weak ..... *P. dijks trai*



**Figure 55.** *A, C, F, I*, *Mimivola pyxidata* (Born), (A, F) specimen in Fig. 53F, H, lv exterior (A), rv exterior (F), (C, I), pair, AM C.047392, holotype of *Mimivola isomeres* Iredale, Lady Elliot Island, Bunker Group, GBR, QLD, 24°07'S 152°42'E, rv exterior (C), lv exterior (I). *B, D, E, G, H*, *Pecten fumatus* Reeve, 2 pairs; (B, G, H) NSW form, AM C.324414, low tide mark, Gunnamatta Bay, Port Hacking, Sydney, NSW, lv interior (B), lv exterior (G), rv exterior (H), (D, E) QLD form, AM C.097594, off Wide Bay, QLD, 55 m, rv exterior (D), lv exterior (E). Scale bars represent 20 mm (A, C, F, I), 30 mm (B, D, E, G, H).

and *Oppenheimopecten* von Teppner, 1922 as subgenera of *Pecten*.

Waller (1991: 36, fig. 11) placed *Amussiopecten*, *Amusium*, *Pecten*, and *Euvola* in the *Pecten* group, and subsequently in tribe Pectinini (Waller, 1993: 198). More recently, Waller

(2006a: 22–27, fig. 1.3) recognized two tribes for this group, placing *Amusium*, *Euvola*, *Leopecten* and *Amussiopecten* in tribe Amusiini and *Pecten*, *Annachlamys* and *Gigantopecten* in tribe Pectinini. For phylogenetic relationships see Waller (1991, 1993, 2006a, 2007, 2011).

***Pecten fumatus* Reeve, 1852**

Figs 55B,D–E,G–H, 56, 57A–B,F–G,I–J, 58A–D

*Pecten medius* Lamarck, 1819: 163; Deshayes, 1836: 130; Hedley, 1902: 303; Pritchard & Gatliff, 1904a: 261; Suter, 1913: 874 (in part); May, 1921: 10; May, 1923: pl. 3, fig. 5; Iredale, 1924: 193; Finlay, 1926: 451; Cox, 1929: 203; Fleming, 1951b: 129, pl. 17, figs 1–4; Rombouts, 1991: 51, pl. 19, fig. 4; Dijkstra, 1994: 470, figs 1–3 (lectotype) (junior secondary homonym of *Pecten medius* Bosc, 1802).

*Pecten ziczac* var. b Lamarck, 1819: 164; Deshayes, 1836: 131.

*Pecten fuscus* “Klein” G. B. Sowerby II, 1842: 47, pl. 16, figs 118–119 (junior secondary homonym of *Pecten fuscus* Bosc, 1802).

*Pecten bifidus* Menke, 1843: 35; Philippi, 1845: 202, pl. 2, fig. 6; Tate, 1881: 402 (junior primary homonym of *Pecten bifidus* Münster in Goldfuss, 1836).

*Pecten lamarckii* Chenu, 1843: 2, pl. 9, figs 7–7b [1844] (new name for *Pecten ziczac* var. b of Lamarck; junior primary homonym of *Pecten lamarckii* DeFrance, 1825).

*Pecten fumatus* Reeve, 1852 [Nov]: sp. 32, pl. 7, fig. 32; Tenison Woods, 1878a: 33, 56; Tate & May, 1901: 441; Fleming, 1951b: 132; Woodburn, 1990: 226; Rombouts, 1991: 50, pl. 18, fig. 8; Lamprell & Whitehead, 1992: [32], pl. 14, fig. 83; Dijkstra & Marshall, 1997: 91, pl. 13, figs 1–2; Beu & Darragh, 2001: 183; Raines & Poppe, 2006: 148–149, lower figs; pl. 94, figs 1–4; pl. 95, figs 1–3; Huber, 2010: 195.

*Pecten modestus* Reeve, 1852 [Dec]: sp. 41, pl. 11, fig. 41 (junior secondary homonym of *Pecten modestus* Bosc, 1802).

*Vola fumata* (Reeve).—Angas, 1868: 933.

*Pecten* (*Janira*) *fumatus* Reeve.—Smith, 1885: 307.

*Pecten fumatus* var. *alba* Tate, 1887b: 113.

*Pecten meridionalis* Tate, 1887b: 115; Tate & May, 1901: 441; Rombouts, 1991: 52, pl. 19, fig. 3 (junior primary homonym of *Pecten meridionalis* Eichwald, 1865).

*Notovola alba* (Tate).—Cotton & Godfrey, 1938: 92, fig. 78; Macpherson & Chapple, 1951: 145; Cotton, 1961: 96, fig. 81.

*Notovola fumata* (Reeve).—Iredale, 1939: 365; Macpherson & Chapple, 1951: 145; Iredale & McMichael, 1962: 11.

*Notovola preissiana* Iredale, 1949: 19.

*Notovola meridionalis* (Tate).—Allan, 1950: 279, pl. 39, fig. 1; Iredale & McMichael, 1962: 11.

*Pecten jacobaeus byronensis* Fleming, 1955: 108, fig. 1; Fleming, 1957: 10, 16, 19, 25, 40, pl. 7, fig. 3 (holotype).

*Pecten benedictus albus* Tate.—Fleming, 1957: 9, 16, 17, 19, 22, 33, pl. 2, fig. 1; Ludbrook, 1978: 47; Ludbrook, 1984: 162, 279, fig. 40a.

*Pecten benedictus fumatus* Reeve.—Fleming, 1957: 9, 13, 16, 17, 19, 22, 28, 32, 33, 34, pl. 1, fig. 5 (lectotype).

*Pecten jacobaeus meridionalis* Tate.—Fleming, 1957: 10, 12, 15, 16, 20, 22, 25, 32, 39, 40, pl. 7, fig. 4.

*Pecten modestus modestus* Reeve.—Fleming, 1951a: 279 (lectotype designation); Fleming, 1957: 10, 16, 19, 36, 37, 38, pl. 7, figs 5 (lectotype), 6 (paralectotype).

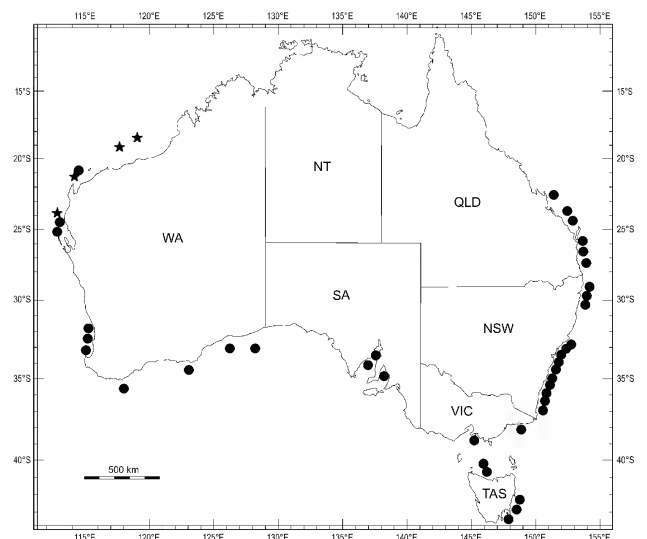
*Notovola byronensis* (Fleming).—Iredale & McMichael, 1962: 11; Garrard, 1969: 5.

*Pecten alba* [sic] Tate.—Macpherson & Gabriel, 1962: 300, fig. 341; Macpherson, 1966: 231.

*Pecten fumata* [sic] Reeve.—Richmond, [1990]: 46, fig. 124.

*Pecten fumatus* “*meridionalis*” Tate.—Waller, 1991: 37, pl. 8, figs 13–14.

**Comments on synonymy.** For annotations, nomenclatural status and taxonomic position of *Pecten medius* Lamarck,



**Figure 56.** Distribution of *Pecten fumatus* Reeve (circles) and *P. dijkstrai* Duncan & Wilson (stars).

1819 and *Pecten ziczac* var. [b] Lamarck, 1819 see Dijkstra (1994: 471).

G. B. Sowerby II (1842) described a new species, *Pecten fuscus*, based on Klein’s pre-Linnean name, from an unknown locality. This subsequently was redescribed by Reeve (1852) from material from Moreton Bay (southern Queensland). This species is clearly identical to *P. fumatus*.

Menke (1843) described the new species *Pecten bifidus*, from “litore occidentali Novae Hollandiae” [littoral, western Australia] collected by Dr Preiss (1838–1842). This species subsequently was figured by Philippi (1845: pl. 2 fig. 6). However, the figured specimen does not have a groove in the centre of each plica of the right valve as described by Menke. Philippi noted that it is only a variant. This species is identical to the Western Australian morph of *P. fumatus*.

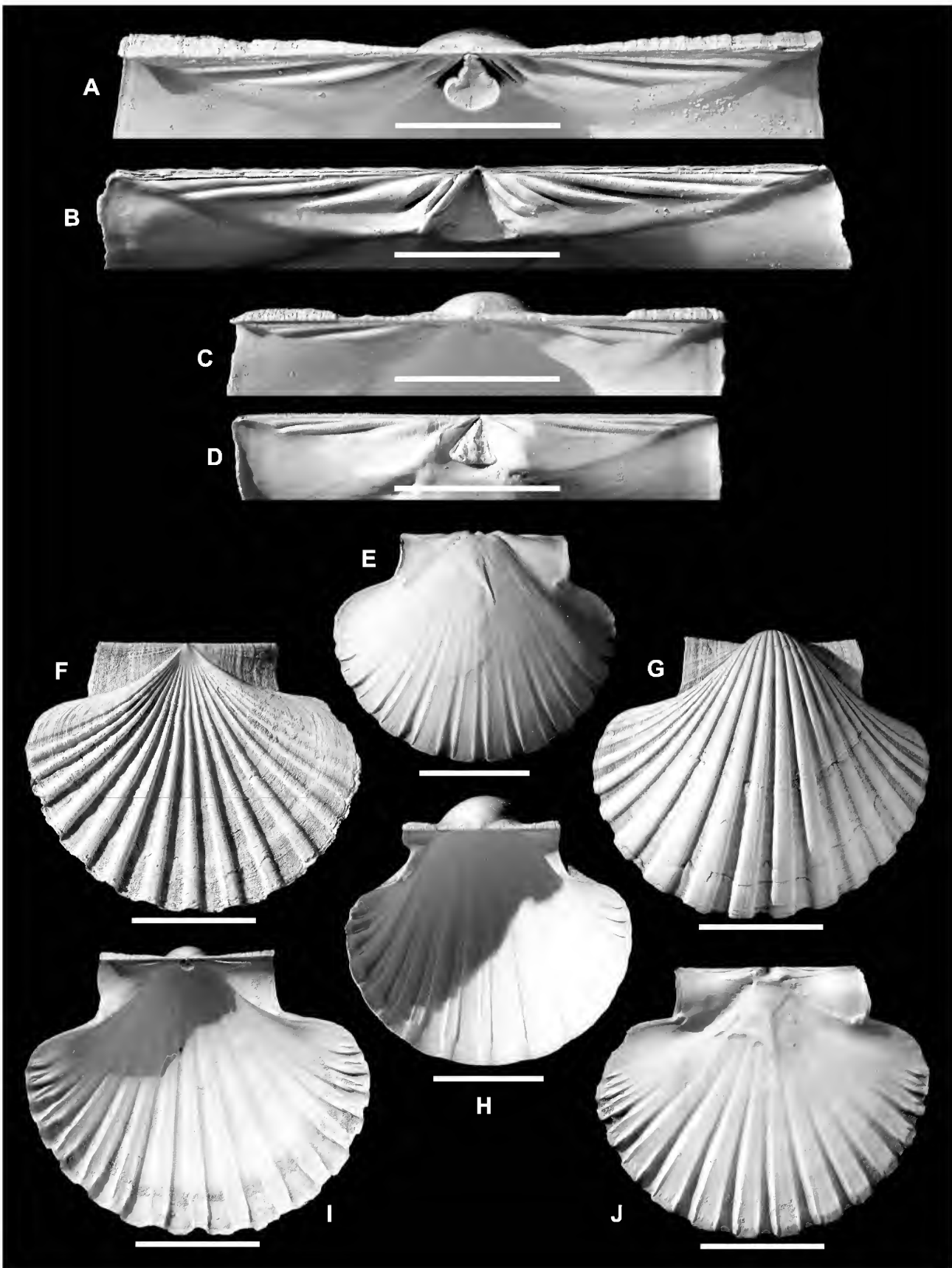
Reeve (1852) also described the new species *Pecten modestus* from Australia, with bifurcated plicae on the right valve, which is similar to Menke’s description. The published type locality “Moreton Bay” is incorrect (see also Fleming, 1951a: 279), and probably should be “Swan River” (Western Australia) according to Cuming’s material in NHMUK. Observed material from Moreton Bay (S Queensland) has no bifurcated plicae. This form is identical to the Western Australian morph of *P. fumatus*.

Tate (1887b) introduced a new variation of the present species, *Pecten fumatus* var. *alba*, from Port Lincoln (South Australia), a geographical variant that is morphologically very close to the present species. However, intermediate variations are observed between typical eastern Australian specimens from southern Queensland and New South Wales and this variant from South Australia.

Tate (1887b) also described a new scallop from Tasmania, *Pecten meridionalis*, which is supposedly larger in size (up to c. 150 mm high, *P. fumatus* generally smaller, up to c. 100 mm high) than *P. fumatus* and less inflated. However, intermediates are also observed and the Tasmanian form is in our opinion a local morph of *P. fumatus*.

Iredale (1949) noted that Menke’s species, *Pecten bifidus*, was “sunk in the synonymy of the unidentifiable *medius* of Lamarck” and introduced a new species name, *Notovola preissiana*, for the Western Australian scallop. Syntypes





**Figure 57.** *A, B, F, G, I, J, Pecten fumatus* Reeve, specimen in Fig. 55D, E, rv hinge (A), lv hinge (B), lv exterior (F), rv exterior (G), rv interior (I), lv interior (J). *C–E, H, Pecten dijksraii* Duncan & Wilson, HM, 7–8 km N of tip of North West Cape, Exmouth, WA, 32–35 m; rv hinge (C), lv hinge (D), lv interior (E), rv interior (H). Scale bars represent 10 mm (A–D), 20 mm (E, H), 30 mm (F, G, I, J).

of this species are morphologically identical to Menke's species, both with bifid plicae on the right valve, and this is also a morph of *P. fumatus*.

Another bifid-ribbed scallop is *Pecten jacobaeus byronensis* Fleming, 1955, recorded from Byron Bay, New South Wales. The type specimen has two grooves on each rib. In our opinion this is a rare sculptural variant of *P. fumatus*. C. A. Fleming stated to AGB several years ago that he had been misinformed about this form; C. Hedley had sorted specimens in AM in a single collection from Byron Bay into more weakly and more strongly sculptured specimens, the latter being the type material of *P. jacobaeus byronensis*. Fleming agreed that it is a sculptural variant of *P. fumatus*.

**Type data.** *Pecten medius* Lamarck: lectotype (pr) MNHN Moll21199, designated by Dijkstra (1994: 471), 3 paralectotypes (pr) MNHN Moll21200. Type locality: Unknown.

*Pecten fuscus* G. B. Sowerby II: three syntypes (pr) NHMUK 1994164. Type locality: Moreton Bay, Queensland (listed by Reeve, 1852).

*Pecten bifidus* Menke: type material probably lost, not in the Seckenberg Museum (R. Janssen, pers. comm.). Type locality: "littore occidentali Novae Hollandiae" [littoral zone of western Australia].

*Pecten fumatus* Reeve: three syntypes (pr) NHMUK 1950.11.14.32–34. Type locality: Sydney, New South Wales.

*Pecten modestus* Reeve: holotype (pr) UMZC.1382. Type locality: Moreton Bay, Australia [sic] (= Swan River, Western Australia).

*Pecten fumatus* var. *alba* Tate: holotype (pr) SAM D8920. Type locality: Port Lincoln, South Australia.

*Pecten meridionalis* Tate: type material not traced. Type locality: "living on the shores of Tasmania".

*Notovola preissiana* Iredale: five syntypes (pr) AM C.090371. Type locality: Shark Bay, Western Australia.

*Pecten jacobaeus byronensis* Fleming: holotype (pr) AM C.005243, 2 paratypes (pr) AM C.170831. Type locality: Byron Bay, southern New South Wales.

**Comments on type data.** For notes on *Pecten medius* Lamarck, 1819 see Dijkstra (1994: 470).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Keppel Bay, Yeppoon, 23°08'S 150°45'E, dead (1 pr, C.119839); Capricorn Channel, 16.8 ml NE of North Reef, 23°08.4'S 152°12.3'E, dead, 115 m (1 v, C.375199); Burnett Heads, 24°46'S 152°24'E, dead (2 pr, C.097597); Bargara, 24°49'S 152°28'E, dead (5 v, C.375211); Hervey Bay, Fraser Island near Bowaraddy Creek, 25°08'S 153°07'E, dead (3 v, C.375212); Hervey Bay, Point Vernon, 25°15'S 152°49'E, dead (1 v, C.119840); Hervey Bay, Pialba, 25°17'S 152°50'E, dead (2 v, C.375216); Hervey Bay, Dundowran Beach, 25°18'S 152°46'E, alive (2 pr, C.064363; 7 pr, C.097592; 18 v, C.375200; 3 v, C.375215); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (2 pr, C.097593); Fraser Island, Eurong, 25°31'S 153°07'E, dead (3 v, C.375208); off Wide Bay, 25°50'S 153°27.4'E, alive, 55–64 m (1 pr, C.097594; 1 pr, C.097598); Tin Can Bay, NE of Gympie, 25°55'S 153°01'E, dead (1 v, C.375213); off Double Island Point, 25°56'S 153°11'E, alive, 46–55 m (2 pr, C.375385); off Tin Can Bay, 26°09.5'S 153°18.5'E, dead, 56 m (1 v, C.375197); ESE of Noosa Heads, 26°34'S 153°40'E, dead, 128 m (4 v, C.096217); Mooloolaba, S side of Point Cartwright, 26°41'S 153°08'E, dead (1 v, C.375217); off Caloundra, 26°47'S 153°35'E, dead, 128 m (1 v, C.375198); Caloundra, 26°49'S 153°10'E, dead (2 v, C.012825; 3 v, C.054686); E of Moreton Bay, 26°55'S 153°33'E, dead, 115–176 m (1 v, C.375214); off Moreton Bay, 27°10'S 153°25'E, dead (2 pr, C.303798); Moreton Bay, 27°15'S 153°15'E, dead (2 pr, C.012169; 1 pr, C.047373); Stradbroke Island, Point Lookout, 27°26'S 153°32'E, dead (6 v, C.375207); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, dead, 5–7 m (1 v, C.119842); Stradbroke Island, 27°35'S 153°28'E, dead (3 v, C.013044); South Stradbroke Island, 27°51'S 153°25'E, dead (1 v, C.375218); off Southport, 27°58'S 153°25'E, dead (1 v, C.108347; 1 v, C.120103); Surfers Paradise, 28°0'S 153°26'E, dead (many v, C.119838); Coolangatta, Point Danger, N side, 28°10'S 153°32'E, dead (8 v, C.111562). **NEW SOUTH WALES:** off Tweed Heads, 28°14'–28°19'S 153°50'E, dead, 128–137 m (2 v, C.324359); Cudgen headland, Kingscliff, 28°15.47'S 153°35.03'E, dead (many v, C.091035); Hastings Point Beach, E of Murwillumbah, 28°21.82'S 153°34.73'E, dead (6 v, C.091037; many v, C.091039; 3 v, C.324484); Cape Byron, 28°37.97'S 153°38.23'E,

dead, (holotype (v) *P. byronensis*, C.005243; (paratypes (2 v) *P. byronensis*, C.170831); off Byron Bay, 28°39'S 153°38'E, dead (8 v, C.092126; 4 pr, C.097596); off Cape Byron, 28°43'–28°39'S 153°51'–153°50'E, dead, 128–139 m (1 v, C.116412); Flat Rock, N of Richmond River entrance, 28°52.2'S 153°34.6'E, dead (6 v, C.050857); off Ballina, 28°52.5'S 153°37.5'E, dead (4 v, C.070652); off Ballina, 29°02'–28°59'S 153°48'–153°49'E, dead, 137 m (1 v, C.116104); E of Yamba, 29°30'S 153°26.3'E, dead, 53 m (2 v, C.324360); 12 km E of Cakora Point, S of Yamba, 29°39.8'S 153°26.4'E, dead, 55 m (1 v, C.123871; 2 v, C.324358); NE of Woolgoolga, 29°44'–29°50'S 153°41'–153°39'E, dead, 165 m (1 v, C.116364); N of North Solitary Island, 29°52'–29°48'S 153°25'–153°26'E, dead, 64 m (1 v, C.324356; 2 v, C.324485); N of Coffs Harbour, 30°0'S 153°23'E, dead, 61 m (1 v, C.324488); E of Cape Hawke, 32°13'S 152°35'E, alive, 85 m (1 pr, C.119823); c. 3 ml off Broughton Island, off Port Stephens, 32°37'S 152°19'E, dead, 82 m (2 v, C.324489); SE of Forster, c. 15 ml offshore, 32°20'S 152°45'E, dead, 100 m (1 v, C.084226); off Port Stephens, 32°40'–32°45'S 152°15'E, dead (2 v, C.077198); Port Stephens, Hawks Nest, 32°41'S 152°10'E, dead (4 v, C.097553); Port Stephens, North Beach, 32°41'S 152°12'E, dead (many v, C.119832); off Port Stephens, 32°42'S 152°05'E, alive, 73 m (1 pr, C.012168; many, C.324543); off Port Stephens, 32°42.5'S 152°15'E, dead, 45.5–73 m (1 v, C.324361); Port Stephens, off Nelson Bay, 32°43'S 152°15'E, dead, 46–73 m (1 v, C.324357); off Broken Bay, 32°52'S 152°32'E, dead, 145 m (3 v, C.139736; 1 v, C.139985); off Port Stephens, 32°52'–32°51'S 152°34'–152°35'E, dead, 150 m (1 v, C.117926); Lake Macquarie, 33°04'S 151°36'E, alive (pr [figd spm, Reeve 1852], C.135228); Swansea, Blacksmiths Beach, 33°05'S 151°39.4'E, ocean dead, beach (many v, C.324486); Swansea Breakwater, Lake Macquarie, 33°05.2'S 151°39'E, alive (1 pr, C.324534); off Lake Macquarie, 33°05'S 151°45'E, dead, 138–146 m (1 v, C.070612); 8.8 km E of the Entrance, 33°20.4'S 151°35.5'E, dead, 40–49 m (1 v, C.324487); off Tuggerah Lake, 33°20'S 151°39.4'E, dead, 60 m (1 v, C.130936); off Norah Head, 33°20'S 151°56'E, dead, 73 m (2 pr, C.130116); E of Tuggerah, 33°20'S 152°04'E, dead, 165–183 m (4 v, C.091038); off The Entrance, 33°21.7'S 151°31'E, alive (1 pr, C.375202); Broken Bay, Patonga, 33°33'S 151°16'E, dead (4 v, C.324351); Jerusalem Bay, Cowan Creek, Hawkesbury River, outer to middle reaches, 33°35.7'S 151°12'E, dead, 12 m (1 v, C.100387); off Broken Bay, 33°43'–33°41'S 151°46'–151°43'E, dead, 170 m (2 v, C.115238); Sydney, S end of Collaroy Beach, 33°44'S 151°18'E, dead (1 v, C.107866); off Sydney, 33°46'S 151°43'E, dead, 176 m (1 v, C.125564); Sydney, Port Jackson, Middle Harbour, The Split, 33°48.5'S 151°14.7'E, dead (2 v, C.324474); Sydney, Middle Harbour, Clontarf, 33°48.5'S 151°15.1'E, edge of sand banks, alive (1 pr, C.119826); Sydney, Middle Harbour, Clontarf Beach, 33°48.5'S 151°15.1'E, alive (1 pr, C.324475; 1 pr, C.324544); Sydney, Middle Harbour, Chinamans Beach, 33°48.97'S 151°14.87'E, alive, 1–15 m (7 v, C.062257; 1 v, C.119829; 1 v, C.324364; 2 pr, C.324365; 8 v, C.324464; 1 v, C.324465); Sydney Harbour, Quarantine Bay, North Head, 33°49'S 151°17'E, dead (1 v, C.324469); Sydney, Middle Harbour, Balmoral, N end of Edwards Beach, 33°49.27'S 151°15.10'E, dead (2 v, C.324470); Sydney, 6 km E of North Head, 33°49.50'S 151°21.8'E, dead, 66 m (2 v, C.324363); off Sydney, 33°50'S 151°19'E, dead (8 v, C.088887); Sydney, Port Jackson, Sow & Pigs Reef, 33°50.3'S 151°16.1'E, dead, 11–16 m (1 v, C.114544; 1 pr, C.324467); Sydney, Port Jackson, near Watsons Bay, 33°50.7'S 151°16.7'E, dead (2 v, C.324471); Sydney Harbour, Nielson Park, Bottle & Glass Rocks, 33°50.94'S 151°16.13'E, dead, 7 m (1 pr, C.054578); Sydney Harbour, 33°51'S 151°14'E, dead (3 v, C.012170); many v, C.064556; 6 v, C.119836; 2 v, C.130115; 9 v, C.324479); Port Jackson, off Morts Dock, Balmain, 33°51.4'S 151°11'E, dead, 7 m (12 v, C.324449; 4 v, C.324450; 5 v, C.324451); Sydney Harbour, off Shark Bay [= Shark Island?], 33°51.6'S 151°15.4'E, dead, 15 m (1 v, C.324468); Sydney, Port Jackson, Rushcutters Bay, 33°52.5'S 151°13.9'E, dead (1 pr, C.119825); Sydney, off Coogee, 33°56'S 151°25'E, dead, 86 m (3 v, C.124257); Sydney, 5.7 km E of Minstral Point, 33°56.47'S 151°19.63'E, alive, 71–77 m (1 pr, C.324510); Botany Bay, Kyeemagh to Bay St, Brighton, 33°57.30'–33°57.74'S 151°09.75'–151°09.28'E, LT, dead (1 v, C.324432); Botany Bay, Bay St, Brighton to Barton St, Monterey, 33°57.74'–33°58.53'S 151°09.28'–151°08.95'E, LT, dead (5 v, C.324434); Sydney, 3 km E of Long Bay, 33°58.2'S 151°16.78'E, dead, 47 m (3 v, C.324455); Sydney, 1.6 km E of Malabar outlet, 33°58.25'S 151°17'E, alive, 66 m (1 pr, C.102067; 1 v, C.102068; many, C.324490; 3 pr, C.324492); Sydney, 2 km E of Long Bay, 33°58.5'S 151°17'E, alive, 66 m (2 pr, C.324452); Sydney, Little Bay, 33°58.9'S 151°15'E, alive (1 pr, C.070595); Sydney, 1.74 km E of Malabar Head, 33°58.17'S 151°17.17'E, alive, 67–73 m (many, C.324494; many, C.324495); Sydney, 1.6 km E of Malabar outlet, 33°58.25'S 151°17'E, alive, 66 m (1 pr + 5 v, C.105565; 1 pr, C.105579; 7 pr, C.324496; 1 pr, C.324498; 2 pr, C.324499; 2 pr, C.324500; 5 pr, C.324501); Sydney, 2 km SE of Long Bay, 33°58.43'S 151°16.32'E, alive, 40 m (3 pr, C.103636); Botany Bay, Yarra Bay, 33°58.76'S 151°13.69'E, dead (3 v, C.122376); E of Sydney, 33°58.77'S 151°17.05'E, alive, 66 m (3 pr, C.324505); Sydney, 2 km E of Long Bay, 33°58.83'S 151°17'E, alive, 66 m (1 pr, C.103642; 1 pr, C.302835; 2 v, C.324454; 2 pr, C.324511; 2 pr, C.324512; 1 pr, C.324514); Botany Bay, 33°59'S 151°12'E, dead (11 v, C.324481); Botany Bay, Yarra Bay, 33°59'S 151°13.3'E, dead, beach (1 v, C.324431); off Sydney, 33°59'S 151°17'–151°20'E, alive, 42–97 m (1 pr, C.324519); Sydney, E of Little Bay, 33°59.1'S 151°16.65'E, alive, 55 m (many, C.324491); Sydney, 3.5 km E of Little Bay, 33°59.05'S 151°16.78'E, alive, 59 m (1 pr + 4 v, C.324457); Sydney, 2 km SE of Little Bay, 33°59.15'S 151°16.17'E, dead, 46 m (1 v, C.324456); Sydney, 2.63 km E of Cape Banks, 33°59.38'S 151°16.77'E, alive, 66 m (2 v, C.324352; many, C.324542); Sydney, 2.6 km ENE of Cape Banks, 33°59.43'S 151°16.77'E, alive, 66 m (1 pr, C.105566); Sydney, 2.3 km E of Malabar, 33°59.45'S 151°16.8'E, alive, 66–73 m (many, C.103639; many, C.103640; 9 pr, C.103641; 1 pr + 6 v, C.105567; 1 pr, C.105568; 1 pr, C.105569; 1 pr, C.105570; 1 pr, C.105571; 1 pr + 2 v, C.324362; 1 pr, C.324459; 5 v, C.324460; 1 pr, C.324493; 2 pr, C.324502); Sydney, 4.7 km E of Long Bay, 33°59.45'S 151°18.68'E, dead, 73 m (1 v, C.324453); off Botany Bay, 34°0'S 151°17.5'E, dead, 82 m (4 v, C.063422); Sydney, 2.2 km E of Cape Banks, 34°00.42'S 151°15.92'E, dead, 49 m (1 v, C.324458); Botany Bay, Kurnell, 34°00.58'S 151°12.38'E, alive (2 pr, C.119831; 1 pr, C.324447; 1 pr, C.324448); Sydney, 4.5 km E of Malabar, 34°01.96'S 151°16.45'E, alive, 70 m (many, C.324497); Sydney, 7 km E of Malabar, 34°02.25'S 151°18.93'E, alive, 70–130 m (2 pr, C.324509); Sydney, off Cronulla, 34°03'S 151°12.5'E, dead, 70–80 m (many v, C.324430); Sydney S, Cronulla, 34°03.5'S

151°09'2"E, alive (2 pr, C.062543); Port Hacking, Gunnamatta Bay, 34°03.7'S 151°08.9'E, intertidal, dead (1 v, C.360914); Sydney, Port Hacking, Gunnamatta Bay, 34°03.95'S 151°08.55'E, alive (4 pr, C.051218; many v, C.094905; many, C.097601; 2 pr, C.102331; 2 pr, C.111392; 1 v, C.324350; 3 v, C.324410; 1 pr, C.324411; 2 pr, C.324412; many, C.324413; 2 pr, C.324414; many v, C.324415; 1 pr, C.324416; 1 pr, C.324417; many, C.324418); Port Hacking, 34°04'S 151°06'E, dead (4 v, C.006494); Port Hacking, Ship Rock, 34°04.42'S 151°07.6'E, alive, 6–12 m, (1 pr, C.324435; 2 pr, C.324535; 1 pr, C.324537); Sydney, off Cronulla, 34°04'S 151°13'E, dead, 64 m (1 v, C.324440); Sydney, off Cronulla, 34°04'S 151°14'E, alive, 40–100 m (1 pr + 4 v, C.079048; 11 v, C.324349; 1 v, C.324441); Port Hacking, Bundena, Simpsons Beach, 34°05'S 151°08'E, alive (3 pr, C.324433); off Cronulla, 34°05'S 151°12'E, alive, 24 m (1 pr, C.324533); Port Hacking, off Jibbon, 34°05'S 151°13'E, alive, 85 m (many, C.119827; 10 v, C.119828; (6 v, C.324477); Port Hacking, off Jibbon, 34°05'S 151°13.5'E, dead, 80 m (6 v, C.100692); off Port Hacking, 34°05'S 151°14'E, dead, 36–64 m (1 pr, C.324443); off Wattamolla, 34°05'S 151°14.5'E, dead, 82 m (1 pr, C.086739); off Botany to Wattamolla, 34°05'S 151°14.5'E, dead, 64 m (2 pr, C.324482); off Port Hacking, 34°05'S 151°15'E, dead, 64 m (5 v, C.124254); Port Hacking, off Jibbon, 34°05'S 151°15'E, alive, 73–91 m (5 v, C.324446); E of Botany Bay, 34°06'S 151°28'E, dead, 135–165 m (2 v, C.124172; 5 v, C.124182); off Wattamolla, 34°08'S 151°15'E, dead, 73–110 m (1 v, C.324472); off Botany Bay, 34°19'–34°20'S 151°19'–151°18'E, dead, 161 m (4 v, C.123370); 10.75 ml SE of Bulli Point, 34°20'S 150°55.8'E, dead, 128 m (8 v, C.070594); off Port Kembla, 34°20'S 151°18'E, dead, 161 m (1 v, C.155833); Bass Point, SE of Shellharbour, 34°36'S 150°55'E, alive, 37 m (5 pr, C.324539); off Shoalhaven Bight, 34°46'–34°56'S 150°50'–150°55'E, alive, 46–55 m (1 pr, C.076113); off Shoalhaven, 34°54'–35°0'S 150°48'E, alive (1 pr, C.324428); off Crookhaven, 34°55'S 150°54'E, dead, 64 m (3 v, C.089265); Shoalhaven Bight, 34°57'S 150°48'E, alive, 27–82 m (1 pr, C.324427); Crookhaven Bight, Whale Point, 35°00.3'S 150°49.75'E, alive, 15 m (2 pr, C.324424); Jervis Bay, Callala Point, 35°00.5'S 150°43.35'E, LT, dead (1 v, C.129704); Jervis Bay, Callala Beach, 35°01.5'S 150°41'E, dead (1 v, C.123093); Jervis Bay, 35°03'S 150°45'E, dead, 27.5 m (1 v, C.324353); Jervis Bay, Honeymoon Bay, 35°03.04'S 150°45.19'E, alive, 20 m (1 pr, C.324546); off Jervis Bay, 35°05'S 151°02'–151°10'E, dead, 400–1000 m (many v, C.324426); off Jervis Bay, 35°05'S 150°45'E, alive, 37–124 m (1 pr, C.111360); Jervis Bay, 35°07.1'–35°07.5' 150°42.7'–150°44.1'E, alive, 18–20 m (11 v, C.119837); Jervis Bay, Captains Beach, 35°07.96'S 150°42.75'E, dead, beach (1 v, C.324425); Bandalong, N of Lake Conjola, 35°15'S 150°32'E, ocean beach, dead (1 v, C.324429); Narooma, off Montague Island, 36°15'S 150°13'E, alive, 13–18 m (13 v, C.040697); Twofold Bay, Eden, 37°04'S 149°54.2'E, dead (1 v, C.324348); off Eden, 37°04'S 150°0'E, dead, 54–82 m (many v, C.324422; 1 pr, C.324423); off Twofold Bay, 37°04'S 150°05'E, dead, 82–91 m (4 v, C.324421); SE of Eden, 37°04'S 150°21'E, dead, 269–282 m (1 v, C.324419); Twofold Bay, 37°05'S 149°54'E, alive, 18–37 m (3 pr, C.049891; 2 pr, C.119830; 2 v, C.324420); Twofold Bay, 37°05.13'S 149°55.35'E, dead, beach (2 v, C.007669); off Twofold Bay, 37°05'S 149°56'E, dead, 55 m (4 v, C.064400); Twofold Bay, 37°05'S 149°57'E, 37 m, 6 v, dead (C.088873); off Twofold Bay, 37°05'S 150°0'E, alive, 73–82 m (1 v, C.082467; 1 pr, C.102580); off Twofold Bay, 37°05'S 150°10'E, dead, 73 m (many v, C.064357; 4 v, C.068564); off Eden, 37°05'S 150°10'E, dead, 101 m (3 v, C.108313); Twofold Bay, East Boyd, 37°06.6'S 149°55'E, LWS, alive (1 pr, C.324532); 12–22 ml NNE of Green Cape, off Merimbula to Eden, 37°08'S 150°10'E, dead, 71–84 m (3 pr, C.050208); SE of Eden, 37°15'–37°13'S 150°21'E, dead, 329–333 m (1 v, C.117012); Disaster Bay, Wonboyn Beach, 37°16'S 149°57'E, alive (1 pr, C.097686); off Green Cape area, 37°16'S 150°13'E, alive, 73 m (1 pr, C.051861); 8 ml S of Green Cape, 37°20'S 150°0'E, alive, 54 m (1 pr, C.051458). **VICTORIA:** Mallacoota, 37°34'S 149°56'E, dead (4 v, C.050295); SE of Gabo Island, 37°43'–37°46'S 150°08'–150°10'E, dead, 220 m (1 v, C.375204); off Lakes Entrance, 37°53'S 147°59'E, alive (1 v, C.050307; 1 pr, C.080121; 4 pr, C.097600); Kalimna, near Lakes Entrance, 37°53'S 147°58'E (1 v [fossil], C.375161); Port Phillip Bay, Brighton Pier, 37°55'S 145°0'E, alive (6 pr, C.082535); off Lakes Entrance, 38°03'S 148°03.5'E, alive (4 pr, C.375201; 2 pr, C.375203; 1 pr, C.375205); Bass Strait, off Western Port, 38°34'S 145°10'E, alive (2 pr, C.097595). **TASMANIA:** Bass Strait, Flinders Island, North East River estuary, 39°44.5'S 147°58'E, dead, beach (1 v, C.375194); Circular Head, near Stanley, 40°45'S 146°18'E, alive (2 pr, C.091036); off Cape Naturaliste, 40°49.5'S 148°32.1'E, dead, 62 m (1 v, C.124187; 1 v, C.124192); Bass Strait, off Devonport & Launceston, 41°0'S 146°35'E, alive (1 pr, C.119822); Devonport, 41°10'S 146°21'E, alive (1 pr, C.375274); Henty, 42°00.5'S 145°12'E, dead (2 v, C.078073); Great Oyster Bay, 42°14.8'S 148°02.8'E, dead, 18 m (1 v, C.095206); Maria Island, 2.5 ml NE of Beaching Bay, 42°35.6'S 148°11.33'E, dead, 82.5–91.5 m (16 v, C.080194); Hobart, 42°53'S 147°19'E, dead (4 pr, C.002415; 1 pr, C.117705); Hobart, Derwent River, 42°53'S 147°19'E, alive (1 pr, C.375275; 5 pr, C.375277); Hobart, Sandy Bay, 42°54'S 147°20'E, dead (2 v, C.375279); Derwent Estuary, 42°55'S 147°23.5'E, alive (3 pr, C.063644); D'Entrecasteaux Channel, Kingston, Browns River, 42°58.7'S 147°19.4'E, dead (13 v, C.117674; 4 v, C.375276); D'Entrecasteaux Channel, Pierson's, Point to SE, 43°02.7'S 147°20.83'E, dead, 14.5–16.5 m (5 v, C.375193); Tinderbox Bay, S of Hobart, 43°03'S 147°20'E, dead, 15 m (5 v, C.375280); D'Entrecasteaux Channel, 43°03.5'S 147°20.5'E, alive, 9–27 m (6 pr, C.058570; 7 pr, C.064356; 4 pr, C.097552; 5 pr, C.097554; 1 v, C.375160); D'Entrecasteaux Channel, Killora Bay, 43°05.6'S 147°19.2'E, alive, 7.5 m (3 v, C.080638; 3 v, C.375195); D'Entrecasteaux Channel, 0.25 ml W of Roberts Point, 43°08.6'S 147°15.33'E, dead, 18–25.5 m (many v, C.096111); D'Entrecasteaux Channel, 1 ml W of Simpsons Point, 43°14.6'S 147°15'E, dead, 9–13 m (1 v, C.375159); D'Entrecasteaux Channel, Sheepwash Bay, W side of Bruny Island, 43°15'S 147°15'E, alive, 10–12 m (3 pr, C.147519); Simpsons Bay, D'Entrecasteaux Channel, South Bruny Island, 43°17'S 147°18'E, alive (1 pr, C.054111); Mills Reef, off W coast Bruny Island, 43°19.5'S 147°14.5'E, dead (1 v, C.375278). **SOUTH AUSTRALIA:** Adelaide, Outer Harbour, 34°49'S 138°29'E, alive (2 pr, C.073491); Port Noarlunga, Onkaparinga Point, 35°10'S 138°27.5'E, alive, 14 m (1 pr, C.375157); St Vincents Gulf, 35°0'S 138°0'E, dead (2 pr, C.001315); Kangaroo Island, Eastern Cove, Rocky Point, 35°48'S 137°50.2'E, dead (2 v, C.375156); Tickera Bay, near Kadina, 33°46'S 137°43'E, dead (1 pr, C.094768); Upper Spencer Gulf, False Bay, 33°01'S 137°40'E, alive (1 pr, SAMD19008); Kangaroo

Island, Kingscote, 35°39'S 137°38'E, dead (1 pr, C.049181); Upper Spencer Gulf, Whyalla-South, 33°05'S 137°37'38"E, alive, 12 m (1 pr, SAM D19007); Wallaroo, 33°55'S 137°36'E, LWM, alive (1 pr, C.130114); Spencer Gulf, Hardwicke Bay, 34°45'S 137°18'E, dead (2 pr, C.097599); W side of Thevenard, near Ceduna, 32°09'S 133°39'E, dead (1 v, C.375151); Nuys Archipelago, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (many v, C.129155); Petrel Bay, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (6 v, C.375158); W of Eyre Peninsula, Streaky Bay Jetty, alive, 3–5 m (1 pr, SAMD19009); Sir Joseph Banks Group, N of rocks between Lusby and Partney Islands, alive, 8 m (1 pr, SAMD19010); Gulf of St Vincent, Port Adelaide, Outer Harbour, alive, 2–6 m (3 pr, SAM D19011); Great Australian Bight, 50 ml SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (8 v, C.091040). **WESTERN AUSTRALIA:** Great Australian Bight, 33°05'–33°20'S 128°40'–128°45'E, dead, 75–147 m (2 v, C.375149); Great Australian Bight, 33°05'S 128°40'E, dead, 75 m (3 v, C.375152); Great Australian Bight, 75 ml E of Rocky Point, 33°43'S 125°04'E, dead, 77–80 m (4 v, C.375154); Recherche Archipelago, off Remark Island, 34°04'S 122°0'E, dead, 37 m (1 v, C.119818); Esperance, at pier opposite Oceanarium, 33°51'N 121°53.6'E, dead (1 v, C.134707); Great Australian Bight, E of Hood Point, 34°32'S 121°31'E, dead, 158 m (1 v, C.160994); Great Australian Bight, E of Hood Point, 34°21'S 121°16'E, dead, 82 m (20 v, C.375148); E of Cheyne Bay, 34°55'S 119°0'E, dead, 71–76 m (19 v, C.117451); Albany, 35°03'S 117°58'E, dead (1 pr, C.010537); Albany, King George Sound, Middleton Beach, 35°01'S 117°56'E, dead (1 v, C.119817; 1 pr, C.375144); off Dunsborough, 33°36'S 115°06'E, dead, 0–3.6 m (1 v, C.086845; 1 v, C.375150); W of Bunbury, 33°03'S 114°44'E, dead, 156 m (1 v, C.074089); Fremantle, Garden Island, 32°12'S 115°40'E, dead (1 pr, C.107375); Cockburn Sound, 32°11'S 115°43'E, alive (1 pr, C.119819); Direction Bay, off Rottnest Island, 31°40.6'S 115°09.6'E, dead, 100 m (1 v, C.375153); Perth, Cottesloe Beach & nearby beaches, 31°59'S 115°45'E, dead (many v, C.119820); Shark Bay, 26°07'S 113°25'E, alive (1 pr + 4 v, C.090371; 1 pr, C.102334); Shark Bay, Peron Peninsula, Herald Bight, 25°37'S 113°33'E, flats with seaweed, dead (1 pr, C.087625); c. 48 km S of Carnarvon, 25°10'S 114°39'E, alive, 15–18 m (1 v, C.095866; 1 pr, C.375386); Carnarvon, 24°53'S 113°40'E, dead (2 v, C.069270); off Carnarvon, 24°52'S 113°36'E, dead (1 v, C.130113); Onslow area, 21°38'S 115°07'E, dead (1 pr, C.375437); near Onslow, W of Flat Island, 21°36'S 114°37'E, alive, 11–18 m (1 pr, WAM 401.73). **TASMAN SEA:** Lord Howe Rise, 31°34.9'S 159°00.3'E, dead, 73 m (3 v, C.375196).

**Description.** Shell (sub)circular, solid, up to c. 150 mm high and c. 170 mm in length, most specimens smaller; inequivalve, equilateral, left valve flat or slightly concave, right valve weakly inflated to strongly convex; auricles almost completely symmetrical; colour highly variable, right valve of most specimens paler than left. Pre-radial umbonal area of left valve smooth, c. 5 mm high.

Both valves sculptured with 15–18 simple radial plicae, with narrow plicae and broad interspaces on left valve, wide plicae and narrow interspaces on right valve. Plicae of right valve subdivided by a median groove in adult growth stage of many specimens, with flatter crests than on left valve. Commarginal microsculpture of closely spaced lamellae throughout, prominent on left valve, very weak or lacking on right valve except in radial interspaces. Internal rib carinae prominent. Dorsal margin straight. Byssal notch shallow, functional ctenolium lacking. Hinge teeth numerous, with prominent dorsal, resilial and intermediate teeth.

**Dimensions.** Illustrated specimens: (A) "*fumatus* form": QLD, off Wide Bay, 55 m (AM C.097594): rv: H 69.6, L 81.8 mm; lv: H 64.9, L 80.0 mm; D 23.5 mm; NSW, Sydney, Port Hacking, Gunnamatta Bay, ELWS (AM C.324414): rv: H 81.9, L 90.7 mm; lv: H 72.5, L 88.8 mm; D 33.4 mm; (B) "*preissiana* form": WA, Shark Bay, prawn trawl (AM C.102334): rv: H 67.5, L 75.8 mm; lv: H 61.6, L 73.9 mm; D 25.8 mm; (C) "*meridionalis* form": TAS, Maria Island, 2.5 miles N of Beaching Bay, 82.5–91.5 m (AM C.080194): rv: H 97.3, L 107.4 mm; lv: H 91.7, L 103.0 mm; D 27.7 mm.

**Habitat.** Living free (not byssally attached to substrates) in colonies on clean white sand (Western Australia) or on muddy sand with rubble (Tasmania), partially buried with the flat (left) valve at the sediment-water interface, in shallow waters to sublittoral depths. As this is an important commercial species, many studies have been carried out on its distribution and abundance, particularly in Tasmania (e.g., Fairbridge, 1953; Olsen, 1955; Hortle & Cropp, 1987; Perrin & Croombe, 1988; Mendo *et al.*, 2014).

**Distribution.** Southern Queensland, New South Wales, Lord Howe Island, Victoria, Tasmania, South Australia and Western Australia as far north as Onslow area. No records are known from the tropical region (northwestern, northern and northeastern) of Australia. Present specimens living in the intertidal zone to 130 m. *Pecten fumatus* is dredged commercially to a great extent in New South Wales, Victoria and Tasmania (Dredge *et al.*, 2016, and references therein).

**Remarks.** For more than a century the taxonomic and nomenclatural position of Australian forms of *Pecten sensu stricto* was rather confusing. Recent genetic investigation by Woodburn (1990) and comparative taxonomic research and field observations imply that only one species inhabits the southeastern, southern and southwestern areas of Australia (see also Beu & Darragh, 2001: 184). These regions could be divided into several geographical morphs or population clusters, i.e.:

- (a) Southeastern to southern Australia: typical (with generally simple, solid radial plicae on right valve; strongly inflated in southern Queensland and New South Wales, inflation decreasing fairly regularly southwards).
- (b) Southwestern and Western Australia: WA morph (generally bifid radial plicae on right valve).
- (c) Tasmanian morph (large form with narrow radial plicae and weakly inflated right valve).

*Pecten raoulensis* Powell, 1958 (Dijkstra & Marshall, 2008: 46, figs 37E–F, 38), from the Kermadec Islands, is closely similar to the present species, especially to the Queensland form (see Dijkstra & Marshall, 1997: 95; 2008, p. 46), but at present is accepted as a separate species. Specimens from depths greater than 50 m have sculpture that falls within the limits of variation of both *P. novaezealandiae* Reeve, 1853 and *P. fumatus*, whereas specimens from shallower depths more closely resemble *P. fumatus*, especially specimens from Queensland (Dijkstra & Marshall, 2008: 46). Woodburn (1990) indicated that *P. fumatus* and *P. novaezealandiae* are genetically distinct species. *Pecten novaezealandiae* was not differentiated from *P. fumatus* on the basis of the 16S ribosomal RNA mitochondrial gene by Saavedra & Peña (2004), but C. Saavedra (Instituto de Acuicultura de Torre la Sal, Castellón, Spain, pers. comm. to AGB, Dec. 2004) stated that his unpublished studies using the COI gene demonstrate that *P. novaezealandiae* and *P. fumatus* are distinct species; the difference is due to the slow evolutionary rate of the 16S gene. In other phylogenetic analyses, *Pecten novaezealandiae* and *P. fumatus* consistently have been found to be distinct species (e.g., Alejandrino *et al.*, 2011: fig. 1; Mynhardt *et al.*, 2014: fig. 3; Sherratt *et al.*, 2016: fig. 2; Serb *et al.*, 2017: fig. 2). Some consistent morphological differences are also observed. The lateral margins of the auricles of *P. fumatus* tend to slope outwards dorsally, whereas they are more nearly vertical in *P. novaezealandiae*. A significant proportion of specimens of *P. novaezealandiae* has weak to quite prominent, narrow radial grooves on plical crests, whereas almost all specimens of *P. fumatus* have smooth plical crests, apart from the consistent shallowly furrowed plicae of Western Australian specimens. Hinge teeth also tend to be more complex in *P. fumatus*, with better-developed intermediate teeth than in *P. novaezealandiae*. The colour of south-eastern

Australian specimens of *P. fumatus* (the *meridionalis* form) also tends to be the opposite of *P. novaezealandiae*, in that the exterior tends to be very pale and the interior dark purplish or brownish in *P. fumatus*, whereas the exterior is often darkly coloured and the interior pale (usually whitish) in *P. novaezealandiae*. Dijkstra & Marshall (2008: 46) also pointed out that the margin of the left valve extends more strongly beyond the right valve and overhangs it further in *P. fumatus* than in *P. novaezealandiae*. The genetic relationships clearly need to be investigated more fully between *P. fumatus*, *P. novaezealandiae* and *P. raoulensis*. It is still possible that one species occupies the entire southern Australia–New Zealand–Kermadec Islands region.

### *Pecten dijkstrai* Duncan & Wilson, 2012

Figs 56, 57C–E, H, 58E–I

*Pecten* cf. *excavatus* Anton, 1839 [sic].–Taylor & Glover, 2004: 262.

*Pecten* sp. nov.–Duncan & Wilson, 2007: 1306.

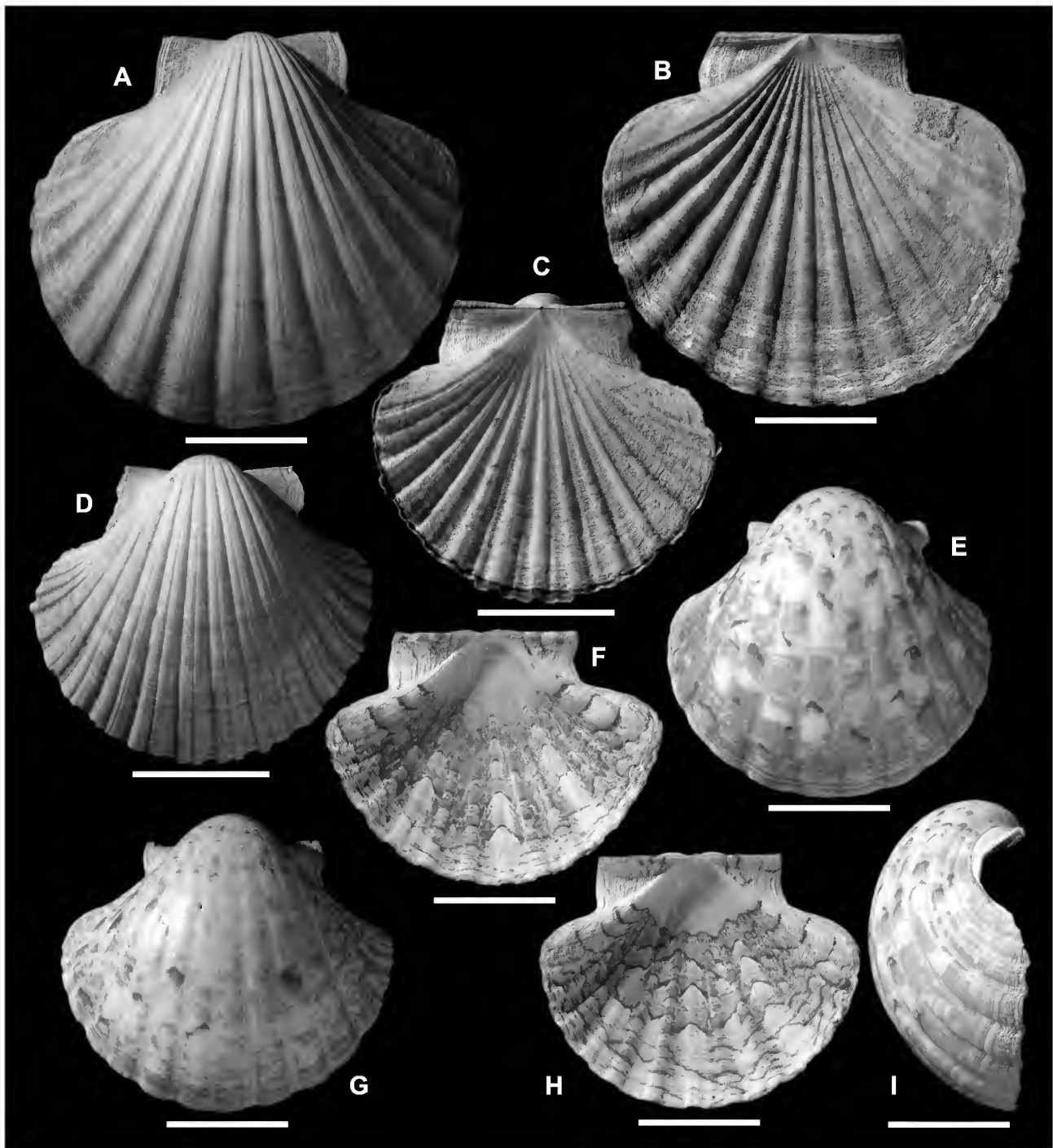
*Pecten dijkstrai* Duncan & Wilson, 2012: 21–26, figs 1–3.

**Type material.** Holotype (pr) Western Australia, off Gnaraloo, 23°52'S 113°29'E, 40–42 m, in areas of coral sand around low-profile, sponge-encrusted limestone reef (H 39.40 mm, L 43.80 mm; D 16.40 mm) AM C.462684, and 30 paratypes (pr & v) as follows: Western Australia, off Gnaraloo Station, 130 km N of Carnarvon, 23°52'S 113°29'E, dead, 40–42 m, on areas of coral sand around low-profile, sponge-encrusted limestone reef (holotype and 2 paratypes (pr), AM C.462684, GW, PD); Exmouth, N of North-West Cape, approx. 21°32'S 114°24'E, dead, 35–40 m, on coral sand adjacent to low-profile limestone reef (2 paratypes (pr), GW, PD); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30.9'–19°28.2'S 118°49.2'–118°55.4'E, dead, 36–37 m, sand (2 paratypes (v), C.149192; paratype (v), AM C.149173); North West Shelf, 77 n.ml NNE of Port Hedland, 19°05'–19°04.9'S 118°58'–118°58.2'E, dead, 82 m, sand & gravel (paratype (v), C.149343); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04.4'–19°04.2'S 119°04.4'–119°00.7'E, dead, 82 m, sand (2 paratypes (v), C.149327); North West Shelf, 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m, sand (20 paratypes (v) [juv-adult], C.146784).

**Additional material examined WESTERN AUSTRALIA:** West of Point Quobba, 30 ml N of Carnarvon, approx. 24°27'S 113°40'E, alive, 35–40 m (1 pr, HM); Exmouth, north of N Murrion Island, 21°39'S 114°22'E, alive, 30 m, sand & gravel (1 pr, HM); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30.9'–19°28.2'S 118°49.2'–118°55.4'E, dead, 36–37 m, sand, dead (2 v, C.149192; 1 v, C.149173); NNE of Dampier Archipelago, 19°23'S 117°21'–117°23'E, alive, 101–102 m (1 pr, WAM S30715); North West Shelf, 19°05'S 118°50'E, alive, c. 80–100 m, muddy sand (1 pr, ZMA Moll.409005); off Broome, 17°58'S 122°14'E, alive, 12–18 m, coarse rubble (2 pr, HM; 1 pr, ZMA Moll.409006); and two additional illustrated HM specimens listed below.

**Description.** Shell subcircular, thin, up to c. 55 mm in length, broader than high, subequilateral, strongly inequivalve. Left valve richly pigmented with brown streaks and creamy-white dots on cream or pinkish background; right valve paler to almost whitish.

Left valve strongly concave, with 12–13 low, almost flat-topped radial plicae, with 1–3 rudimentary plicae near anterior and posterior margins; interstices each broader than one plica. Delicate, closely spaced commarginal lamellae on entire disc, almost smooth on central part, more prominent near margins. Anterior auricle slightly larger than posterior one, anterior edge rather concave; both auricles covered with



**Figure 58** *A–D*, *Pecten fumatus* Reeve, 2 pairs, (A, B) AM C.080194, *meridionalis* form, 2.5 miles N of Beaching Bay, Maria Island, TAS, 82.5–91.5 m; rv exterior (A), lv exterior (B); (C, D) AM C.102334, *preissiana* form, prawn trawl, Shark Bay, WA, lv exterior (C), rv exterior (D). *E–I*, *Pecten dijkstrai* Duncan & Wilson, 2 pairs, both HM, (E, H, I) specimen in Fig. 57C–E, H, rv exterior (E), lv exterior (H), rv exterior anterior view (I); (F, G) Murion Island, 8 km NE of North West Cape, Exmouth, WA, 30–38 m, lv exterior (F), rv exterior (G). Scale bars represent 30 mm (A–D), 20 mm (E–I).

fine, close-set, unevenly developed, prominent commarginal lamellae; with or without 1–3 weak radial ridges near dorsal margin. Dorsal margin straight. Interior surface with paired angular internal rib carinae; adductor muscle scar well-defined; resilifer triangular; prominent resilial, intermediate and dorsal teeth developed on both sides of resilium.

Right valve strongly inflated, with 12–14 broad, low radial plicae with rounded crests, some specimens with a narrow radial groove on plical crests near ventral margin, plus 1–3 rudimentary plicae near anterior and posterior margins;

interstices each much narrower than one plica. Delicate, close-set commarginal lamellae present near ventral margin; central part of disc smooth. Auricles of some specimens with c. 5 weak radial riblets; most specimens with fine, closely spaced commarginal lamellae (less well-developed than on left valve). Byssal notch shallow, functional ctenolium absent in adult stage. Dorsal margin straight; teeth and sockets prominent, corresponding to those in left valve.

**Dimensions.** Illustrated specimens: WA, Exmouth, Murion I., 8 km NE of North West Cape, 30–38 m (HM): rv, H 49.0, L



55.1, D (single valve) 23.3 mm; lv, H 41.5, L 54.1, D (single valve) 10.4 mm; WA, Exmouth, 7–8 km N of tip of North West Cape, 32–35 m (HM): rv, H 50.6, L 52.8, D (single valve) 24.6 mm; lv, H 41.6, L 51.4, D (single valve) 11.3 mm.

**Habitat.** Living in the sublittoral zone to the mid-continental shelf on soft sediment of sandy patches within flat reef areas.

**Distribution.** Continental shelf of Western Australia, from Carnarvon to northwest of Port Hedland. Possibly also southern Indonesia. Present specimens alive at 18–101 m (minimum depth range).

**Remarks.** *Pecten dijkstrai* is most nearly similar to *Pecten excavatus* Anton, 1838, known from southern Japan to Indonesia. *Pecten dijkstrai* is less solid and somewhat wider than *P. excavatus*. The left valve of *P. dijkstrai* is also more deeply concave and the radial plicae are weaker and less angular than in *P. excavatus*. *Pecten dijkstrai* is also paler in colour than *P. excavatus*. Other characters are identical.

*Pecten dijkstrai* differs strongly from *P. fumatus* in having a much more deeply concave left valve; it is almost flat in *P. fumatus*. The right valve of *P. dijkstrai* is also more strongly convex than that of *P. fumatus*. *Pecten dijkstrai* is also thinner (less solid) and smaller in size (up to c. 55 mm in length; *P. fumatus* up to c. 170 mm in length) and less nearly circular than *P. fumatus*. *Pecten fumatus* also has more strongly developed radial plicae than *P. dijkstrai*. For comparison with *Pecten afribenedictus* Kilburn & Dijkstra, 1995 from South Africa and *Pecten erythraeensis* G. B. Sowerby II, 1842 from the Red Sea see Kilburn & Dijkstra (1995).

## **Pedinae Bronn, 1862** (= **Chlamydinae von Teppner, 1822**)

**Diagnosis.** Pectinidae with a persistent byssal notch and ctenolium, most species with radial plicae that crenulate valve margins. Internal rib carinae lacking. Dentition simple, of dorsal and resilial teeth.

### **Pedini Bronn, 1862**

**Diagnosis.** Pedinae with microsculpture in early ontogeny of fine antimarginal ridgelets, crossing early radial sculpture once it develops; true shagreen microsculpture (united across outer surfaces of cells in fresh specimens) present in early growth stage of many taxa and throughout ontogeny in some. Internal rib carinae lacking except in *Notochlamys* and *Equichlamys*. Primary radial costae or plicae subdividing or intercalated, to increase rather irregularly. Dorsal and resilial teeth present.

### **Complicachlamys Iredale, 1939**

*Complicachlamys* Iredale, 1939: 362. Type species (by original designation): *Complicachlamys wardiana* Iredale, 1939; Recent, QLD, Australia.

**Diagnosis.** Elongate, medium-sized Pedini with 7–9 primary radial plicae and numerous secondary radial costae; valves flattened, subequilateral; interstitial commarginal sculpture present, but no shagreen microsculpture; auricles very unequal, anterior large, posterior small; hinge teeth small, with obsolete resilial teeth and prominent dorsal teeth,

intermediate teeth lacking; byssal notch deep, ctenolium well-developed.

**Distribution.** Recent. Tropical southwestern Pacific, living in the littoral zone, byssally attached to rocks or other hard substrates.

**Discussion.** Iredale (1939: 362) introduced *Complicachlamys* and included several “representative” species, viz. *Complicachlamys fulvicostata* A. Adams & Reeve, 1850 [sic], *Complicachlamys luculenta* Reeve, 1853 [sic] = *Complicachlamys dringi* Reeve, 1853 [sic], and *Complicachlamys crouchi* Smith, 1892 [sic] [all the authors and years should have been placed between parentheses]. All these species have shagreen microsculpture and should be placed in *Semipallium* [Jousseau] Lamy, 1928. *Complicachlamys wardiana* does not have this peculiar microsculpture, although Iredale (1939: 362) mentioned sculpture in the interstices of the secondary radial costae “producing a honeycomb effect”, which is somewhat similar to the shagreen sculpture of *Semipallium* species. *Complicachlamys wardiana* has interstitial commarginal sculpture of curved lamellae, producing hollow sections on most specimens. Other characters (outline, primary plicae and secondary costae, highly unequal auricles, deep byssal notch, well-developed ctenolium) are almost indistinguishable from those of *Semipallium*, and it is possible that *C. wardiana* is simply a species of *Semipallium* that has lost shagreen sculpture. This would be resolved best by comparison of DNA sequences.

Hertlein (1969: N366) treated *Complicachlamys* as a junior synonym of *Semipallium*, and was followed by Vaught (1989: 119). Wagner (1989b: 111) considered *Complicachlamys* to be a junior synonym of *Chlamys* Röding, 1798.

### **Complicachlamys wardiana Iredale, 1939**

Figs 59D–E, G–H, J–K, 60, 61B–C

*Pecten dringi* Reeve, 1853: sp. 152, pl. 33, fig. 152a (in part); Wagner, 1989b: 114, figs 6–7 (paralectotypes).

*Complicachlamys wardiana* Iredale, 1939: 362, pl. 5, figs 25–25a; Wagner, 1989b: 114, fig. 8 [holotype]; Dijkstra, 1991: 37; Lamprell & Whitehead, 1992: [28], pl. 12, fig. 73; Slack-Smith & Bryce, 2004: 236; Taylor & Glover, 2004: 262; Raines & Poppe, 2006: 186–187, lower figs; pl. 89, figs 1–3; pl. 135, figs 1–7; pl. 190, figs 1–9; Huber, 2010: 209; Raines, 2010: 618, pl. 1000, figs 1–7; Dijkstra, 2013: 57, pl. 15, figs 3a–d, pl. 28, figs 1a–b.

*Semipallium wardiana* (Iredale).—Abbott & Dance, 1982: 308, fig.; Wang, 2002: 217, pl. 3, fig. 4.

*Semipallium (Semipallium) fulvicostatum* (A. Adams & Reeve).—Wang, 1985: 502, fig. 2 (misidentification).

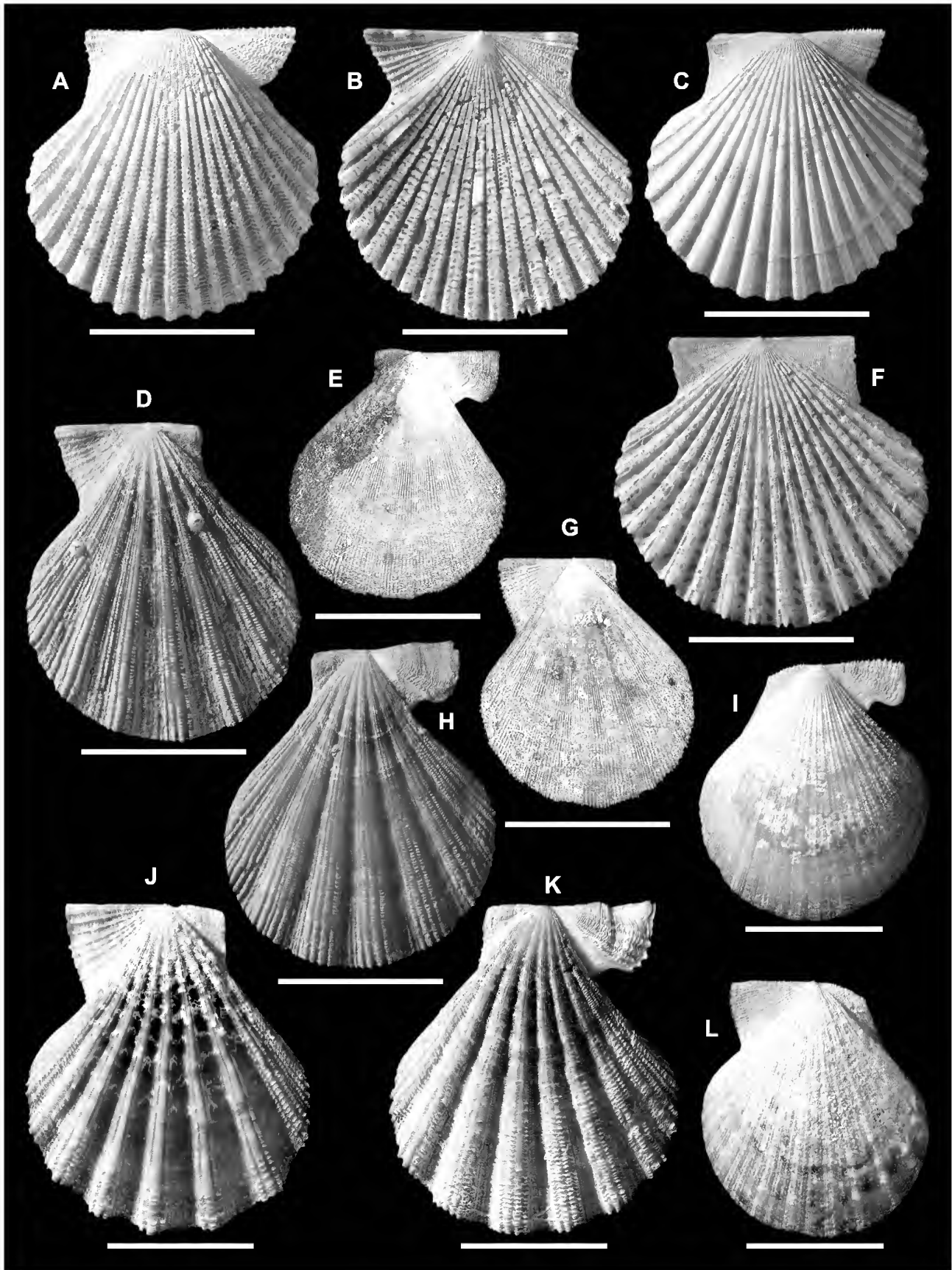
*Semipallium luculentum* (Reeve).—Springsteen & Leobrera, 1986: 328, pl. 93, fig. 15 (misidentification).

*Complicachlamys dringi* (Reeve).—Lamprell & Whitehead, 1992: [28], pl. 12, fig. 72 (in part).

*Semipallium fulvicosta* (A. Adams & Reeve) [sic].—Xu & Zhang, 2008: 87, figs 247a–c (misidentification).

**Type data.** Holotype (pr) AM C.090373 (Fig. 59E, G). Type locality: QLD, Whitsunday Passage, Hayman Island.

**Comments on type data.** The paralectotypes of *Pecten dringi* Reeve, 1853 are specimens of *Complicachlamys wardiana* Iredale, 1939 from Bathurst Island (Wagner, 1989b: 114).



**Figure 59** *A, B*, *Serratovola pallula* Dijkstra, pair, AM C 165231, 72 nautical miles NNW of Dampier, WA, 110 m, rv exterior (A), lv exterior (B). *C, F*, *Serratovola rubicunda* (Récluz), separate valves, AM C 151488, S of Swain Reefs, E QLD, 100 m, rv exterior (C), lv exterior (F). *D, E, G, H, J, K*, *Complicachlamys wardiana* Iredale, 3 pairs, (D, H) AM C.057307, intertidal, Entrance Point, Broome, WA; lv exterior (D), rv exterior (H); (E, G) AM C.090373, holotype of *C. wardiana*, Hayman Island, Whitsunday Passage, QLD; rv exterior (E), lv exterior (G); (J, K) AM C.303787, East Arm, Darwin Harbour, NT, 12°30'S; lv exterior (J), RV exterior (K). *I, L*, *Coralichlamys madreporarum* (G. B. Sowerby II), pair, AM C 303771, Drimmie Head, Melville Bay, Gove, NT, rv exterior (I), lv exterior (L). Scale bars represent 10 mm (A, B, I–L), 20 mm (C, E–G, J, K), 30 mm (D, H).

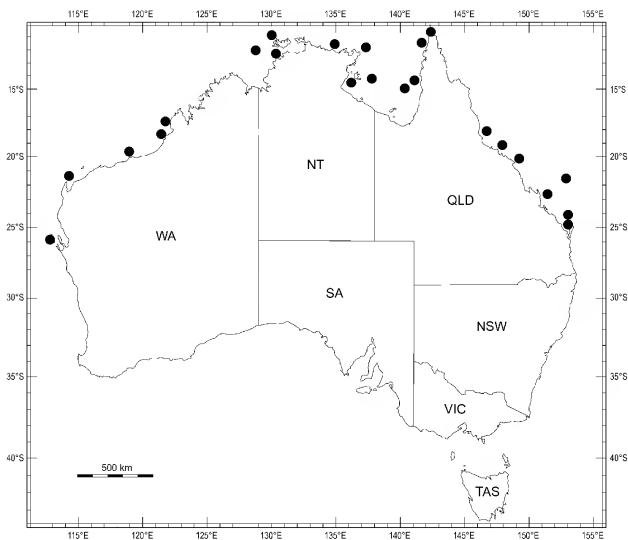


Figure 60. Distribution of *Complicachlamys wardiana* Iredale.

#### Additional material examined.

—AUSTRALIA: **QUEENSLAND:** Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (1 v, C.372282); Torres Strait, 10°0'S 143°0'E, dead (1 pr, C.047358); Torres Strait, Thursday Island, 10°35'S 142°13'E, alive (1 pr, C.097531); Cape York, Evans Bay, 10°42.4'S 142°32.7'E, alive (1 pr, C.007539); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (4 v, C.036130; 1 pr, C.055670); Gulf of Carpentaria, Jardine River mouth, 10°56'S 142°13'E, alive (1 pr, C.012052); N Gulf of Carpentaria, 11°30'S 140°26'E, dead, 65 m (1 v, C.369640); Gulf of Carpentaria, Mapoon, 11°58'S 141°53'E, dead (1 v, C.131553); Gulf of Carpentaria, beaches around Mapoon, 11°58'S 141°53'E, dead (3 v, C.014167); N Gulf of Carpentaria, 12°05'S 139°19.5'E, dead, 62 m (1 v, C.369642); W Gulf of Carpentaria, 14°17'S 137°51'E, dead, 59 m (1 v, C.369641); Gulf of Carpentaria, W of Mitchell River, 15°09.5'S 141°09.8'E, alive, 22 m (1 pr, C.372262); E Gulf of Carpentaria, W of Nassau River, 15°51'S 140°54.2'E, alive, 22 m (1 pr, C.369639); E Gulf of Carpentaria, W of Nassau River, 15°53.5'S 140°42'E, dead, 25.6 m (1 pr, C.369638); GBR, off Grenville, Sunday Island, 11°56'S 143°12'E, dead (1 v, C.075232); GBR, Penguin Channel, 16°15'S 145°31'E, alive, 22–25 m (1 pr, C.372300); GBR, Low Isles, 16°23'S 145°34'E, 16–22 m, dead (2 v, C.372302); Gulf of Carpentaria, Forsyth Island, 16°50'S 139°06'E, dead, beach (4 v, C.014848); Kurraming Beach, S of Innisfail, 17°47'S 146°06'E, dead (1 v, C.372299); Forrest Beach, S of Lucinda, 18°43'S 146°18'E, dead (1 v, C.133072); Magnetic Island, 19°08'S 146°50'E, dead (1 v, C.075241); Townsville, 19°16'S 146°49'E, dead (4 v, C.131554; 1 v, C.133554); off Bowen, 19°44'S 148°14'E, dead, 40 m (1 v, C.372308); GBR, E of Bowen, 19°45.7'S 148°19'E, dead, 46 m (1 v, C.372307); Port Moller, S of Shute Harbour, 20°0'S 148°50'E, alive, 18 m (2 pr, C.012053); GBR, Whitsunday Islands, off Hayman Island, 20°03'S 148°53'E, dead, 9 m (1 v, C.100370); GBR, Whitsunday Islands, Hayman Island, 20°03.6'S 148°53.5'E, alive (1 pr, C.090373; 1 v, C.100361); Bowen, Edgcombe Bay, 20°08'S 148°23'E, dead (2 v, C.372305); Whitsunday Passage, Henning Island, 20°19'S 148°56'E, dead (1 v, C.372303); GBR, Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, dead (many v, C.058937); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (many v, C.372317); E of Mackay, 20°52'S 149°29'E, dead, 35 m (8 v, C.116563); GBR, E of Sarina, 21°27.5'S 150°08'E, dead, 42 m (1 v, C.372320); GBR, Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, alive, 64–73 m (1 pr + 23 v, C.372270); GBR, SE of Sarina, 21°47'S 150°34'E, dead, 59 m (1 v, C.372319); off Yeppoon, 22°30'S 151°26'E, dead, 55 m (1 pr, C.372329); Keppel Bay, 1.5 ml NW of South Keppel Island, 23°09'S 150°57'E, alive, 13–20 m (2 pr, C.372268); Keppel Bay, off Keppel Island, 23°09'S 150°56'E, dead (1 v, C.372328); Capricorn Channel, 4 ml E of North Reef, 23°09'S 151°58'E, dead, 64 m (1 v, C.372331); off South (Great) Keppel Island, 23°12'S 150°58'E, alive, 4 m (1 pr, C.372327); GBR, Capricorn Group, Wilson Island, E side, 23°18'S 151°57'E, alive (1 pr, C.372269); GBR, Capricorn Group, North West Island, 23°18'S 151°42'E, dead (3 v, C.372323); GBR, Capricorn Group, Heron Island, 23°26'S 151°57'E, dead (1 pr, C.372321); GBR, Bunker Group, off Lady Musgrave Island, 23°54'S 152°25'E, dead, 47 m (1 v, C.372330); Port Curtis, 23°55'S 151°23'E, dead (1 pr, C.047357); off Burnett Heads, 24°46'S 152°24'E, alive, 37 m (2 pr, C.097528); Hervey Bay, off Picnic Point, 25°06'S 152°49'E, alive, 9–12 m (1 pr, C.103802); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (2 pr, C.097529). **WESTERN AUSTRALIA:** Shark Bay, 26°07'S 113°25'E, dead (3 v, C.119676); Exmouth Gulf, Bundegi Reef, S end, outer part of rich coral reef, 21°51.5'S 114°09.3'E, dead, 2–4 m (1 v, WAM494); Exmouth, Bundegi Reef, 21°51'S 114°11'E, alive, 6 m (6 pr + 1 v, C.369648); North West Cape, 21°49.05'S 114°14.56'E, dead, 23 m (1 v, C.369649); 40 ml S of Dampier, 21°0'S 116°06'E, dead (1 v, C.369565); Port Hedland, 20°18'S 118°35'E, alive (1 v, C.083717; 1 pr, C.119677); 0.5 ml N of Port Smith, 18°30'S 121°47'E, dead (1 v, C.369647); Broome, Entrance Point, 18°01'S 122°12'E, alive (3 pr + 1 v, C.057307; 4 pr, C.121368); Broome, Roebuck Bay, 18°0'S 122°15'E, 0–13 m, alive (1 pr, C.092016; 1 pr, C.097530; 4 pr, C.131549; 1 v, C.369591; 3 pr, C.372263); Gantheaume Point, W of Broome, 17°59'S 122°11'E, alive (1 v, C.138836; 1 pr, C.372248); Black Ledge, Roebuck Bay, S of Broome, 17°59'S 122°17'E, dead (many v, C.303788); Broome, 17°58'S 122°14'E, 16 m, dead (1 v, C.075237; 2 pr, C.103814; 1 pr, C.131550; 8 v, C.369589; 1 pr, C.369646); Broome, Cable Beach, 17°56'S 122°12'E,

dead (1 v, C.079279); Beagle Bay, 16°56'S 122°32'E, dead (10 v, C.119678); King Sound, 16°50'S 123°30'E, dead (3 pr, C.097534); Cape Leveque, 16°24'S 122°55'E, alive, 0–0.5 m (1 pr, C.057109; 1 pr, C.095975; 1 pr, C.097533); Leapede Islands, Middle Island, 16°51.5'S 122°08'E, dead (1 v, C.069280); Cape Leveque, 16°24'S 122°55'E, dead (1 v, C.369598). **NORTHERN TERRITORY:** Timor Sea, 30 km W of Bathurst Island, 11°39'S 129°48'E, alive, 25 m (5 pr, NTM P008199); Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (2 v, C.131551); Darwin, West Point, 12°26.5'S 130°46'E, alive (2 pr, C.073086; 1 v, C.369579; 2 pr, C.372250); Port Darwin, East Point, 12°25'S 130°49'E, dead (1 v, C.068396; 1 v, C.111355); Port Darwin, Dudley Point, 12°25'S 130°49'E, lower eulittoral zone, alive (1 pr, C.073183); Darwin, Larrakeyah, 12°27.4'S 130°49'E, dead (1 pr, C.369643); Darwin, off Emery Point, 12°27'S 130°49'E, dead (3 v, C.369644); Darwin, Waigait, 11°28'S 130°50'E, on rocky sheltered reef, alive (many, C.111870; 9 pr, C.372251; 8 pr, C.372252); Darwin, Stokes Hill Powerhouse, 11°28'S 130°50'E, alive (1 pr, C.107994); Port Darwin, 12°28'S 130°50'E, dead, 0–10 m (2 v, C.013919; 1 v, C.019468; 1 pr, C.047361; 4 pr, C.073647; 1 pr, C.097423; 9 v, C.131217; 5 v, C.369624); near Darwin, 14°0'S 130°50'E, dead (1 v, C.092648); Darwin, N end of Casuarina Beach, Free Beach, adjacent to outlet of Sandy Creek, 12°21'S 130°53.3'E, dead (1 v, NTM P005102); Darwin Harbour, East Arm, 12°30'S, specimen illustrated in "Bivalves of Australia 1" (28, fig. 72) (AM C.303787); Darwin Harbour, reef to right of East Arm Boat Ramp, 12°29.5'S 130°53.8'E, close to channel, dead (3 pr + 3 v, NTM P002068); Darwin, Lee Point, 12°20'S 130°54'E, dead (2 v, C.077157); Darwin, Buffalo Creek, E of Lee Point, 12°20'S 130°55'E, dead (1 v, C.108668); Melville Island, Cape Conder, 11°44'S 131°17'E, dead (1 v, C.369627); Cobourge Peninsula, Smith Point, 11°07'S 132°08'E, dead (2 v, C.101950; 1 v, C.104021); Berkeley Bay, E side of Port Essington, 11°13'S 132°11'E, dead (1 v, C.122539); Arafura Sea, 125 km N of Goulburn Island, 10°23'S 133°36'E, dead, 62 m (1 v, C.369645); Arnhem Land, Boucaut Bay, 12°0'S 134°27'E, dead (1 pr + 1 v, C.061365); W Gulf of Carpentaria, Grootte Eylant, 14°0'S 136°25'E, dead (1 pr, C.097532; 1 v, C.369634; 1 v, C.369636); Wessel Islands, Marchinbar Island, 11°15'S 136°38'E, dead (1 v, C.071439); Gove Peninsula, Melville Bay, Yirrkala, Dundas Beach, 12°15'S 136°45'E, dead (1 v, C.369630); Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (1 v, C.060172). —CHINA: Kwangtung, alive, intertidal (1 pr, ZMA Moll.143060). —VIETNAM: Nha Trang, Hon Mieu, alive, 15 m (1 pr, ZMA Moll.146125). —PHILIPPINE ISLANDS: Coron, Palawan, alive, 30 m (9 pr, ZMA Moll.140839); Recodo, alive, 5 m (13 pr, ZMA Moll.141354); off Zamboanga, alive, 20–30 m (2 pr, ZMA Moll.140275). —THAILAND: Gulf of Siam, Samui Island, alive, 5–20 m (1 pr, ZMA Moll.145794). —MALAYSIA: Sentosa Island, near ferry wharf, 1°25'S 103°83.3'E, alive, upper littoral (1 pr, C.372264); Kelantan, alive, 34 m (5 pr, ZMA Moll.143063). —INDONESIA: off Bangka, alive, 7–10 m (1 pr, ZMA Moll.140093).

**Description.** Shell up to 60 mm high, most specimens to c. 40 mm; rather solid, somewhat prosocline, left valve flattened, right valve slightly more inflated, inequivalve, inequilateral, auricles highly unequal in shape and size, umbonal angle c. 80–85°; colour highly variable, white, cream, yellowish, orange, red, purple, brown or almost black; uniform, mottled or with paler zig-zag streaks.

Both valves with 7–9 (8 on most specimens) evenly spaced, low (in Queensland morph) to more angulate (in WA morph) radial plicae. Numerous closely spaced radial riblets on plicae (3–5) and in interspaces (7–10), with rather coarse lamellae on plicae in WA morph, lamellae delicate or lacking in Queensland morph. Microscopic interstitial commarginal lamellae in WA morph, more minute or lacking in Queensland morph. Anterior auricles much larger than posterior, with c. 8–10 fine radial riblets on left valve, c. 5–6 more prominent ones on right valve. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium with c. 8 well-developed teeth.

**Dimensions.** Illustrated specimens: WA, Broome, Entrance Point (AM C.057307): rv: 57.4, L 49.9 mm; lv: H 57.2, L 49.6 mm; D 12.9 mm; NT, Darwin Harbour, East Arm, 12°30'S, illustrated by Lamprell & Whitehead (1992: pl. 12, fig. 72) (AM C.303787): rv: H 45.2, L 40.1 mm; lv: H 45.2, L 38.8 mm; D 11.8 mm. Iredale (1939: 363) stated the dimensions of the holotype as H 29.5, L 25 mm.

**Habitat.** Living in the intertidal to sublittoral zones, byssally attached to undersides of coral slabs on hard reef at extreme low tide, often in silty conditions. Some adults become detached and lie in the silt under slabs.

**Distribution.** Tropical Indo-West Pacific from China to the Gulf of Siam and from the Philippines to northern Australia (Raines & Poppe, 2006: 188); Vietnam to Australia, 0–180

m (Huber, 2010: 209); Philippines, 14–90 m (Dijkstra, 2013: 58); South China Sea (as “*Semipallium fulvicosta*”) (Xu & Zhang, 2008: 87); Indonesia, Sulawesi (Dijkstra, 1991: 38); Maximum depth range of live-taken specimens is from the intertidal zone to 180 m. Present specimens from Australia alive in the intertidal zone to 73 m.

**Remarks.** Specimens from northwestern Australia have coarser sculpture than those from Queensland, but specimens from central northern Australia intergrade slightly. Examined material from the Indo-West Pacific is indistinguishable from the type material from Queensland.

### *Coralichlamys* Iredale, 1939

*Coralichlamys* Iredale, 1939: 355. Type species (by original designation): *Coralichlamys acroporicola* Iredale, 1939 (= *Pecten madreporarum* G. B. Sowerby II, 1842); Recent, Australia.

**Diagnosis.** Small, coral-dwelling Pedini, irregularly shaped, with numerous unevenly spaced radial ribs; auricles highly unequal, posterior declined; antimarginal microsculpture in early ontogeny, secondary commarginal sculpture on anterior auricles and in late ontogeny; with prominent resilial and dorsal teeth; byssal notch deep, ctenolium well-developed.

**Distribution.** Miocene–Recent (Hayami, 1989: 15). In our opinion, *Chlamys rutteni* (Martyn, 1914), from the Eocene of Java, Indonesia, does not belong in *Coralichlamys*. Indo-West Pacific, living in the subtidal to shallow sublittoral zones, lodged amongst *Acropora* branches.

**Discussion.** Hertlein (1969: N355) treated *Coralichlamys* as a junior synonym of *Chlamys* Röding, 1798 in the *Chlamys* group. Currently *Coralichlamys* is regarded as a monotypic genus in Chlamydini (i.e., Pedini) (Waller, 1993: 203). In some recent phylogenies (Sherratt et al., 2016; Serb, 2016), specimens identified as *Coralichlamys madreporarum* (G. B. Sowerby II, 1842) are located in up to three distinct areas of the phylogram, indicating that the material consists of several unrelated taxa. Resolution of this question is beyond the scope of the present review.

### *Coralichlamys madreporarum* (G. B. Sowerby II, 1842)

Figs 59I,L, 61E–F, 62, 63A,C

*Pecten madreporarum* [Petit] G. B. Sowerby II, 1842: 68, pl. 14, fig. 68; Reeve, 1853: sp. 117, pl. 28, fig. 117; Philippi, 1845: 203, pl. 2, figs 4–5; Brazier, 1879: 199; Küster & Kobelt, 1888: 131, pl. 36, fig. 6; Hedley, 1899: 494; Melvill & Standen, 1899: 183; Lynge, 1909: 157.

*Pecten nigromaculatus* Kobelt in Küster & Kobelt, 1888: 273, pl. 71, figs 7–8.

*Coralichlamys acroporicola* Iredale, 1939: 355, pl. 5, figs 26–26a; Woolacott, 1952: 79, pl. 2, figs 1–3.

*Pecten (Chlamys) madreporarum* Sowerby.—Adam & Leloup, 1939: 58, pl. 4, fig. 2.

*Chlamys madreporarum* (Sowerby).—Waller, 1972a: 238, pl. 3, fig. 42; Wells, Slack-Smith & Bryce, 2000: 42; Dharma, 2005: 248, pl. 99, figs 10a–d; Xu & Zhang, 2008: 81, fig. 226.

*Chlamys (Coralichlamys) madreporarum* (Sowerby).—Kira, 1967: 137, pl. 49, fig. 12; Wang, 1983c: 47, pl. 1, fig. 11; Dijkstra, (1983–1994) 1986: 7, figs; Rombouts, 1991: 23, pl. 24, fig. 10; Hayami, 2000: 899, pl. 447, fig. 15.

*Coralichlamys madreporarum* (Sowerby).—Dijkstra et al., 1990: 7–8, figs; Dijkstra, 1991: 32; Dijkstra, 1998a: 30; Dijkstra & Knudsen, 1998: 73, pl. 10, figs 44–45; Subba Rao & Dey, 2000: 223; Wang, 2002: 182, pl. 5, fig. 2; Slack-Smith & Bryce, 2004: 236; Raines & Poppe, 2006: 188, 189, pl. 136, figs 2, 4–6; Dijkstra & Moolenbeek, 2008: 18; Huber, 2010: 208; Raines, 2010: 618, pl. 1000, figs 8–9; Dijkstra, 2013: 58, pl. 16, figs 1a–d.

*Chlamys (Chlamys) madreporarum* (Sowerby).—Lamprell & Whitehead, 1992: [20], pl. 8, fig. 44.

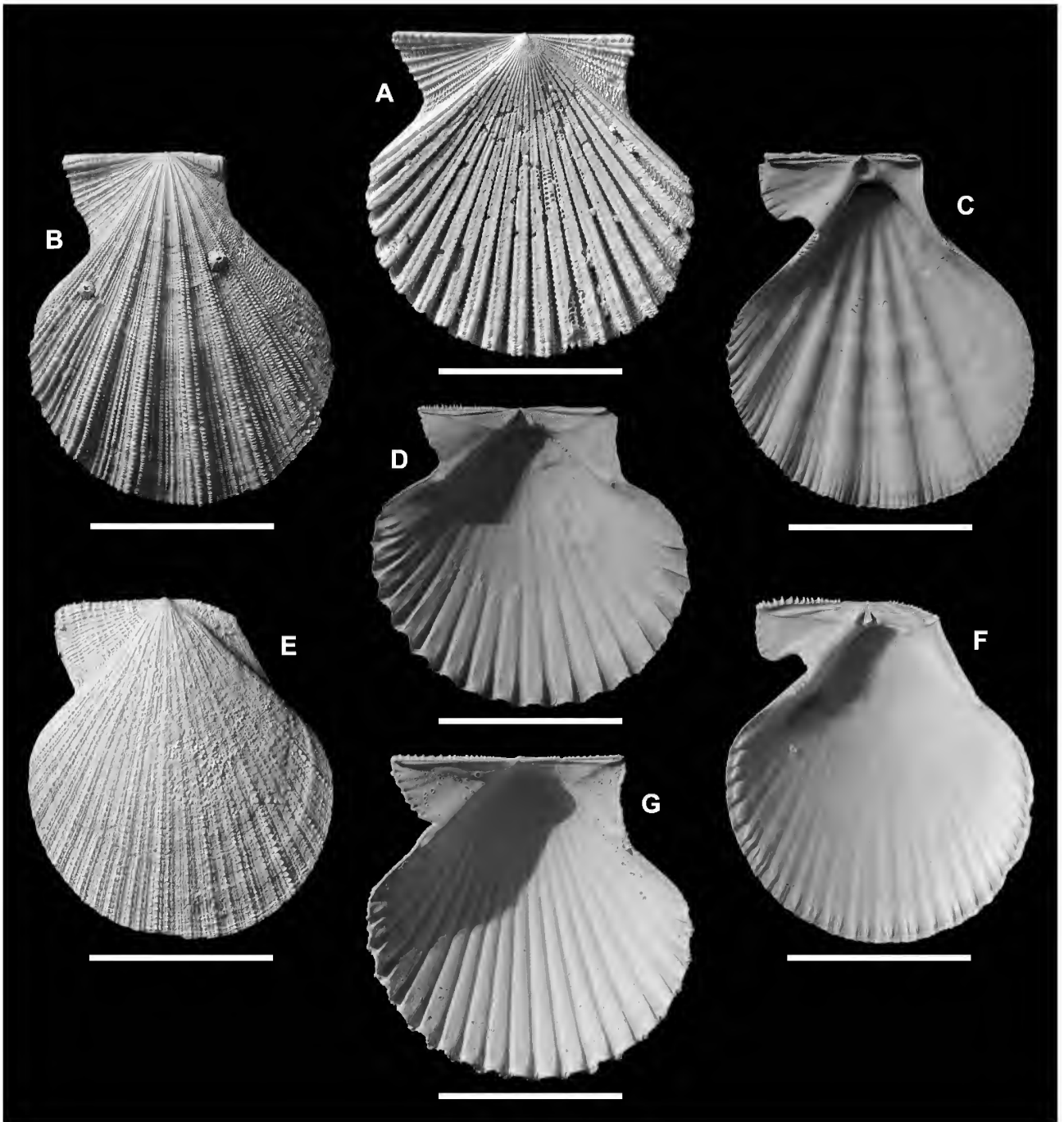
**Type data.** *Pecten madreporarum* Sowerby: lectotype (pr) NHMUK1995083/1 designated by Dijkstra & Knudsen (1998: 75), figured by G. B. Sowerby II (1842: sp. 70, pl. 14, fig. 68); paralectotype (pr) NHMUK1995083/2, figured by Reeve (1853: sp. 117, pl. 28, fig. 117), paralectotype (pr) NHMUK1995083/3 (not figured). Type locality: “Red Sea” (original description), “Java” (label).

*Pecten nigromaculatus* Kobelt: lectotype (pr) ZMB Moll.114.608 (designated by Dijkstra & Köhler, 2008: 39), H 22.0, L 18.5 mm, labelled “*Pecten nigromaculatus* Dkr/Viti Isl.”, i.e., Fiji Islands (Dijkstra & Köhler, 2008: 39, fig. 3e).

*Coralichlamys acroporicola* Iredale: holotype (pr) AM C.090374 (Fig. 63A, C). Type locality: QLD, Low Isles, near Port Douglas.

**Comments on type data.** Reeve (1853: sp. 117) did not follow the original description by Sowerby (1842: 68) and mentioned as the locality “Java (in masses of madreporae)”, following the misleading label “Java” accompanying the type lot. However, Sowerby clearly mentioned in the original description “... found in holes of Madreporae. It is from the Red Sea.” Therefore the type locality is taken here as the Red Sea (see also Dijkstra & Knudsen, 1998: 73), although it is quite likely that these localities were both provided by Hugh Cuming at different times and are equally spurious. Beu (2006: 171–172) concluded that “localities accompanying material from Cuming’s collection should all be regarded as unreliable unless confirmed by subsequent re-collecting”.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (2 v, C.161013); Cape York, 10°43'S 142°28'E, alive (2 pr, C.012045); GBR, Lizard Island, No. 1 Bommie, 14°41'S 145°28'E, alive, 0–15 m (2 pr, C.343932); GBR, Lizard Island, Bird Islet, 14°41'S 145°28'E, dead, 0–24 m (1 pr, C.344063); GBR, Low Isles, 16°23'S 145°34'E, alive (1 pr, C.090374); 15 v, C.344062); GBR, Low Isles, near Port Douglas, 16°32'S 145°34'E, dead (4 v [?paratypes of *Coralichlamys acroporicola* Iredale, 1939], C.161022); GBR, Low Isles, 16°23'S 145°34'E, dead, 16–22 m (1 v, C.344061); GBR, Michaelmas Cay, 16°36'S 145°59'E, dead (1 v, C.119512); Palm Islands, 18°40'S 146°33'E, dead (2 v, C.009985); Whitsunday Islands, off Hayman Island, 20°03'S 148°53'E, dead, 9 m (1 pr, C.344058); Whitsunday Islands, Hayman Island, 20°03'S 148°53'E, alive (1 pr, C.344059); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (1 v, C.344057); GBR, Swain Reefs, alive (2 pr, WAM); GBR, Swain Reefs, 20 mls N of Heralds Prong No. 1 Reef, 21°10'S 151°24'E, dead (5 v, C.119788); Keppel Bay, Pelican Island, 23°14'S 150°52'E, alive (1 pr, C.344060); GBR, Capricorn Group, North West Island, 23°18'S 151°42'E, alive (1 pr, C.119513). WESTERN AUSTRALIA: S Muiron Island, 21°40.86'S 114°20.55'E, dead, 4–8 m (1 v, WAM); S Muiron Island, 21°40.46'S 114°20.91'E, alive, 3–5 m (1 pr, WAM); Montebello Islands, NW Hermite Island, 20°30.01'S 115°27.43'E, dead, 5–8 m (1 pr, WAM); Kendrew Island, 20°28.30'S 116°32'E, alive, 7 m (3 pr, WAM); Kimberley, Albert Reef, 14°15.05'S 125°10'E, alive, 27 m (5 pr, WAM); Cassini Island, 13°56.37'S 125°38.45'E, alive, 30 m (1 pr, WAM); Cassini Island, 13°56'S 125°38'E, dead (1 pr, WAM). NORTHERN TERRITORY: Port Essington, Orontes Reef, alive, 12 m (1 pr, WAM); Gove, Melville Bay, Drimmie Head, 12°14'S 136°42'E, alive (3 pr, C.157591); 2 pr, C.303771). —DIJIBOUTI: Gulf of Aden, alive, 18 m (2 pr, ZMA Moll.143584). —CHINA: Hainan, alive (1 pr, ZMA Moll.142567). —SINGAPORE: S Singapore, NE corner of Port St. John, alive (many, WAM). —INDONESIA: Moluccas, Ceram, alive (12 v, ZMA Moll.142564). —PAPUA NEW GUINEA: Madang, Kranket Island, inlet at N end, 5°11'S 145°51'E, alive, intertidal (1 pr, C.343933; 1 pr, C.344066); Tubuseiria (Tupuseleia), 9°33'S 147°19'E, alive (1 pr, C.012046). —SOLOMON ISLANDS: Santa Cruz Group, Reef Island, 10°15'S 166°10'E, alive (1 pr, C.052135); Russell Group, Pavuvu Island, Samata, alive, 6 m (1 pr, ZMA Moll.144013). —SAMOA: Tutuila Island, 14°18'S 170°42'W, alive (1 pr, C.344067). —FIJI ISLANDS: Viti Levu, Deuba, 18°15'S 178°05'E, dead (1 v, C.344065). —NEW CALEDONIA: Loyalty Islands, Lifu Island, behind Cap des Pins, 21°04'S 167°28'E, dead (2 v, C.344064); Nouméa, Baie des Isoles, Ouemo, Magenta, 22°16'S 166°29'E, dead (1 v, C.161023).



**Figure 61.** *A, G, Serratovola pallula* Dijkstra, specimen in Fig. 59A, B, lv exterior (A), rv interior (G). *B, C, Complicachlamys wardiana* Iredale, specimen in Fig. 59D, H; lv exterior (B), rv interior (C). *D, Serratovola rubicunda* (Récluz), specimen in Fig. 59C, F; rv interior. *E, F, Coralichlamys madreporarum* (G. B. Sowerby II), specimen in Fig. 59I, L; lv exterior (E), rv interior (F). Scale bars represent 10 mm (A, E–G), 30 mm (B, C), 20 mm (D).

**Description.** Shell up to c. 30 mm high, most specimens xenomorphic or irregular in shape, oblong, prosocline, inequivalve, with right valve slightly more convex than left, inequilateral, auricles unequal in shape and size, umbonal angle 80–90°; cream or whitish, left valve of most specimens with fine brown maculations, right valve paler and without brown markings in most specimens.

Both valves sculptured with numerous, unevenly spaced, scabrous, fasciculate radial riblets. Near ventral margin, riblets bear microsculpture of fine commarginal lamellae; near posterior margin some specimens also have interstitial microscopic antimarginal striae. Auricles highly unequal, anterior much larger than posterior, bearing fine radial riblets

and commarginal lamellae; posterior ones with weaker sculpture, dorsal margin strongly declined. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium with 4–6 teeth. Hinge with prominent resilial teeth; resilifer very narrowly triangular.

**Dimensions.** Illustrated specimens: NT, Gove, Melville Bay, Drimmie Head (AM C.303771): rv: H 18.5, L 16.5 mm; lv: H 18.3, L 16.4 mm; D 5.5 mm. Iredale (1939: 356) stated the dimensions of “the Australian species” (implying the holotype of *Coralichlamys acroporicola*) as H 29, L 24 mm, although he noted that Sowerby’s (1842: pl. 14, fig. 68) illustrations indicated a shell measuring H 20, L 16 mm.



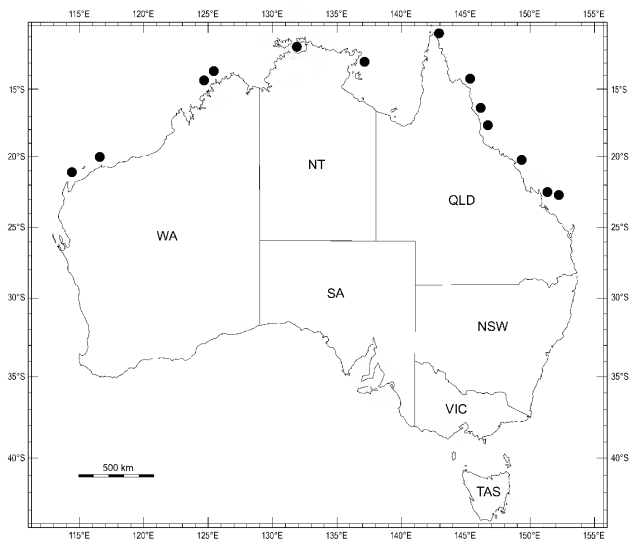


Figure 62. Distribution of *Coralichlamys madreporarum* (G. B. Sowerby II).

**Habitat.** Living in the littoral zone; a coral-dwelling species, lodged amongst lower *Acropora* branches (Woolacott, 1952: fig. 3, in situ) and most specimens prefer calmer waters or lagoons.

**Distribution.** Tropical Indo-West Pacific from southern Japan to northern Australia, westwards to the Red Sea, Gulf of Aden, Malagasy and Mauritius, and eastwards to Samoa (Raines & Poppe, 2006: 188); Red Sea to Amami, 0–22 m (Huber, 2010: 208); Red Sea, 4–8 m, Gulf of Aden, 18 m (Dijkstra & Knudsen, 1998: 75); Philippines, intertidal zone to 24 m (Dijkstra, 2013: 60); Indonesia (Dijkstra, 1991: 32); Papua New Guinea (Dijkstra, 1998a: 30). Maximum depth range of live-taken specimens is from the intertidal zone to 38 m (unpublished data, HHD). Present specimens from Australia alive from the intertidal zone to 30 m.

**Remarks.** Although the present specimens are extremely variable in shape and many are deformed as a result of their habitat among coral branches, other characters are identical to those of the type material of *Coralichlamys madreporarum*.

### *Equichlamys* Iredale, 1929

*Equichlamys* Iredale, 1929: 162. Type species (by original designation): *Pecten bifrons* Lamarck, 1819; late Pliocene to Recent, southeastern Australia.

**Diagnosis.** Plicate Pedini with aequipectinoid shell shape, inflation of valves almost equal, acline or weakly prosocline, auricles almost equal in size; coarse shagreen microsculpture present throughout ontogeny; internal rib carinae prominent; hinge with prominent resilial and dorsal teeth; byssal notch shallow, ctenolium obsolete or lacking in late ontogeny.

**Distribution.** Late Pliocene–Recent (Beu & Darragh, 2001). Southeastern Australia, living in the littoral to sublittoral zones on soft sediment (muddy sand or sand) with seagrass beds.

**Discussion.** Hertlein (1969: N357) treated *Equichlamys* as a subgenus of *Chlamys* Röding, 1798 in the *Chlamys* group. Waller (1991: 30) considered it to be a representative of the suprageneric *Chlamys* group or, more recently, in Chlamydini (i.e., Pedini) (Waller, 1993, 2006a).

Waller (1991: 30) compared the morphological convergence of *Equichlamys* and *Notochlamys* and suggested that the two are not closely related and have different ancestries. As *Equichlamys* and *Notochlamys* are almost the only examples of internally carinate Pedini, they provide examples of Pedini that have evolved internal rib carinae independently from non-carinate ancestors.

For biostratigraphy of *Equichlamys* see Beu & Darragh (2001).

### *Equichlamys bifrons* (Lamarck, 1819)

Figs 63B,D–H, 64, 65A–C,F

*Pecten bifrons* Lamarck, 1819: 164, no. 4; Deshayes, 1836: 131, no. 4; Delessert, 1841: pl. 15, figs 5a–c; Chenu, 1843: 3, pl. 22, figs 3–3b; Reeve, 1852: sp. 45, pl. 12, fig. 45; Chenu, 1862: 184, figs 925–926; Tenison Woods, 1878a: 33, 56; Tate & May, 1901: 440; Chapman, 1920: 229; Dijkstra, 1994: 472, pl. 2, figs 4–5, pl. 3 figs 6–7 [lectotype].

*Pecten subbifrons* Tate, 1882: 44; Tate, 1886: 104, pl. 3, fig. 2. *Pecten consobrinus* Tate, 1886: 104, pl. 3, fig. 6; Tate & Dennant, 1893: 224; Harris, 1897: 317; Tate, 1899: 269.

*Pecten palmipes* Tate, 1886: 105, pl. 5, fig. 4, pl. 7, figs 4a–b; Harris, 1897: 318.

*Chlamys bifrons* (Lamarck).—Pritchard & Gatliff, 1904a: 263; Hedley, 1918a: M9; May, 1921: 10; May, 1923: pl. 3, fig. 6; Coleman, 1975: 273, fig. 626.

*Equichlamys bifrons* (Lamarck).—Iredale, 1929: 162; Cotton & Godfrey, 1938: 94, fig. 79; Macpherson & Chapple, 1951: 145; Cotton, 1957: 127; Cotton, 1961: 97, fig. 82; Macpherson & Gabriel, 1962: 306, fig. 348; Iredale & McMichael, 1962: 11; Richmond, [1990]: 46, fig. 126; Waller, 1991: 30, pl. 3, figs 9–10; Rombouts, 1991: 38, pl. 14, figs 3–3a; Lamprell & Whitehead, 1992: [24], pl. 10, fig. 60; Slack-Smith, 1998: 275, 277, text-fig. 6.18D, pl. 13, fig. 2; Beu & Darragh, 2001: 53, text fig. 1, figs 13A–H, 14A–F; Raines & Poppe, 2006: 190–191, upper figs; pl. 137, figs 1–5; pl. 138, figs 1–5; Huber, 2010: 206.

*Chlamys (Equichlamys) consobrina* (Tate).—Ludbrook, 1955: 31; Ludbrook, 1959: 225, pl. 1, fig. 2.

*Chlamys (Equichlamys) subbifrons* (Tate).—Ludbrook, 1959: 224, pl. 1, fig. 1.

*Chlamys (Equichlamys) palmipes* (Tate).—Ludbrook, 1959: 225, pl. 1, figs 3–6.

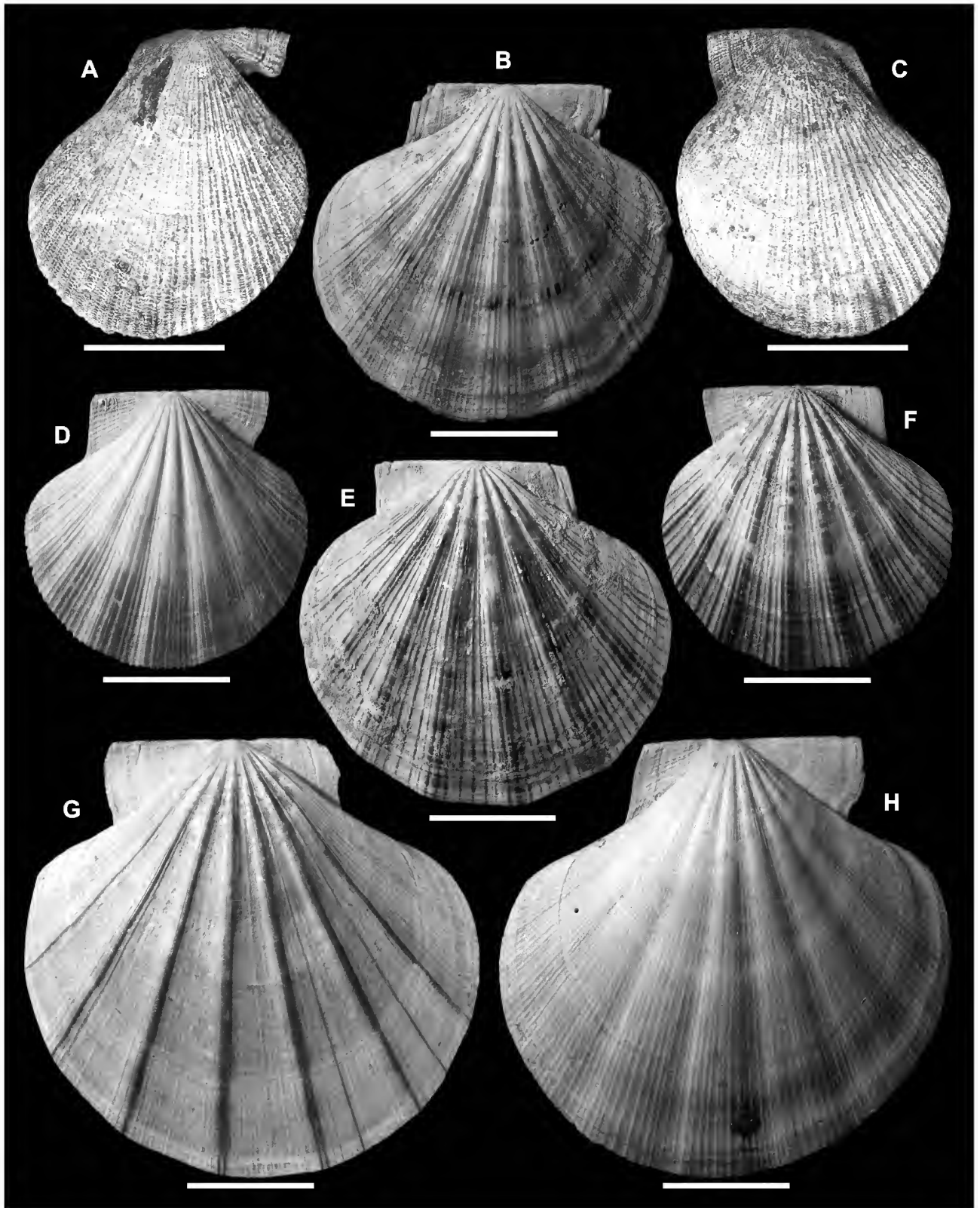
*Chlamys (Equichlamys) bifrons palmipes* (Tate).—Ludbrook, 1978: 46, pl. 2, fig. 5.

*Chlamys (Equichlamys) bifrons subbifrons* (Tate).—Ludbrook, 1978: 47, pl. 2, figs 6–7; Ludbrook, 1983: 47; Ludbrook, 1984: 240.

*Chlamys (Equichlamys) bifrons* (Lamarck).—Ludbrook, 1984: 160, 296, pl. 8f, figs 38a–b; Ludbrook & Gowlett-Holmes, 1989: 642, figs 11.37a–b, pl. 42, fig. 5.

**Type data.** *Pecten bifrons* Lamarck: lectotype (pr) MNHN Moll21188, designated by Dijkstra (1994: 472), 3 paralectotypes (pr) MNHN Moll21189, one paralectotype (pr) MHNG1088/14/2, figured by Delessert (1841: pl. 15, figs 5a–c) and by Chenu (1843: pl. 22, figs 3–3b; 1862: figs 925–926), one possible paralectotype (pr) MHNG1088/14/1. Type locality: “Les mers australes et de la Nouvelle Hollande. Péron”. This type locality is in part incorrect as the species is restricted to southern Australia (see Dijkstra, 1994: 472).

*Pecten subbifrons* Tate: lectotype SAM T959A, designated by Ludbrook (1959: 224), Tate’s (1886: pl. 3 fig. 2) figured specimen, 4 paralectotypes SAM T959B–D. Type locality: “Adelaide”, i.e., Hallett Cove Sandstone, late

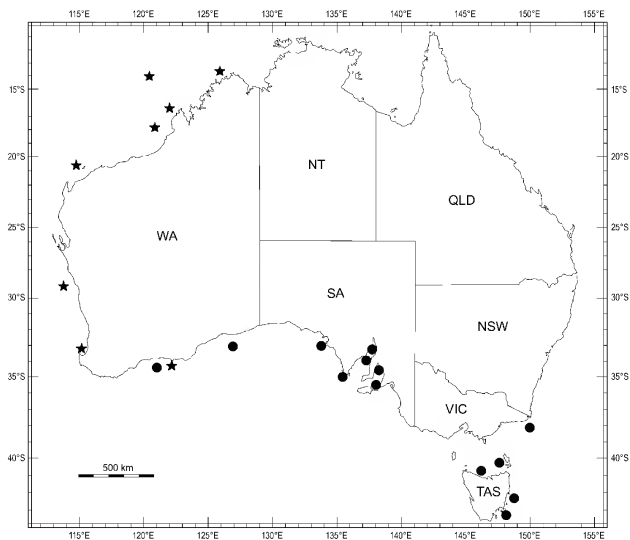


**Figure 63** A, C, *Corallichlamys madreporarum* (G. B. Sowerby II), pair, AM C.090374, holotype of *Corallichlamys acroporicola* Iredale, Low Isles, near Port Douglas, QLD; rv exterior (A), lv exterior (C). B, D–H, *Equichlamys bifrons* (Lamarck), (B–F) 2 pairs, AM C.097523, Henley Beach, SA; rv exteriors (B, D), lv exteriors (E, F); (G, H) large pair, AM C.102328, off Hobart, TAS; lv exterior (G), rv exterior (H). Scale bars represent 10 mm (A, C), 30 mm (B, D–H).

Pliocene (Ludbrook, 1959). See also Beu & Darragh (2001).

*Pecten consobrinus* Tate: lectotype SAM T937B, designated by Ludbrook (1959: 225, 233) as “holotype” statement, Tate’s (1886: pl. 3 fig. 6) figured syntype, paralectotype

SAM T937A. Type locality: “Oyster Banks, Aldinga”, i.e., Hallett Cove Sandstone, late Pliocene. Four paralectotypes SAM T968A–D, unfigured, not conspecific with lectotype and from other localities. See also Beu & Darragh (2001).



**Figure 64.** Distribution of *Equichlamys bifrons* (Lamarck) (circles) and *Hemipecten forbesianus* A. Adams & Reeve (stars).

*Pecten palmipes* Tate: lectotype SAMT932A, designated by Ludbrook (1959: 225), Tate's (1886: pl. 7 figs 4a–b) figured syntype, paralectotype SAM T932B. Type locality: Edithburgh, South Australia, Hallett Cove Sandstone, late Pliocene.

**Comments on type data.** See Beu & Darragh (2001: 55).

**Additional material examined.**—AUSTRALIA: VICTORIA: Between Green Cape & Snowy River mouth, 38°0'S 149°30'E, alive, 91–183 m (1 pr, C.374883); S of Gabo Island, 38°08'S 149°55'E, alive, 183–457 m (8 v, C.037005). TASMANIA: Bass Strait, Flinders Island, Settlement Point, 40°01'S 147°51'E, dead (5 v, C.129066); Bass Strait, Flinders Island, Arthur Bay, 40°03'S 147°56'E, dead (1 v, C.129068); Bass Strait, Flinders Island, S side of Trousers Point Beach, 40°13'S 148°02'E, dead (1 v, C.129067); Tomahawk Point, S of Tomahawk Island, 40°52'S 147°46'E, dead (1 v, C.080634); Bass Strait, off Devonport, 41°05'S 146°22'E, dead, 26–69 m (1 v, C.375045); Hobart, 42°53'S 147°19'E, alive (2 pr, C.002417; 1 pr, C.102328); Hobart, Derwent River, 42°53'S 147°19'E, dead (1 pr, C.375033; 1 pr, C.375037); Derwent River, opposite Hobart, Bellerive, 42°53'S 147°22.5'E, dead (5 v, C.111413); Hobart, Sandy Bay, 42°54'S 147°20'E, dead (1 pr, C.086689; 1 v, C.111406); Cremorne Bay, 42°58'S 147°32'E, dead (2 v, C.375043); D'Entrecasteaux Channel, Pierson's Point to SE, 43°02.75' 147°20.83'E, dead, 14.5–16.5 m (1 v, C.375032); Tinderbox Bay, S of Hobart, 43°03'S 147°20'E, dead, 15 m (10 v, C.300340); D'Entrecasteaux Channel, 43°03.5'S 147°20.5'E, alive, 12–27 m (9 v, C.058571; 4 pr, C.097524; 4 v, C.097526); D'Entrecasteaux Channel, Killora Bay, 43°05.6'S 147°19.2'E, alive, 7.5 m (1 pr + 1 v, C.096121); Port Arthur, Long Bay, 43°06'S 147°51.5'E, dead (1 pr, C.375039); D'Entrecasteaux Channel, 1 ml W of Simpsons Point, 43°14.6'S 147°15'E, dead, 9–13 m (7 v, C.374890); Bruny Island, off Simpsons Point, 43°14'S 147°19'E, alive, 11 m (2 pr, C.086644); D'Entrecasteaux Channel, Simpsons Bay, South Bruny Island, 43°17'S 147°18'E, alive (1 pr, C.054110); Mills Reef, off W coast Bruny Island, 43°19.5'S 147°14.5'E, dead, 2 m (1 v, C.375030). SOUTH AUSTRALIA: Lacedpede Bay, SE of Kingston, 36°50'S 139°51'E, dead (2 v, C.104184); Port Elliott, 35°32'S 138°41'E, dead (1 v, C.132128); Henley Beach, 34°56'S 138°31'E, dead (2 pr, C.097523); Adelaide, Outer Harbour, 34°49'S 138°29'E, alive (3 pr, C.073487); Adelaide, Outer Harbour Beach, 34°49'S 138°29'E, alive (2 pr, C.097525); Adelaide, Semaphore Beach, 34°50'S 138°29'E, alive (4 v, C.097527; 2 pr, C.374887; 1 pr, C.374888); Port Adelaide, 34°52'S 138°30'E, dead (3 pr, C.374889); Adelaide beaches, 34°51'S 138°30'E, dead (3 pr, C.089653); Largs North Beach, c. 19 km N of Adelaide, 34°49'S 138°29'E, dead (2 v, C.116884); Adelaide, off Glenelg, 34°59'S 138°28.5'E, alive, 3.5 m (10 v, C.374885); Adelaide, 3.2 km off Glenelg, 34°59'S 138°28.5'E, alive, 11 m (1 pr, C.375056); Port Noarlunga, 35°09.1'S 138°27.8'E, dead (3 v, C.374886); Port Noarlunga, Onkaparinga Point, 35°10'S 138°27.5'E, alive, 14 m (2 pr, C.375054); Port Pirie, Solomontown Beach, 33°12'S 138°01'E, dead (1 v, C.124976); Sir Joseph Banks Group, N of rocks between Lusby and Partney Islands, alive, 6 m (1 pr, SAM D18993); St. Vincents Gulf, 35°0'S 138°0'E, dead (2 pr, C.004560); Yorke Peninsula, Lowly Point, alive, 9–18 m (7 pr, SAM D18995); Yorke Peninsula, Edithburgh Jetty, alive, 5 m (2 pr, SAM D18997); NE of Kangaroo Island, Penneshaw, 35°43'S 137°56'E, alive, 5 m (2 pr, C.375058); Kangaroo Island, Eastern Cove, Rocky Point, 35°48'S 137°50.2'E, dead (3 v, C.374872); Kangeroo Island, American River near Ballast Point jetty, 35°45.8'S 137°48'E, alive, 3 m (2 pr, C.111265); Whyalla, Backy Point, 32°55'S 137°47'E, dead (1 pr, C.119784); Upper Spencer Gulf, Port Bonython, 33°01'S 137°45'E, alive, 15 m (1 pr, SAM D18994); Edithburgh, 35°05'S 137°45'E, alive (1 pr, C.375055); Yorke Peninsula, off Edithburgh, 35°05'S 137°45.5'E, alive, 9 m (4 pr, C.375050); Kangaroo Island, American River, 35°48'S 137°45'E, dead (2 v, C.132130); Tickera Bay, near

Kadina, 33°46'S 137°43'E, dead (1 pr, C.080132); Kangaroo Island, Kingscote, 35°39'S 137°38'E, dead (1 v, C.049182); Tiparra Reef, off Point Hughes, 34°03'S 137°24'E, alive, 6–7.5 m (1 pr, C.112554); Wallaroo, 33°55'S 137°36'E, dead (6 v, C.374884); off Kangaroo Island, 35°0'S 137°0'E, dead (6 v, C.030802); Spencer Gulf, Tumbby Bay, 34°22'S 136°08'E, dead (3 v, C.374870); Donington Island, off Port Lincoln, 34°43.3'S 136°0'E, dead, 7–9 m (1 pr, C.303778); Sir Joseph Banks Group, SE point of Lusby Island, alive, 6 m (1 pr, SAM D18996); Port Lincoln, 34°44'S 135°54'E, alive, 15 m (3 pr, C.375051); Port Lincoln, 34°47'S 135°51'E, alive, 9 m (3 pr, C.012162; 1 pr, C.119786; 3 pr, C.108902); Coffin Bay, 34°37'S 135°27'E, alive, 6 m (3 pr, C.375052); Smoky Bay, 32°18'S 133°50'E, dead (2 v, C.070260); W side of Thevenard, near Ceduna, 32°09'S 133°39'E, dead (6 v, C.095245); Petrel Bay, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (1 v, C.374871). WESTERN AUSTRALIA: Great Australian Bight, 33°05'S 128°40'E, dead, 75 m (1 v, C.374868); Great Australian Bight, 34°21'S 121°16'E, dead, 82 m (4 v, C.374869).

**Description.** Shell up to 135 mm high (Huber, 2010), most specimens smaller than 80 mm; solid, circular, right valve slightly more convex than left, to equally inflated; somewhat equivalve and equilateral, auricles almost equal, umbonal angle c. 100–115°; cream with purplish radial streaks, most specimens purplish, a few orange or brownish, interior of most specimens purplish.

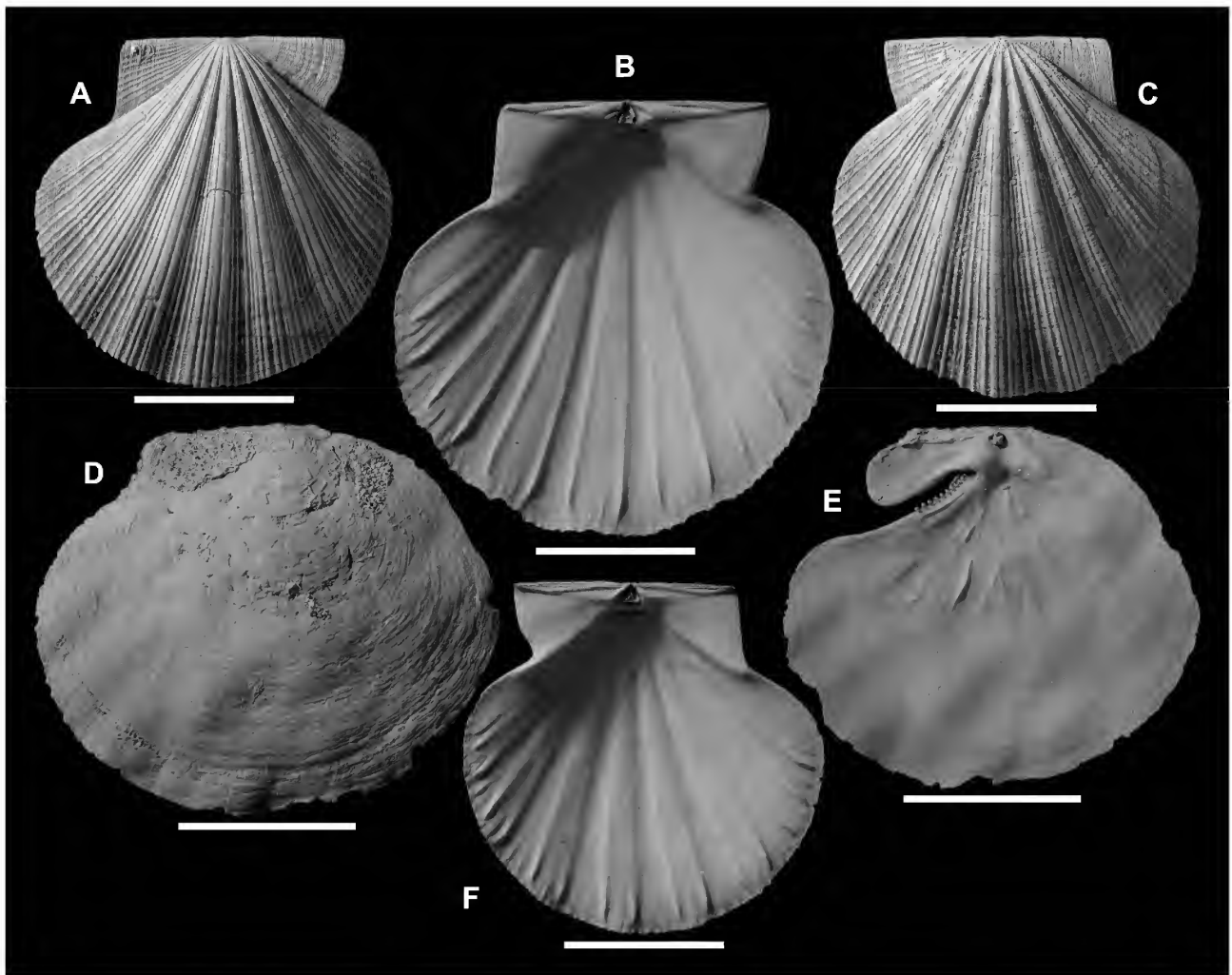
Both valves sculptured with 7–11 obvious, evenly spaced radial plicae (most specimens with 8–10), varying greatly in prominence, narrowly angular to more broadly rounded. Interspaces of left valve each wider than one plica, plicae of right valve each wider than one interspace. Numerous widely to closely spaced radial riblets on plicae and interspaces; coarse shagreen microsculpture throughout on juveniles and some unabraded adults, more developed into commarginal lamellae near ventral margin on some adults. Auricles with 6–10 weak, narrow radial riblets. Byssal notch moderately shallow, byssal fasciole very weak. Functional ctenolium present in juveniles, lacking in adults. Internal rib carinae prominent near ventral margin.

**Dimensions.** Illustrated specimens: TAS, off Hobart (AM C.102328): rv: H 103.5, L 106.5 mm; lv: H 103.8, L 107.5 mm; D 33.4 mm; SA, Henley Beach (AM C.097523), larger specimen: rv: H 79.4, L 83.7 mm; lv: H 81.9, L 88.0 mm; D 27.5 mm; smaller: rv: H 65.5, L 67.0 mm; lv: H 68.0, L 68.9 mm; D 23.6 mm.

**Habitat.** In South Australia living free in the littoral to sublittoral zones on soft sediment, preferring clean sand, and on seagrass, *Zostera* (“ribbon weed”). In Tasmania on silty-muddy bottom conditions amongst shell rubble, generally in deeper water. Wolf & White (1997) discussed the factors affecting the distribution of *Equichlamys bifrons* in fishing grounds in D'Entrecasteaux Channel, Tasmania. Mendo *et al.* (2014) also commented on the environments preferred by the three commercial scallops *E. bifrons*, *Mimachlamys asperrima* (Lamarck, 1819) and *Pecten fumatus* in D'Entrecasteaux Channel. They concluded that *P. fumatus* is associated with fine-grained sediment, shells and macroalgae, and is affected by the abundance of the invasive seastar *Asterias amurensis*. *Equichlamys bifrons* is strongly associated with macroalgae and seagrass cover, and abundant *M. asperrima* is strongly associated with sponge cover.

**Distribution.** Southernmost New South Wales, Victoria, Tasmania, South Australia westwards to the Great Australian Bight, SE Western Australia (present data; Raines & Poppe, 2006: 190). Present specimens alive at 3–91 m (minimum depth range).

**Remarks.** For synonymy and comparison with fossil species see Beu & Darragh (2001: 57). The present species is aquacultured and utilized for commercial



**Figure 65.** A–C, *Equichlamys bifrons* (Lamarck), specimens in Fig. 63B, D–F, rv exterior (A), lv interior (B), lv exterior (C), rv interior (F) D, E, *Hemipecten forbesianus* A. Adams & Reeve, pair, AM C.303801, Torres Strait, QLD; lv exterior (D), rv interior (E). Scale bars represent 30 mm (A–C, F), 10 mm (D, E).

consumption. Dix (1976) and Cragg (2016) described the unusual lecithotrophic development of *Equichlamys bifrons*, which contrasts strongly with the planktotrophic development and correspondingly long larval life of most other common shallow-water scallops. Cragg (2016: 36) noted that “Lecithotrophic development occurs in a temperate-water pectinid (*Equichlamys*), sublittoral cave-dwelling cycloclamysids and propeamussiids ... the coral reef *Caribachlamys* ... the hydrothermal vent *Catillopecten* (= *Bathypecten*) *vulcani* and bathyal to abyssal pectinids (*Hyalopecten*) and propeamussiids ... Planktotrophic development is the dominant mode in euphotic waters, but where suspended particulate food is limited ... or where the parental environment is extremely patchy ... lecithotrophic development may improve the chances of survival to settlement in the parental environment. Lecithotrophic development may also correlate with small adult size”. Another southern Australian species, *Notochlamys hexactes* (Lamarck, 1819), also has lecithotrophic development, acquired independently. Presumably this mode of development is responsible for the great range of variation shown by both *E. bifrons* and *N. hexactes*, because of the lack of genetic exchange between distant populations.

### *Hemipecten* A. Adams & Reeve, 1849

*Venilia* A. Adams & Reeve, in Anonymous, 1848: 776. Type species (by monotypy): *Venilia concentrica* A. Adams & Reeve, in Anonymous, 1848. Junior homonym of *Venilia* Duponchel, 1829, Lepidoptera (Petit, 2007: 100).

*Hemipecten* A. Adams & Reeve, 1849: 133; Adams & Reeve, 1850: 72 [diagnosis]. Type species (by monotypy): *Hemipecten forbesianus* A. Adams & Reeve, 1849; living, Sulu Archipelago, Philippine Islands.

*Hemipecten* Reeve in Forbes & Hanley, 1849: 323 [*nomen nudum*].

*Semipecten* Fischer, 1886: 945 (incorrect subsequent spelling of *Hemipecten* A. Adams & Reeve).

**Diagnosis.** Hemipectinae [sic] Habe (1977: 88) [in Japanese]: “Shell medium in size, attached to substrate with right valve, looks like *Anomia chinensis*. Shape of the shell irregular and thin, right valve with anterior auricle only, deep byssal notch, pectinated in anterior edge, left valve with well-developed anterior auricle (only anterior auricle is developed well)” [translation of original diagnosis]. An unevenly shaped (*Anomia*-like), inaequivalve pectinid; antimarginal microsculpture fine; slightly auriculated posteriorly; hinge edentulous; resilium high, narrow (resembling that of

*Spondylus*); resilial teeth of right valve towards resilium; hinge plate broad with weak transverse grooves; byssal notch deep, ctenolium prominent.

**Distribution.** Pliocene–Recent. Indo–West Pacific (Hayami, 1989: 15), intertidal to sublittoral.

**Remarks.** Hertlein (1969: N354) placed *Hemipecten* in the *Eburneopecten* group, together with the extant genera *Cyclopecten* Verrill, 1897 (with subgenera *Chlamydella* Iredale, 1929 and *Pectinella* Verrill, 1897), *Palliolum* Monterosato, 1884 (with subgenera *Delectopecten* Stewart, 1930, *Hyalopecten* Verrill, 1897 and *Lissochlamis* Sacco, 1897) and *Pseudamussium* Mörch, 1853. *Cyclopecten* and *Chlamydella* are now considered to be genera of Cyclochlamydidae. *Palliolum* and *Pseudamussium* were placed by Waller (1991: 35; 1993: 198) in Palliolini, a tribe of Pectininae, although he later (Waller, 2006a: 10) raised this to a separate subfamily Pallioliinae of Pectinidae. *Delectopecten* is now the only extant genus of Camptonectinae. *Cyclopecten* has no *Camptonectes*-like (antimarginal) microsculpture and is closely related to the radially sculptured ancestor *Praechlamys* Allasinaz, 1972 (see Waller & Marinovich, 1992: 219). The remaining genus *Lissochlamis* has simple antimarginal microsculpture without radial macrosculpture and perhaps therefore could be placed in Camptonectinae. Yonge (1981) stated that *H. forbesianus* has a homorhabdic gill, unlike all other Pectinidae. However, Beninger & Decottignies (2008) demonstrated that it actually has the same heterorhabdic gill as all other pectinids, removing concerns about its taxonomic position. Habe (1977: 88) placed *Hemipecten* in a new subfamily Hemipectininae, but T. R. Waller (USNM, pers. comm. 2008) stated to us that it is most closely related to *Laevichlamys* and should be included in Pedini.

### *Hemipecten forbesianus* A. Adams & Reeve, 1849

Figs 64, 65D–E, 67A,C

*Venilia concentrica* A. Adams & Reeve, in Anonymus, 1848: 776 (Petit, 2007: 99–101) (*nomen oblitum*).

*Hemipecten forbesianus* A. Adams & Reeve, 1849: 133, pl. 1, fig. 2; Reeve, 1849: sp. 1, pl. 1, figs 1a–c, 2a–d; A. Adams & Reeve, 1850: 72, pl. 20, figs 1a–c, 2a–d; Pelseneer, 1911: 16, 31, pl. 12, fig. 13 [anatomy]; Kuroda, 1931: 82, figs 96–96a; Hertlein, 1969: N354, figs C.76.5a–b; Waller, 1972a: 256; Higo, 1973: 323; Habe, 1977: 88; Yonge, 1981: 29, figs 2e–5; Koyama *et al.*, 1981: 69; Dance, 1990: 78, pl. 27, fig. 580; Dijkstra, 1990a: 5, pl. 2, figs 11–12; 1991: 24, fig.; Dijkstra *et al.*, 1990: 3, fig.; Dijkstra, (1983–1994) 1991: 18, figs; Lamprell & Whitehead, 1992: [18], pl. 7, fig. 36; Higo & Goto, 1993: 577; Bernard *et al.*, 1993: 51; Goto & Poppe, 1996: 909; Dijkstra & Marshall, 1997: 89, pl. 7, figs 1–6; Kiliias, 1997: 137; Slack-Smith, 1998: 277, fig. 6.18E–F; Higo *et al.*, 1999: 447; Wells, Slack-Smith & Bryce, 2000: 42; Higo, Callomon & Goto, 2001: 157, fig. B490 (lectotype); Slack-Smith & Bryce, 2004: 237; Taylor & Glover, 2004: 262; Dufour, Steiner & Beninger, 2006: 35; Raines & Poppe, 2006: 68, 71, upper figs; pl. 4, fig. 10; Petit, 2007: 99–101; Beninger & Decottignies, 2008: 137–141, figs 1A–H, 2A–F [anatomy]; Huber, 2010: 204; Dijkstra, 2013: 61, pl. 16, figs 2a–d (*nomen protectum*).

*Semipecten forbesianus* (A. Adams & Reeve).—Melville & Standen, 1907: 808.

*Pecten difformis* Odhner, 1917: 15, pl. 1, figs 4–5.

*Cyclopecten (Hemipecten) forbesianus* (A. Adams & Reeve).—Rombouts, 1991: 79.

**Type data.** *Hemipecten forbesianus* A. Adams & Reeve: lectotype (pr) designated by Dijkstra & Marshall (1997: 89) NHMUK1874.12.11.376, figured in Adams & Reeve (1849: pl. 1, fig. 2; 1850: pl. 20, figs 2a–d); paralectotype (pr) (Adams & Reeve, 1850: pl. 20, figs 1a–c) not in type lot, not traced. Type locality: Philippine Islands, Sulu Sea, c. 26 m.

*Pecten difformis* Odhner: syntypes (6 pr) Swedish Museum of Natural History, Stockholm, SMNH1555. Type locality: Western Australia, off Cape Jaubert, Pearl Bank [33 km offshore W of Cape Jaubert, 18°57'S 121°13'E].

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Torres Strait, alive (1 pr, C.303801); GBR, Lady Elliot Island, S end, 24°06'54"S 152°42'48"E, reef front slope, alive, 15 m, on *Turbinaria* (1 pr, WAM S41991; growth series, WAM S41992). WESTERN AUSTRALIA: Esperance, Cull Island, 31°19'S 133°07'E, alive, 2–10 m (1 pr, WAM S14229); Geographe Bay, NE of Dunsborough, 33°37'S 115°18'E, alive (1 pr, WAM S41993); Geographe Bay, E of Dunsborough, 33°37'S 115°18'E, alive, 20 m (5 pr, WAM S14228); Dunsborough, off Castle Rock, 33°37'S 115°18'E, alive, 18 m (6 pr, WAM S41994); Abrolhos Islands, 28°48.5'S 114°01.5'E, dead, 40 m (1 v, WAM S41995); Abrolhos Islands, Beacon Island, 28°28'S 113°47'E, intertidal, reef flat, alive (1 pr, WAM S13339); Montebello Islands, Hermite Island, 20°28.06'S 115°32.42'E, alive, 6 m (1 pr, WAM S41996); Kimberley, Dampierland, Beagle Bay, "garden bottom", 16°52'S 122°32'E, alive, 9 m (1 pr, WAM S41990); Kimberley, Albert Reef, 14°15'S 125°09'E, alive (1 pr, WAM S41997); Scott Reef, North Reef, approx. 14°0'S 121°45'E, east lagoon, sand flat, alive (1 pr, WAM S14231).—REUNION: Boucan Canot, dead, 67 m (1 v, ZMA Moll.142262).—THAILAND: Phuket, S of Ko Ha Yai, alive, 24–30 m (1 pr, ZMA Moll.145609).—INDONESIA: Moluccas, Damar Island, 0°59'S 128°22'E, alive, 45 m (1 pr, ZMA Moll.011396).—SOLOMON ISLANDS: W side Malaupaina Island, 161°58'E 10°14.5'S, alive, 24–30 m (2 pr, WAM12555; 1 pr, WAM12543). CORAL SEA: Capel Bank, 25°20'S 159°44'E, alive, 56 m (1 pr, ZMA Moll.143847).—NEW CALEDONIA: Prony Bay, Ouen Islet, 22°32'S 166°38'E, alive, 23 m (1 pr, ZMA Moll.142264).

**Description.** Shell up to c. 40 mm high, most specimens smaller, to 20 mm; semi-translucent or opaque, milky white or cream to reddish brown, fragile, flattened; left valve slightly convex, right valve flat; highly irregular in shape (almost circular to obliquely oblong), inequivalve, inequilateral; auricles unequal in size and shape.

Both valves with very delicate antimarginal scratches (*Camptonectes*-like microsculpture) throughout, macrosculpture lacking. Anterior auricle of right valve somewhat declined, separated from disc by suture, bearing weak radial riblets; other auricles not differentiated from disc. Byssal notch narrow, extremely deep, curving towards umbo, byssal fasciole small; ctenolium present throughout ontogeny, with 8–12 well-developed teeth; outer ligament rather broad, stationary; resilium narrow.

**Dimensions.** Illustrated specimen: QLD, Torres Strait (AM C.303801): rv: H 20.5, L 23.3 mm; lv: H 21.8, L 25.7 mm; D 4.4 mm.

**Habitat.** Living byssally attached to the scleractinian coral *Turbinaria mesenterina* (Dana) (Yonge, 1981: 29); in Western Australia, forming large lettuce leaf-like formations amongst rubble and weed on sand in the intertidal to sublittoral zones. Usually found in groups of 5–20 specimens, covered with epiphytes on the left valve.

**Distribution.** Tropical Indo–West Pacific, from southern Japan southwards to Australia, westwards into the Indian Ocean to Réunion, and eastwards into the Pacific to New Caledonia (Raines & Poppe, 2006: 70); Philippines, 4–30 m (Dijkstra, 2013: 61); Norfolk Island, 6–28 m (Dijkstra & Marshall, 1997: 89). Now also from the Solomons (24–30 m). Maximum depth range of live-taken specimens is from the intertidal zone to 67 m (Dijkstra & Marshall, 1997: 89).



Present material from Australia living from the intertidal zone to 20 m.

**Remarks.** The present specimens are very variable in shape (circular to oblong and oblique), probably caused by their constricted living position on the scleractinian coral *Turbinaria* (Yonge, 1981: 29). The shell characters of the immature type specimens of *Pecten difformis* from Western Australia are identical to those of *Hemipecten forbesianus* at the same size. For descriptions of soft parts of this species see Yonge (1981) and, for the gills, Beninger & Decottignies (2008).

Petit (2007: 99–101) pointed out that the name *Venilia concentrica* was proposed for this species accidentally, in an anonymous report, with a recognisable description (“the lower valve having a remarkable lateral incision on the left side, after the manner of *Pedum*, whilst the hinge partakes of the structure of *Pecten* and *Avicula*; both valves are, moreover, of the same fragile tenuity as the *Placuna placenta*”) but that *Venilia* is a junior homonym. The name *Hemipecten forbesianus* was then proposed for it first by Adams & Reeve (1849: 133, pl. 1, fig. 2; 25 Apr 1849), later by Reeve (1849: *Hemipecten* monograph, sole species; text dated Sept 1849), and only in 1850 by Adams & Reeve (1850: 72, pl. 20, figs 1a–c, 2a–d; 31 Aug 1850) in the zoology of the “*Samarang*” voyage. In the chresonomy above we list the more than 25 usages of the name *H. forbesianus* (as the

presumed valid name for this species by at least 10 authors during the last 50 years) that are required to make this name a *nomen protectum* under ICZN Article 23.9.1, and we declare *Venilia concentrica* a *nomen oblitum*.

### ***Laevichlamys* Waller, 1993**

*Laevichlamys* Waller, 1993: 204. Type species (by original designation): *Pecten multisquamatus* Dunker, 1864. Recent, tropical western Atlantic.

**Diagnosis.** Non-cemented or embedded Pedini with weak radial costae or riblets (evenly or unevenly spaced), shagreen microsculpture secondarily absent from most specimens, intercalated antimarginal striae, commarginal ridges absent, byssal notch shallow to deep, ctenolium well-developed, hinge teeth weak.

**Distribution.** Upper Miocene–Recent (Waller, 1993: 204). Western Atlantic and Indo-West Pacific, living in the subtidal to sublittoral zones.

**Discussion.** Waller (1993: 204) created a new genus for the chlamydoid taxa with weak to almost smooth macrosculpture. Most of the representative extant species live in the Indo-West Pacific, the exception being the type species (see above).

### **Key to species of *Laevichlamys* from Australia**

- 1 Shell c. 30 mm high, oblong, thin, weakly inflated, almost equivalve and equilateral, auricles unequal, valves with numerous (c. 60) closely and evenly spaced, squamous radial riblets, byssal notch deep, byssal fasciole broad ..... *L. andamanica*
- Shell with 40–50 unevenly spaced radial riblets ..... 2
- 2 Shell c. 40 mm high, subcircular to prosocline, thin, weakly inflated, almost equally convex, auricles highly unequal, valves with 40–50 unevenly spaced, minute squamose radial riblets, byssal notch deep, byssal fasciole broad ..... *L. cuneata*
- Shell with 45–50 spinous radial riblets ..... 3
- 3 Shell c. 25 mm high, oblong, almost equally inflated, equivalve and equilateral, auricles highly unequal, valves with 45–50 unevenly spaced, spinous radial riblets, byssal notch weak, byssal fasciole narrow ..... *L. deliciosa*
- Shell with 60–70 spinous radial riblets ..... 4
- 4 Shell c. 30 mm high, ovate, some prosocline or acline, thin, valves almost equally weakly inflated, auricles highly unequal, valves with 60–70 very closely, unevenly spaced spinous radial riblets, byssal notch deep, byssal fasciole broad ..... *L. limatula*
- Shell with numerous (>100) evenly spaced radial riblets ..... 5
- 5 Shell c. 50 mm high, circular, thin, weakly inflated, almost equally convex, auricles unequal, valves with numerous (>100) evenly spaced, very delicate squamous radial riblets, byssal notch deep, byssal fasciole broad ..... *L. mollita*
- Shell with 9–12 low, coarsely scaly primary radial ribs on lv ..... 6

- 6 Shell c. 65 mm high, subcircular to ovate, thin, flattened, right valve slightly more inflated than left, auricles highly unequal, left valve with primary and secondary radial riblets, irregular in prominence, right valve more evenly radially sculptured with c. 25–35 riblets, byssal notch deep, byssal fasciole broad ..... *L. squamosa*
- Shell with 60–70 radial riblets. uneven in spacing and prominence ..... 7
- 7 Shell c. 35 mm high, oblong, somewhat prosocline, thin, moderately inflated, almost equally convex, auricles highly unequal, valves with 60–70 weak, low, squamous radial riblets, uneven in spacing and prominence, byssal notch deep, byssal fasciole broad ..... *L. wilhelminae*

***Laevichlamys andamanica* (Preston, 1908)**

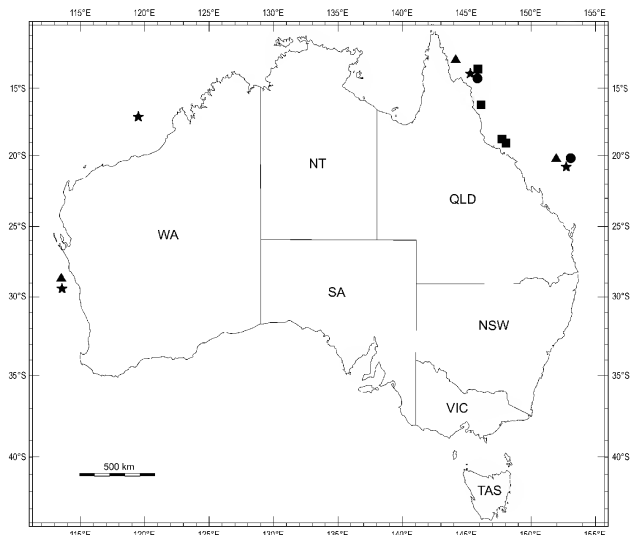
Figs 66, 67B, 69K–L

*Chlamys andamanica* Preston, 1908: 204, pl. 14, fig. 19; Dijkstra, 1991: 29, fig. 90; Subba Rao & Dey, 2000: 222.  
*Pecten perfectus* Melvill, 1909: 127, pl. 5, fig. 15; Trew, 1987: 56.  
*Chlamys perfecta* (Melvill).—Viader, 1937: 62; Oliver, 1982: 7; Dijkstra, (1983–1994) 1986: 9, figs.  
*Mimachlamys andamanica* (Preston).—Dijkstra & Knudsen, 1998: 81, pl. 4, figs 14–15.  
*Laevichlamys andamanica* (Preston)—Dijkstra, 1998a: 30; Raines & Poppe, 2006: 196–197, upper figs; pl. 140, figs 1, 2, 4, 6, 8–9; pl. 144, fig. 5; Dijkstra & Moolenbeek, 2008: 19; Huber, 2010: 207 [in part]; Raines, 2010: 622, pl. 1002, fig. 1.

**Type data.** *Chlamys andamanica* Preston: holotype (pr) ZSI M4042/1. Type locality: Bay of Bengal, Andaman Islands.  
*Pecten perfectus* Melvill: holotype (pr) NHMUK. 1910.3. 17.22. Type locality: Indian Ocean, Chagos Archipelago, Peros Banhos, Diamant, 16 fathoms [29 m].

**Additional material examined.**—AUSTRALIA: QUEENSLAND: No. 10 Ribbon Reef, SW end, 14°56'S 145°42'E, dead, 8–10 m (1 v, C.157602); E of Swain Reefs, 21°43'S 152°51'E, dead, 113 m (2 v, C.153558). —RED SEA: Elat, alive, 12–15 m (3 pr, ZMA Moll.142022). —YEMEN: off Hadibo, alive, 18 m (2 pr, ZMA Moll.142031). —KENYA: off Watamu, alive, 27 m (1 pr, ZMA Moll.139616). —SEYCHELLES: Mahé, N-point, alive, 13 m (1 pr, ZMA Moll.143608). —MASCARENE ISLANDS: Cargados Island, 16°0'S 60°0'E, dead (13 v, C.119508). —MALDIVE ISLANDS: Helengeli Hansreef, alive, 5–25 m (2 pr, ZMA Moll.142029). —ANDAMAN ISLANDS: Snake Island, alive, 8 m (2 pr, 1 v, ZMA Moll.142032). —VIETNAM: off Nha Trang, Hon Mieu, alive, 15 m (1 pr, ZMA Moll.146126). —SOLOMON ISLANDS: Kira Kira, San Cristobal, 10°27'S 161°53'E, dead, 15–24 m (1 pr + 1 v, WAM515). CORAL SEA: Osprey Reef, SE end, 13°59'S 146°40'E, dead, 20–30 m (1 v, C.332557); North East Herald Cay, 16°56'S 149°11'E, dead (4 v, C.153559); North East Herald Cay, 16°56'S 149°11'E, dead, beach (33 v, C.332556); Wreck Reef, Porpoise Cay, 22°13'S 155°18'E, dead, 1–2 m (1 v, C.157595). —NEW CALEDONIA: 20°16'S 169°51'E, dead, 85–100 m (3 v, C.154684); Nouméa, alive, 2–5 m (1 pr, ZMA Moll.141975). TUVALU: Funafuti Atoll, 8°31'S 179°13'E, dead (1 v, C.006148).

**Description.** Shell small, up to c. 30 mm high, thin, oblong, weakly inflated, right valve slightly more convex than left, almost equivalve and equilateral, auricles unequal in shape and size, umbonal angle c. 85°; colour variable, red, orange, yellow, purple or brown, with paler or darker maculations and striations or mottled, a few specimens uniformly coloured.  
 Both valves sculptured with numerous, closely spaced, squamous radial costae (c. 60 in adult stage), granulous microsculpture in interspaces in early growth stage, developed into divaricate scratches near anterior and posterior margins in late growth stage. Anterior auricles with prominent squamose radial riblets crossed by commarginal lamellae. Byssal notch deep, byssal fasciole broad. Functional ctenolium well-developed, with c. 6–8 teeth.



**Figure 66.** Distribution of *Laevichlamys andamanica* (Preston) (circles), *L. deliciosa* (Iredale) (stars), *L. limatula* (Reeve) (triangles) and *L. mollita* (Reeve) (squares).

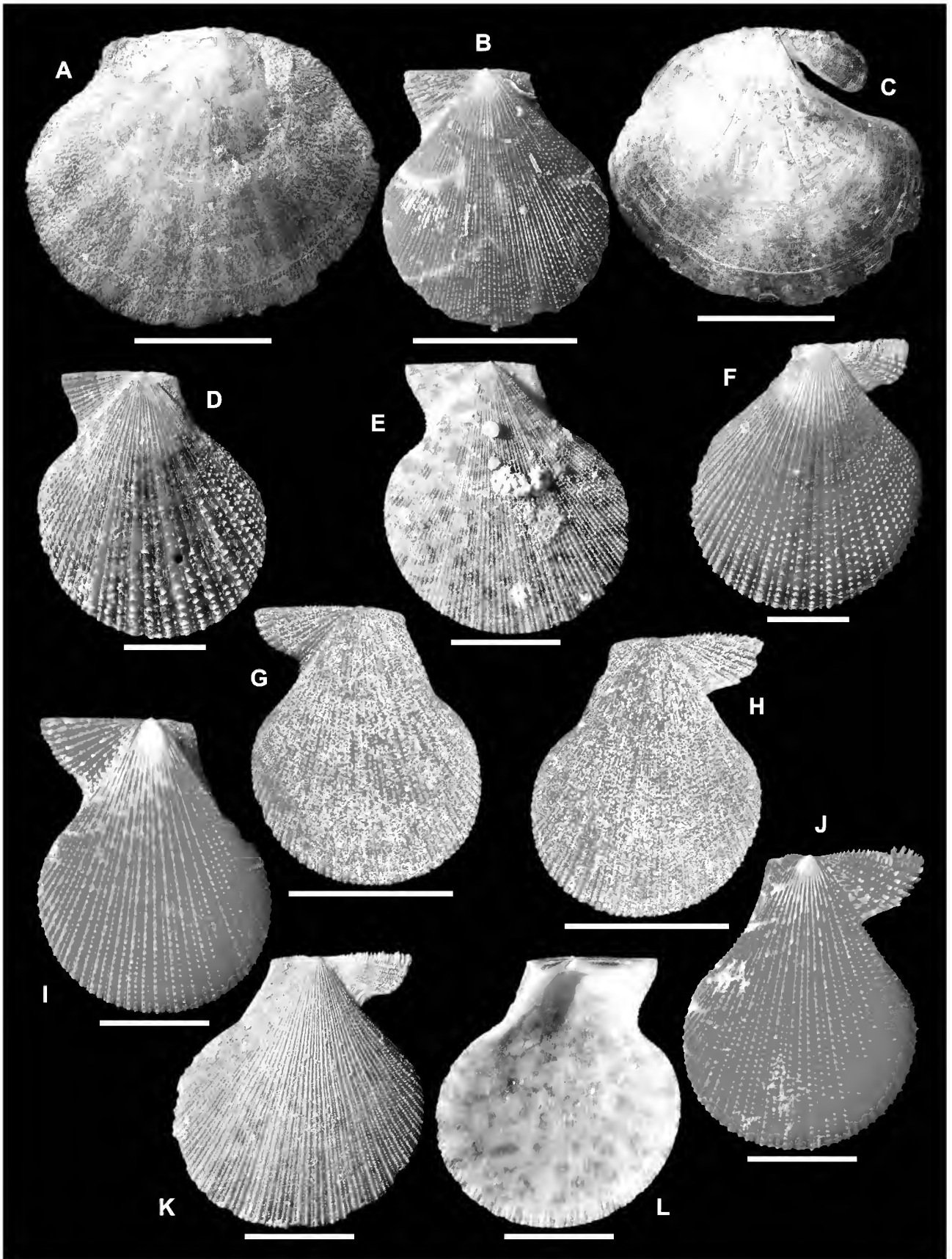
**Dimensions.** Illustrated specimen: QLD, GBR, E of Swain Reefs, 113 m (AM C.153558), lv only: H 15.9, L 13.9 mm.

**Habitat.** Living in tropical shallow waters, byssally attached to rocks or coral, or amongst coral rubble on sandy substrates.

**Distribution.** Tropical Indo-West Pacific from Vietnam to northeastern Australia, westwards into the Indian Ocean to eastern Africa and the Red Sea, and eastwards across the Pacific to Tuvalu (Raines & Poppe, 2006: 196); Red Sea, 1.5–20 m, Gulf of Aden, 18 m (as *Mimachlamys andamanica*; Dijkstra & Knudsen, 1998: 82). Maximum depth range of live-taken specimens is 2–27 m. Present specimens from Australia dead at 8–10 m and 113 m.

**Remarks.** *Laevichlamys andamanica* is a **new record** for Australia. Only dead shells have been found from the offshore reefs of Queensland. They are similar to the type material. Juveniles could easily be confused with small specimens of *Laevichlamys deliciosa* (Iredale, 1939), also known from Queensland, but occurring in deeper water. *Laevichlamys andamanica* differs from *L. deliciosa* by its more subcircular and flatter shape (*L. deliciosa* more inflated and dorso-ventrally elongate), by its coarser radial riblets that are more widely spaced than those of *L. deliciosa*, and by its variable and darker coloration (*L. deliciosa* is bright orange, red, yellow or cream).

For synonymy see Dijkstra & Knudsen (1998: 82).



**Figure 67.** *A, C*, *Hemipecten forbestanus* A. Adams & Reeve, specimen in Fig. 65D, E, lv exterior (A), rv exterior (C). *B*, *Laevichlamys andamanica* (Preston), lv only, AM C.153558, E of Swain Reefs, E QLD, 21°43'S 152°51'E, 113 m; lv exterior. *D, F*, *Laevichlamys cuneata* (Reeve), pair, AM C.303770, off Great Palm Island, GBR, QLD; lv exterior (D), rv exterior (F). *E, K, L*, *Laevichlamys limatula* (Reeve), pair, WAM S30731, Beacon Island, E side of Goss Passage, Wallabi Group, Abrolhos Islands, WA, 28°28'S 113°45'E; lv exterior (E), rv interior (K), lv interior (L). *G–J*, *Laevichlamys deliciosa* (Iredale), 2 pairs: (G, H) lectotype of *Mimachlamys deliciosa*, AM C.089669, Great Barrier Reef Exped. stn 14, 0.5 miles SE of Lizard Island, Low Isles, N QLD, 14°41'S 145°29'E, 35 m; lv exterior (G), rv exterior (H); (I, J) AM C.119510, 0.25 miles N of North Direction Isle, GBR, QLD, 34.5 m; lv exterior (I), rv exterior (J). Scale bars represent 10 mm.

*Laevichlamys cuneata* (Reeve, 1853)

Figs 67D,F, 68, 69F,H

*Pecten irregularis* G. B. Sowerby II, 1842: 69, pl. 13, figs 51–52; Reeve, 1852: species 19, pl. 4, fig. 19a; Küster & Kobelt, 1888: 76, pl. 19, fig. 4; Dunker, 1882: 240, pl. 11 fig. 15 (junior primary homonym of *Pecten irregularis* von Schlothheim, 1813).

*Pecten cuneatus* Reeve, 1853: sp. 94, pl. 24, figs 94a, 95; Küster & Kobelt, 1888: 74, pl. 19, figs 1–2, pl. 22, fig. 4.

*Pecten (Chlamys) irregularis* Sowerby.—Dautzenberg & Bavay, 1912: 13.

*Chlamys cookei* Dall, Bartsch & Rehder, 1938: 90, pl. 24, figs 1–4.

*Chlamys irregularis* (Sowerby).—Kira, 1962: 139, pl. 50, fig. 3; Masuda, 1962: 171, pl. 24, figs 2–3; Kay, 1979: 525, figs 168B–C; Wagner, 1982: 86; Dijkstra, 1991: 31; Dharma, 1992: 84–85, pl. 20, figs 5–5a; Bernard *et al.*, 1993: 48; Dijkstra, (1983–1994) 1993: 8, figs 1–3; Hu & Tao, 1995: 170, pl. 92, fig. 1; Xu, 1997: 68; Wang, 2002: 177, pl. 4, fig. 5; Dharma, 2005: 248, pl. 99, figs 4a–b; Xu & Zhang, 2008: 81, fig. 223.

*Chlamys* sp. cf. *irregularis* (Sowerby).—Waller, 1972a: 238, 239, pl. 2, figs 34–35, fig. 3.

*Chlamys (Corallichlamys) irregularis* (Sowerby).—Wang, 1983c: 48, 54, pl. 1, fig. 2; Higo & Goto, 1993: 573.

*Chlamys (Chlamys) irregularis* (Sowerby).—Dijkstra, 1990a: 9, 11; Lamprell & Whitehead, 1992: [20], 174, pl. 8, fig. 41.

*Chlamys (Scaeoichlamys) irregularis* (Sowerby).—Rombouts, 1991: 33, pl. 12, fig. 8; Higo *et al.*, 1999: 442.

*Laevichlamys irregularis* (Sowerby).—Waller, 1993: 202, 204; Dijkstra, 1997: 320, figs 5–8; Dijkstra, 1998a: 32, pl. 5, figs 1–4.

*Laevichlamys brettehami* Dijkstra, 1998b: 246 (unnecessary replacement name for *P. irregularis* Sowerby).

*Chlamys (Laevichlamys) irregularis* (Sowerby).—Hayami, 2000: 899, pl. 447, fig. 10.

*Chlamys brettehami* (Dijkstra).—Higo *et al.*, 2001: 156, fig. B441 (syntype of *Pecten irregularis* Sowerby, here designated lectotype).

*Laevichlamys cuneata* (Reeve).—Raines & Poppe, 2006: 198, 199, pl. 142, figs 1, 5–6; pl. 151, fig. 4; Dijkstra & Moolenbeek, 2008: 19; Huber, 2010: 207; Raines, 2010: 622, pl. 1002, fig. 3; Dijkstra, 2013: 64, pl. 17, figs 1a–d, 3a–b, pl. 28, figs 3a–b.

**Type data.** *Pecten irregularis* Sowerby: lectotype (pr) NHMUK 1950.11.14.39, figured by Sowerby (1842: fig. 51) and Higo *et al.* (2001: 156, fig. B441), herein designated. Type locality: not indicated. Examined typical specimens are from the Philippine Islands (AM, HD, MNHN, ZMA).

*Pecten cuneatus* Reeve: lectotype (pr) NHMUK 2001 0485/1, largest specimen, figured by Reeve (1853: pl. 24, fig. 94a), herein designated. One paralectotype (pr) NHMUK 20010485/2, figured by Reeve (1853: pl. 24, fig. 95), and one unfigured paralectotype (pr) NHMUK 20010485/3. Type locality: Moluccas, Indonesia.

*Chlamys cookei* Dall, Bartsch & Rehder: holotype (pr) USNM 484166. Type locality: Hawaiian Islands, off the entrance to Honolulu Harbor, Oahu, 11 fathoms [20 m].

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (2 v, C.161013 [in part]); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (1 pr, C.132190); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (14 v, C.029787); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (5 v, C.029790); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (4 v, C.336882); Cape York Peninsula, Halfway Island, NNW face, 11°23'S 142°57'E, dead, 4–9 m (1 v, C.384097); Long Sandy Reef, NW end, 12°29'S 143°46'E, dead, 10 m (1 v, C.332572); Bligh Reef, on N side of Bligh's Boat Passage, 12°51'S 143°49'E, dead, 4–18 m (1 pr, C.332571); Ham Cay, 13°02'S 145°52'E, dead, 10–12 m

(1 v, C.157605); GBR, Ham Reef, 13°02'S 145°52'E, alive, 6–9 m (2 pr, C.344011); No. 8 Sand Cay, N side, 13°21'S 143°57'E, dead, 15 m (1 v, C.157599); No. 8 Sand Cay, N side, 13°21'S 143°57'E, alive, 15 m (1 pr, C.157601); Reef 13-074, off sandbank, 13°29'S 144°02'E, dead, 7–10 m (2 v, C.332573); Reef 13-119, S end, 13°40'S 144°08'E, dead, 5–13 m (1 v, C.332570; 1 v, C.160957); Reef 13-119, 13°40'S 144°09'E, dead, 3–6 m (1 v, C.336886); No. 5 Sandbank Reef (13-120), SW end, 13°45'S 144°16'E, alive, 8–10 m (3 pr, C.157607); No. 5 Sandbank Reef (13-120), S end, 13°45'S 144°16'E, dead, 9–15 m (1 v, C.336884); No. 5 Sandbank Reef (13-120), S end, 13°45'S 144°16'E, dead, 3–15 m (1 v, C.336885; 1 v, C.160958); Jewell Reef, SE elbow of reef, 14°24'S 145°24'E, dead, 15–16 m (1 v, C.332569); Jewell Reef, SE corner, 14°24'S 145°24'E, alive, 10–12 m (1 pr, C.344016); off Lizard Island, Carter Reef, 14°33'S 145°36'E, dead, 15 m (1 pr, C.336893); off Lizard Island, Yonge Reef, 14°66.7'S 145°46.7'E, alive (1 pr, C.125135); Yonge Reef, E of Lizard Island, N end, 14°35'S 145°37'E, dead, 15–17 m (1 v, C.336894); E of Lizard Island, Yonge Reef, 14°35'S 145°37'E, alive, 9–17 m (1 pr, C.344014); Lizard Island, North Point, 14°39'S 145°27'E, alive, 3.5 m (2 pr, C.344010); Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29'E, dead, 6–17 m (2 v, C.332567); Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29.5'E, dead, 9–15 m (1 v, C.336883; 1 pr, C.336895); Lizard Island, off Rocky Point, 14°40'S 145°26'E, dead, 9 m (1 v, C.161004); Lizard Island, off Point S of Rocky Point, 14°40'S 145°27'E, dead, 6–7.5 m (1 pr, C.336896); Lizard Island, Lizard Head, S side, 14°40'S 145°28'E, alive, 1–2 m (1 pr, C.336892); No Name Reef, SW end, 14°40'S 145°39'E, dead, 15–20 m (1 v, C.332568); between South & Bird Islands, Lizard Island, 14°41'S 145°28'E, dead, 3 m (1 v, C.336891); Lizard Island, No. 1 Bommie, 14°41'S 145°28'E, alive, 0–15 m (1 pr, C.344017); Eyrie Reef, W of Lizard Island, 14°42'S 145°23'E, E reef slope, dead, 3–11 m (1 pr, C.127495); Lizard Island, SW end of South Island, 14°42'S 145°27'E, dead, 9–12 m (6 v, C.161015); Reef 14-151, 14°55'S 145°41'E, dead, 8–13 m (1 v, C.336890); No. 10 Ribbon Reef, SW end, 14°55.5'S 145°42'E, dead, 4.5–18 m (1 v, C.157603; 4 v, C.336887); No. 10 Ribbon Reef, SW end, 14°56'S 145°42'E, dead, 8–10 m (1 v, C.336897); No. 9 Ribbon Reef, NW end, 14°57'S 145°42.5'E, dead, 9–11 m (3 v, C.138330); No. 9 Ribbon Reef, NW end, 14°57'S 145°42.5'E, dead, 11 m (1 v, C.336888); No. 7 Ribbon Reef, NW end, 15°08'S 145°44'E, dead, 6–15 m (1 v, C.336889; 1 v, C.336898); No. 5 Ribbon Reef, 15°21'S 145°46'E, dead, 6 m (1 v, C.336878); Ruby Reef, NW side, 15°44'S 145°47'E, dead, 9–18 m (3 v, C.157611); Endeavour Reef, 15°47'S 145°35'E, dead, 8–10 m (1 pr, C.157606); Pickersgill Reef, 15°50'S 145°34'E, alive (1 pr, C.344009); off Undine Reef, 16°08'S 145°40'E, alive (2 pr, C.336881); Opal Reef, N of Cairns, 16°15'S 145°50'E, dead, 29 m (1 v, C.153554); Low Isles, 16°23'S 145°34'E, dead (1 v, C.133074; 1 v, C.161018); Spur Reef, off Cairns, 16°24'S 146°03'E, dead, 6–12 m (4 v, C.336880); Hastings Reef, 16°31'S 146°01'E, dead, intertidal (1 pr, C.153557); Michaelmas Cay, 16°36'S 145°59'E, alive (1 pr, C.097430); Michaelmas Cay, 16°36'S 145°59'E, dead (8 v, C.119509); Green Island, near Cairns, 16°46'S 145°58'E, dead (1 pr, C.332566); Briggs Reef, off Cairns, 16°57'S 146°11'E, dead, intertidal (3 v, C.336879); North Barnard Islands, 17°40'S 146°10'E, dead (1 v, C.009984); Orpheus Island, Pioneer Bay, 18°35'S 146°29'E, alive, 3–4 m (1 pr, ZMA Moll.146236); John Brewer [= Watt] Reef, 18°37'S 147°03'E, dead, subtidal (1 pr, C.132192); off Great Palm Island, 18°43'S 146°37'E, alive (1 pr, C.303770); Wheeler Reef, NE of Townsville, 18°46'S 147°31'E, dead, subtidal (1 pr, C.132191; 1 pr, C.153556); Wheeler Reef, SE side, 18°46'S 147°31'E, dead, 14 m (1 pr, C.332565; 1 v, C.336873); Wheeler Reef, NE of Townsville, N side, 18°46'S 147°31'E, dead, 11 m (1 v, C.336875); Broadhurst Reef, E of Townsville, 18°57'S 147°44'E, dead, subtidal (2 pr, C.132121; 1 pr, C.153551; pr, C.336874); Broadhurst Reef, E of Townsville, 18°57'S 147°44'E, dead, sublittoral (1 pr, C.153552; 1 pr, C.153553); Little Broadhurst Reef, E of Townsville, 18°59'S 147°43'E, dead, subtidal (1 pr, C.132193); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 4–6 m (2 v, C.148169); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 6–10 m (1 v, C.336876); Swain Reefs, Reef 21-184, 21°23'S 151°42'E, dead, 10–11 m (1 v, C.336877); GBR, Swain Reefs, Reef 21-184, 21°23'S 151°42'E, beach, alive (1 pr, C.344015); Swain Reefs, Sanctuary Reef, 22°03.8'S 152°40.2'E, alive, 6–14 m (1 pr, C.157608); Capricorn Group, North West Island, SW corner, 23°18'S 151°42'E, dead, 4–5 m (1 v, C.332564); Capricorn Group, One Tree Island, 23°30'S 152°05'E, alive (1 pr, C.332563); Gladstone, 23°51'S 151°16'E, alive (1 pr, C.080130). **WESTERN AUSTRALIA:** Quobba, at end of road along cliffs from Blowholes, 24°29'S 113°25'E, dead (11 v, WAM 519.91); Point Quobba, behind island, 24°29'S 113°25'E, alive (1 pr, C.160999); Rowley Shoals, approx. 17°10'S 119°20'E, dead, 10–15 m (2 pr, ZMA Moll.146219); off Broome, Rowley Shoals, c. 2–3 m N of North Passage, NE corner of Clerke Reef, approx. 17°10'S 119°20'E, on outer slope of reef, dead, c. 17 m (1 v, WAM 1323.82); Rowley Shoals, Bedwell Island, Clerke Reef, 17°10'S 119°20'E, dead, beach (2 v + 3 fragm., WAM499.91); Clerke Reef, SE reef, 17°10'S 119°20'E, dead (4 v + 1 fragm., WAM498.91); Rowley Shoals, Mermaid Reef, W side, approx. 17°07'S 119°36'E, dead, intertidal (1 v, WAM497.91); Scott Reef, NE entrance of North Reef, 14°05'S 121°50'E, dead, 10 m (1 pr, ZMA Moll.143828); Scott Reef, eastern North Reef, outer reef, approx. 14°0'S 121°45'E, dead, 9–18 m (4 v, ZMA 2895.84); Seringapatam Reef, NE corner, 13°41'S 122°05'E, dead, 10 m (1 pr, ZMA Moll.143827); Seringapatam Reef, E side, 13°41'S 122°05'E, dead, 10 m (1 pr, ZMA Moll.143833); Cartier Island, N side, 12°31'S 123°29'E, dead, 12 m (1 pr, ZMA Moll.143829); Ashmore Reef, approx. mid-northern coast, 12°17'S 123°02'E, outer reef slope, dead, 12 m (1 v, NTM P010139); Ashmore Reef, NE corner, 12°14'S 123°05'E, dead, 15–18 m (1 pr, ZMA Moll.145818). **NORTHERN TERRITORY:** Port Darwin, beach, 12°23'S 130°44'E, dead (1 v, ZMA Moll.143819). —JAPAN: Kii Prefecture, Wakayama, alive, 28–32 m (2 pr, ZMA Moll.139584); Ryukyu Islands, Okinawa, alive, 23 m (1 pr, ZMA Moll.142431). —CHINA: Hong Kong, just S of Wong Mau Chau (S Gau Island), 22°27'N 114°24'E, dead, 10 m (1 v, C.336899); Hong Kong, SE of Ping Chau Island, Mirs Bay (Tai Pang Wang), E side, 22°33'N 114°24'E, dead, 8 m (9 v, C.336900). —VIETNAM: off Nha Trang, Hon Mieu, alive, 4–5 m (1 pr, ZMA Moll.139640). —PHILIPPINE ISLANDS: Bohol, Pamilacan Island, 9°30'N 123°55'E, alive, 1–3 m (2 pr, C.161932); Sulu Archipelago, Basilan Island, off Zamboanga, alive, 1–4 m (13 pr, ZMA Moll.142428). —MARSHALL ISLANDS: Kwajalein Atoll, Carlson Islet, outside lagoon, alive, 12 m (2 pr, ZMA Moll.142360); Kwajalein Atoll, Shell Islet, inside lagoon, alive, 6 m (1 pr, ZMA Moll.142361); Kwajalein Atoll, inside lagoon,

alive, 15 m (1 pr, ZMA Moll.142377); Kwajalein Atoll, oceanside of west reef, alive, 15 m (1 pr, ZMA Moll.144038). —INDONESIA: Irian Jaya, Biak Island, alive, intertidal on exposed reef (1 pr, ZMA Moll.143721); Ambon, Hitu, Kaitetu (near Hila), alive, intertidal (1 pr, ZMA Moll.143752). SRI LANKA: Hikkaduwa, dead, beach (12 v, ZMA Moll.011963). —THAILAND: Phuket Island, Raya Ya Islet, alive, 20–40 m (2 pr, ZMA Moll.143691). COCOS (KEELING) ISLAND: W of Direction Island, dead, 15–20 m (1 pr + 1 v, WAM500); Turk Reef, dead, 9–35 m (1 v, WAM501; 1 v, WAM502); Flat SE Horsburgh Island, alive, 5 m (1 pr, WAM503); SE Horsburgh Island, dead, 15–25 m (1 v, WAM504); Horsburgh Island, dead, to 40 m (1 pr, WAM505); NW side, dead, 15–25 m (2 v, WAM506); N side, dead (1 v, WAM507). CHRISTMAS ISLAND (Indian Ocean): 10°30'S 105°40'E, dead (3 pr, C.147395); Flying Fish Cove, 10°30'S 105°40'E, dead, 5–25 m (2 pr, ZMA Moll.146221); Flying Fish Cove, Nissa Maru, 10°30'S 105°40'E, dead, 15 m (1 pr, ZMA Moll.143651); E side of North West Point, dead, 0–30 m (3 pr + 1 fragm., WAM508); Flying Fish Cove, dead (9 v, WAM509); W coast, just N of Egeria Point, dead, 3–25 m (1 pr + 1 v, WAM510); off Dolly Beach, dead, 0–25 m (1 pr + 1 v, WAM511); Greta Beach, dead (1 pr, WAM512); Flying Fish Cove, opp. small boat ramp, dead, 0–25 m (2 pr + 7 v, WAM513). —PAPUA NEW GUINEA: Madang, Sek Harbour, sheltered N side, 5°05'S 145°50'E, alive (1 pr, C.344012); Madang, Kranket Island, inlet at N end, 5°11'S 145°51'E, dead, intertidal (1 pr, C.332561); Madang Harbour, Tab Island, S side, 5°11'S 145°50'E, dead, 11 m (1 pr, C.332562); Port Moresby, Horeshoe Reef, 9°28'S 147°10'E, dead, 25 m (1 v, C.332560); Port Moresby, Manudaba (Local) Island, off W end, 9°31'S 147°10'E, dead, 18–22 m (1 v, C.336901); Port Moresby, Quayles Reef, alive, 6 m (2 pr, ZMA Moll.141102). —SOLOMON ISLANDS: Guadalcanal, Honiara, W of Point Cruz, 9°25'S 159°56'E, dead, beach (1 v, C.332559); Guadalcanal, Bonegi, alive, 9 m (1 pr, ZMA Moll.142372); Russell Islands, Mbanika Islet, Linggatu Cove, alive, 6–9 m (3 pr, ZMA Moll.142373); Kira Kira, San Cristobal, 10°27'S 161°53'E, dead, 15–24 m (1 pr + 1 v, WAM515). CORAL SEA: Portlock Reef, 9°43.48'S 144°49.24'E, alive, 8 m (2 pr, C.303898); Osprey Reef, SE end, 13°59'S 146°40'E, dead, 8–15 m (1 v, C.332558); Saumarez Reef, 21°49'S 153°40'E, alive, 6 m (1 pr, C.344013). —NEW CALEDONIA: Nouméa, outside main reef, alive, 15 m (1 pr, ZMA Moll.142365); Pouébo, alive, 20 m (1 pr, ZMA Moll.142367).

**Description.** Shell up to 40 mm high, most specimens under 30 mm; subcircular to prosocline, inequivalve, inequilateral, left and right valves almost equally inflated, auricles highly unequal in shape and size, umbonal angle c. 80–85°; colour highly variable, cream, yellow, orange, red, purple, brown to almost black; uniform or a variable pattern of dots and/or streaks. Interior glossy, coloured as exterior.

Both valves sculptured with c. 40–50 unevenly spaced, minutely squamose, rounded radial riblets of variable prominence. Intercalated microscopic antimarginal scratches laterally, more prominent on anterior end of right valve. Anterior auricles much larger than posterior, with delicate scaly riblets (c. 10 on left valve, c. 5 coarser ones on right valve), anterior auricle of right valve somewhat declined dorsally. Byssal notch deep, byssal fasciole broad. Functional ctenolium well-developed, with c. 6–8 teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, off Great Palm Island (AM C.303770): rv: H 32.8, L 29.3 mm; lv: H 32.6, L 27.8 mm; D 9.4 mm.

**Habitat.** Living in the littoral zone, byssally attached to undersides of coral slabs, amongst rubble and live coral on sandy bottoms.

**Distribution.** Tropical Indo-West to central Pacific, from southern Japan southwards to northern Australia, westwards into the Indian Ocean to Sri Lanka, and eastwards across the Pacific to the Phoenix Islands (as *Chlamys* sp. cf. *C. irregularis*; Waller, 1972: 239; Raines & Poppe, 2006: 198); Japan to Indonesia, 2–150 m (Huber, 2010: 207); Philippines, 4–24 m (Dijkstra, 2013: 65); Indonesia, 10–25 m, dead (Dijkstra & Moolenbeek, 2008: 19); Papua New Guinea, 3–25 m (as *Laevichlamys irregularis* (Sowerby II, 1842); Dijkstra, 1998a: 32–33). Maximum depth range of live-taken specimens is from the intertidal zone to 40 m. Present specimens from Australia alive at 1–17 m.

**Remarks.** The present specimens from tropical Australia are similar to the type material, although slightly more subcircular, but intermediate variations are commonly observed (AM, HD, MNHN). Other characters are identical.

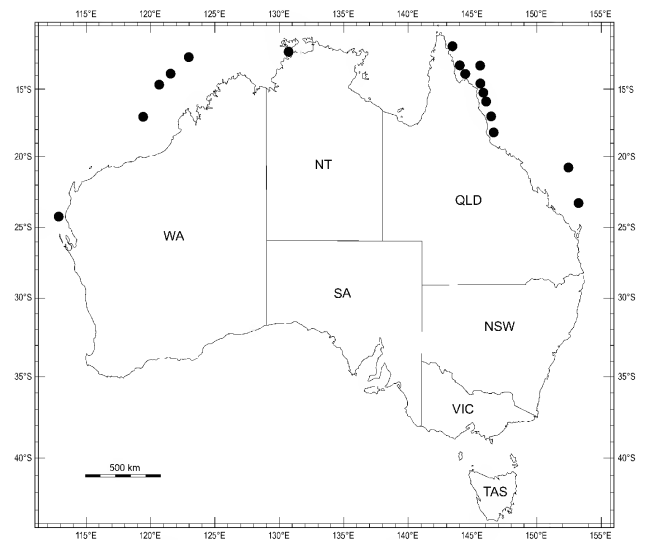


Figure 68. Distribution of *Laevichlamys cuneata* (Reeve).

Waller (1972a: 238) listed a scallop, *Chlamys* sp. cf. *irregularis* (Sowerby), from “Cocos-Keeling, Caroline, Marshall, Gilbert, and Phoenix Islands”, which is conspecific with the present species, with identical characters to the type material of *Laevichlamys cuneata*.

The Hawaiian morph, *Chlamys cookei* Dall, Bartsch & Rehder, 1938, differs slightly from *Laevichlamys cuneata* in having a more circular shape (*L. cuneata* is more obliquely oblong), by its finer radial sculpture, and by its brighter coloration (dark colours as in typical specimens from the western Pacific are not observed). It is possible that *Chlamys midwayensis* Habe & Okutani, 1968 from Midway Island (in the Hawaiian chain) is conspecific with the Hawaiian morph, although it has somewhat coarser radial sculpture and probably occurs in deeper waters (400–460 m).

### *Laevichlamys deliciosa* (Iredale, 1939)

Figs 66, 67G–J, 69A–B

*Mimachlamys deliciosa* Iredale, 1939: 350, pl. 5, figs 22–22a; Dijkstra, (1983–1994) 1990: 5, figs.

*Chlamys* (*Chlamys*) *princessae* Kuroda & Habe in Kuroda *et al.*, 1971: 364, pl. 79, figs 16–17; Rombouts, 1991: 17, pl. 24, fig. 6; Higo *et al.*, 2001: 156, fig. B445 (paratype, not holotype as indicated).

*Chlamys* (*Chlamys*) *deliciosa* (Iredale).—Dijkstra, 1990a: 8; Lamprell & Whitehead, 1992: [20], 172, pl. 8, fig. 43.

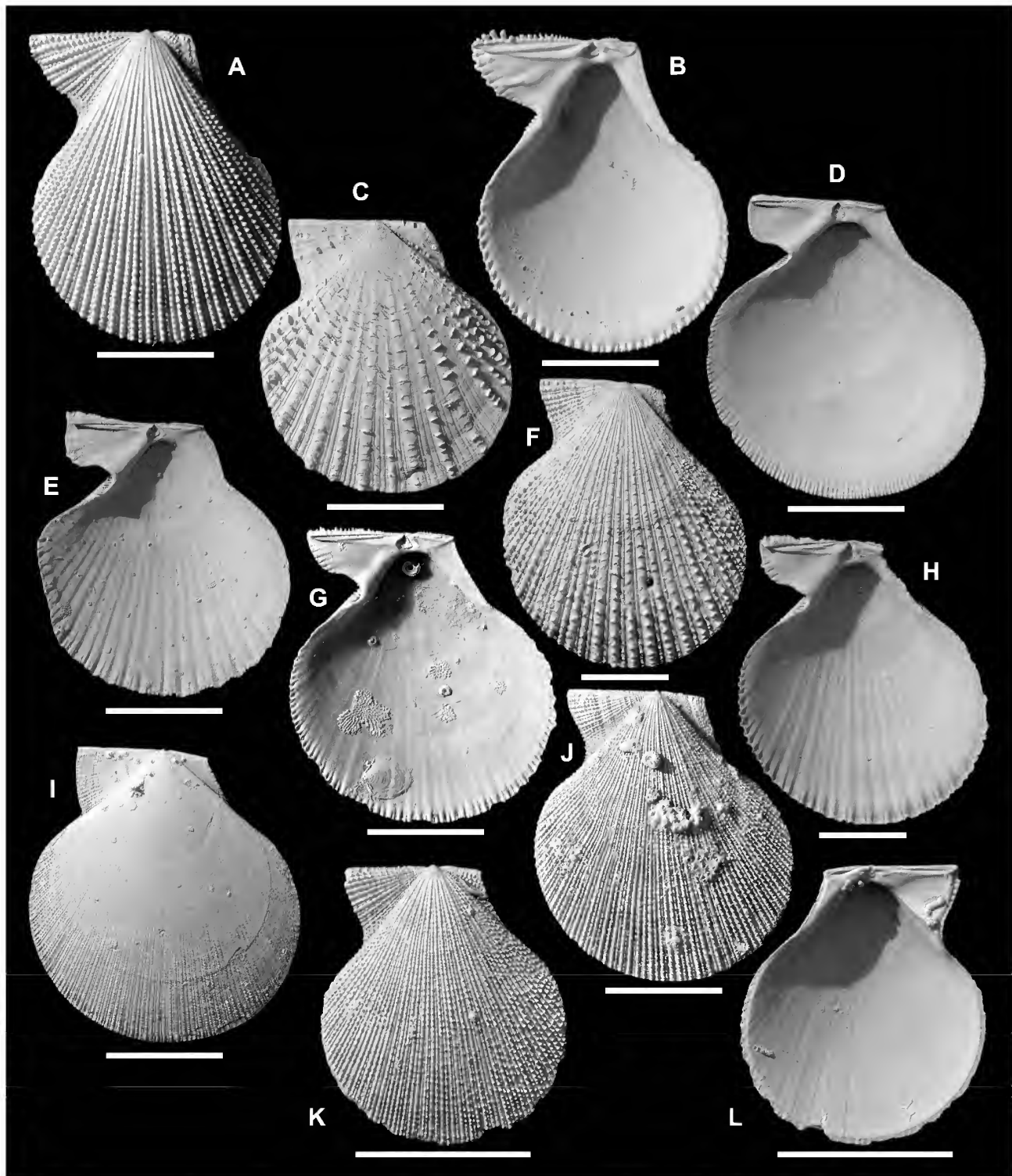
*Chlamys deliciosa* (Iredale).—Dijkstra, 1991: 30; Dharma, 2005: 248, pl. 99, figs 9a–b.

*Chlamys* (*Mimachlamys*) *deliciosa* (Iredale).—Rombouts, 1991: 28.

*Laevichlamys deliciosa* (Iredale).—Dijkstra & Kastoro, 1997: 268, fig. 134; Dijkstra & Kilburn, 2001: 288, figs 23–24; Raines & Poppe, 2006: 200, 201, upper figs; pl. 142, figs 2–3; Dijkstra & Maestrati, 2008: 105, figs 44–45; Huber, 2010: 207; Raines, 2010: 622, pl. 1002, fig. 2; Dijkstra, 2013: 65, pl. 17, figs 2a–d, pl. 28, figs 4a–b.

**Type data.** *Mimachlamys deliciosa*, lectotype (pr) AM C.089669 (Fig. 67G–H), herein designated, 4 paralectotypes (pr) AM C.212823. Type locality: Australia, N QLD, GBR Expedition stn 14, 0.5 mile south-east of Lizard Island, Low Isles, 14°41'S 145°29'E, 35 m.





**Figure 69.** *A, B*, *Laevichlamys deliciosa* (Iredale), lectotype, specimen in Fig. 67I, J, lv exterior (A), rv interior (B). *C, E*, *Laevichlamys squamosa* (Gmelin), pair, AM C.132040, sublittoral, Broadhurst Reef, E of Townsville, GBR, QLD; lv exterior (C), rv interior (E). *D, I*, *Laevichlamys mollita* (Reeve), pair, AM C.132030, sublittoral, Broadhurst Reef, E of Townsville, GBR, QLD; rv interior (D), lv exterior (I). *F, H*, *Laevichlamys cuneata* (Reeve), specimen in Fig. 67D, F; lv exterior (F), rv interior (H). *G, J*, *Laevichlamys limatula* (Reeve), specimen in Fig. 67E, K, L, rv interior (G), lv exterior (J). *K, L*, *Laevichlamys andamanica* (Preston), specimen in Fig. 67B; lv exterior (K) and interior (L). Scale bars represent 10 mm.

*Chlamys* (*Chlamys*) *princessae* Kuroda & Habe: holotype (pr) NSMT-Mo R18503, figured by Higo *et al.* (2001: 156, fig. B445), refigured by Showa Memorial Institute (ed.) (2002: 60). Type locality: Japan, Sagami Bay.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: 0.25 ml N of North Direction Isle, 14°44'S 145°31'E, alive, 34.5 m (3 pr, C.119510); Swain Reefs, 3 km NE of W side of Gillett Cay, 21°42'S 152°26'E, dead, 64–73 m (1 v, C.336902). WESTERN AUSTRALIA: W of Dongara, 29°20.8'S 114°05.7'E, dead, 192–219 m (2 fragm., WAM497), off Rowley Shoals, 33 n. miles S of Bedwell

Island, Clerke Reef, 17°48.7'–17°48.2'S 119°22.3'–119°23.1'E, dead, 250 m (1 v, WAM12560). —JAPAN: Okinawa, 1 km WNW of Onna, 26°29.8'N 127°50.7'E, dead, 45 m (1 v, C.336903); Okinawa, Seragaki, alive, 38–40 m (3 pr, ZMA Moll.141409). —PHILIPPINE ISLANDS: Cebu, off Sogod, alive, 160–200 m (1 pr, ZMA Moll.142198); Bohol, Balicasag Island, alive, 130–140 m (1 pr, ZMA Moll.139557). —INDONESIA: Tanimbar Islands, 7°59'S 133°02'E, alive, 184–186 m (1 pr, ZMA Moll.139810); NNE coast of Sumba, E of Melolo, 9°53.2'S 120°43.2'E, alive, 100 m (1 pr, ZMA Moll.144668). CORAL SEA: Chesterfield Islands, 19°49'S 158°21'E, alive, 42 m (1 pr, ZMA Moll.142204). —NEW CALEDONIA: Grand Récif Sud, 22°46'S 167°01'E, alive, 65 m (1 pr, ZMA Moll.142199). —FIJI ISLANDS: Viti Levu, Yanuca Island, dead, 34 m (1 v, ZMA Moll.143983).

**Description.** Shell up to 25 mm high, most specimens under 20 mm; a few specimens subcircular, most oblong, somewhat prosocline, right valve slightly more inflated than left, almost equivalve and equilateral, auricles very unequal in shape and size, umbonal angle c. 80–85°; uniform cream, orange (most specimens), yellow, pink or purple, some specimens patterned with darker rays or blotches.

Both valves sculptured with numerous fine, unevenly spaced, spinous radial riblets, increasing to c. 45–50 by intercalation towards ventral margin in adult stage. Radial interspaces bearing granulate or reticulate microsculpture in early radial stage, smooth in late radial stage near ventral margin. Anterior auricles long, bearing 9–14 delicate radial riblets, posterior auricles very short with fewer (6–10) still more delicate riblets. Anterior auricle of left valve somewhat declined near disc flank. Postero-dorsal margin somewhat declivous. Byssal notch very weak, byssal fasciole narrow. Functional ctenolium well-developed, with c. 4–6 teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, 0.25 miles N of North Direction Isle, 34.5 m (AMC.119510); rv: H 13.5, L 10.7 mm; L 11.7 m (including anteriorly protruding auricle); lv: H 13.5, L 10.7, D 4.7 mm. Iredale (1939: 351) stated the dimensions of a representative syntype (presumably the lectotype) as H 17, L 14 mm.

**Habitat.** Living in the littoral zone to the upper bathyal zone, amongst coral rubble on sandy or muddy sand bottoms. Surface of many specimens encrusted with sponges.

**Distribution.** Subtropical-tropical Indo-West Pacific, from southern Japan to northern Australia, westward into the Indian Ocean to Mozambique and South Africa (not recorded from the Red Sea, Arabian Sea and Persian Gulf), and eastwards across the Pacific to the Fiji Islands (Raines & Poppe, 2006: 200); Africa to Japan, 35–390 m (Huber, 2010: 207); Mozambique, 80 m, South Africa, 10–100 m (Dijkstra & Kilburn, 2001: 289); Philippines, c. 80 m (Dijkstra, 2013: 66); Indonesia, 80–212 m (Dijkstra, 1991: 30; Dijkstra & Kastoro, 1997: 268); Solomon Islands, 120–655 m, dead; Norfolk Ridge, 180–250 m, dead (Dijkstra & Maestrati, 2008: 106); Vanuatu, 45–101 m (Dijkstra & Maestrati, 2012: 399). Maximum depth range of live-taken specimens 10–390 m. Present specimens from Australia alive at 34.5 m.

**Remarks.** The present specimens from western and eastern Australia are indistinguishable from the type of *Laevichlamys deliciosa*. Typical specimens are strongly oblong, but the shape (subcircular to elongate) and convexity (strongly inflated to more flattened) of this species are rather variable.

## *Laevichlamys limatula* (Reeve, 1853)

Figs 66, 67E,K–L, 69G,J

*Pecten limatula* Reeve, 1853: sp. 124, pl. 28, fig. 124; Küster & Kobelt, 1888: 257, pl. 67, fig. 5; Melvill & Standen, 1899: 183.

*Pecten (Chlamys) limatula* Reeve.—Dautzenberg & Bavay, 1912: 12.

*Laevichlamys limatula* (Reeve).—Waller, 1993: 204; Raines & Poppe, 2006: 204–205, upper figs; pl. 144, figs 2a–b; Dijkstra & Moolenbeek, 2008: 19.

**Type data.** Holotype (pr) NHMUK1981246, figured by Reeve (1853: pl. 28, fig. 124), refigured by Raines & Poppe (2006: pl. 144, figs 2a–b). Type locality: Unknown.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, No. 8 Sand Cay, N side, 13°21'S 143°57'E, dead, 4–21 m (1 v, C.157597); GBR, Swain Reefs, Reef 21-176, N slope, 21°20'S 151°36'E, dead, 10 m (1 v, C.332602). WESTERN AUSTRALIA: Abrolhos Islands, Wallabi Group, E side of Goss Passage, Beacon Island, approx. 28°28'S 113°45'E, dead, subtidal (2 pr, WAM S30731); Abrolhos Islands, Wallabi Group, E side of Beacon Island, approx. 28°28'S 113°47'E, dead, 6–27 m (1 v, WAM490.91); Abrolhos Islands, Wallabi Group, SW of Dicks Island, Noon Reef, approx. 28°28'S 113°45'E, alive, 2–3 m (1 pr, WAM491.91). —CHRISTMAS ISLAND: Flying Fish Cove, dead, 5–25 m (1 pr, ZMA Moll.146222). —MARSHALL ISLANDS: Kwajalein Atoll, Carlos Island, outside lagoon, alive, 15 m (1 pr, ZMA Moll.142482); Kwajalein Island, ocean side of reef, alive, 12–18 m (3 pr, ZMA Moll.142478). —FIJI ISLANDS: Viti Levu, Beqa Island, alive, 18 m (1 pr, ZMA Moll.142486). —LINE ISLANDS: Christmas Island, Cook Isle, alive, 12 m (6 pr, ZMA Moll.142487).

**Description.** Shell up to c. 30 mm high, thin, semi-translucent, ovate, some specimens prosocline, others acline; valves almost equally weakly inflated, slightly inequivalve, equilateral, auricles highly unequal in shape and size, umbonal angle c. 85–90°; brightly coloured, cream, orange or yellow with radial blotched streaks of darker colour; some specimens uniformly coloured.

Both valves sculptured with numerous, very closely and unevenly spaced, spinous radial riblets (c. 60–70 in adult stage near ventral margin), increasing by intercalation and varying slightly in prominence. Interstitial microsculpture commarginal in early growth stage, more antimarginal in late ontogeny. Anterior auricles with 6–10 squamous radial riblets, posterior ones with 4–6. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium well-developed, with 4–6 teeth.

**Dimensions.** Illustrated specimen: WA, Abrolhos Islands, Wallabi Group, E side of Goss Passage, Beacon Island, approx. 28°28'S 113°45'E (WAM S30731): H 25.2, L 22.3, D 7.6 mm.

**Habitat.** Living in the littoral zone, byssally attached to the undersides of coral boulders, or amongst coral rubble on clean sand.

**Distribution.** Tropical Indo-West Pacific, from the Philippines to northern Australia, westwards to Christmas Island, and eastwards into the central Pacific to the Line Islands (Raines & Poppe, 2006: 204); Indonesia, 10–25 m, dead (Dijkstra & Moolenbeek, 2008: 19). Maximum depth range of live-taken specimens is 12–18 m. Present specimen from Australia alive at 2–3 m.

**Remarks.** The epithet “limatula” (Latin, diminutive of “lima”, a file) is an indeclinable noun. The present specimens from Australia are indistinguishable from the holotype.

Wagner (1982: 86) synonymized the present species with *Laevichlamys irregularis* (Sowerby, 1842) (= *Laevichlamys cuneata* (Reeve, 1853), above), and considered that there are no significant morphological differences between the two nominal taxa. However, *L. limatula* has much finer and more

evenly arranged radial sculpture than *L. cuneata*, which has much more unevenly spaced and less well-developed narrow and broad radial costae. Moreover, *L. limatula* is smaller in size, relatively thin, and more brightly coloured. Waller (1993: 204) placed both species in his new genus *Laevichlamys*.

### *Laevichlamys mollita* (Reeve, 1853)

Figs 66, 69D,I, 71B,D

*Pecten mollitus* Reeve, 1853: sp. 100, pl. 25, fig. 100; Küster & Kobelt, 1888: 202, pl. 54, figs 3–6.

*Chlamys mollita* (Reeve).—Kira, 1959: 121 pl. 18, fig. 8; Masuda, 1962: 179, pl. 21, fig. 7, pl. 23, figs 6–8; Dijkstra, (1983–1989) 1983: 5, figs; Matsukuma et al., 1991: 137, pl. 135, fig. 5.

*Chlamys (Chlamys) mollita* (Reeve).—Rombouts, 1991: 16, pl. 6, fig. 8; Lamprell & Whitehead, 1992: [20], no 40, pl. 8, fig. 40; Higo et al., 1999: 442.

*Laevichlamys mollita* (Reeve).—Waller, 1993: 204; Dijkstra, 1997: 321, figs 9–12; Dijkstra, 1998a: 28, pl. 5, figs 5–8; Raines & Poppe, 2006: 204–205, lower figs; pl. 146, figs 2–6; Huber, 2010: 208; Raines, 2010: 620, pl. 1001, figs 6–8; Dijkstra, 2013: 68, pl. 18, figs 2a–d, pl. 20, figs 3a–b, pl. 29, figs 2a–b.

**Type data.** Two syntypes (pr) NHMUK1995081. Type locality: Japan.

**Comments on type data.** The largest specimen in the type lot does not belong to the type series. Reeve (1853) described *Laevichlamys mollita* from Japan. However, the type lot has three labels, on two of which is written “Celebes” (Sulawesi, Indonesia). This again suggests confusion by Cuming over the true locality for these shells. The smallest syntype of *L. mollita* was refigured by Higo et al. (2001: 156, fig. B438).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Lizard Island, Granite Bluff, 14°39'S 145°27'E, dead, 15 m (4 v, C.128031); No Name Reef, SW end, 14°40'S 145°39'E, dead, 15–20 m (3 v, C.153124); Opal Reef, N of Cairns, 16°15'S 145°50'E, dead, 29 m (1 v, C.336872); Wheeler Reef, NE of Townsville, 18°46'S 147°31'E, dead, subtidal (1 pr, C.132031); Wheeler Reef, W side, NE of Townsville, 18°46'S 147°31'E, dead, 18 m (1 pr, C.336871); Broadhurst Reef, E of Townsville, 18°57'S 147°44'E, dead, subtidal (1 pr, C.132027; 1 pr, C.132028; 1 pr, C.132029; 1 pr, C.132030). —PAPUA NEW GUINEA: off Port Moresby, outer reef, alive, 20 m (1 pr, ZMA Moll.141099); Milne Bay, Waga Waga, alive, 18–26 m (3 pr, ZMA Moll.141328); Duke of York Island, alive, 34 m (1 pr, ZMA Moll.142577). —SOLOMON ISLANDS: Russell Group, Mbanika Island, Linggatu Cove, alive, 6 m (1 pr, ZMA Moll.142578); Russell Group, Pavuvu Island, Samata, alive, 6 m (1 pr, ZMA Moll.142580); Guadalcanal, W of Honiara, between Bonegi I and II wrecks, alive, 39 m (1 pr, ZMA Moll.142581); Guadalcanal, W of Honiara, alive, 20–30 m (1 pr, 1 v, ZMA Moll.142583).

**Description.** Shell up to 61 mm high (Raines, 2010), thin, circular, weakly inflated, almost equally convex, somewhat inequivalve, equilateral, auricles unequal in shape and size, umbonal angle c. 100°; colour highly variable, yellow, orange, red, pink, purple or brown, mottled, with c. 8 paler radial streaks.

Both valves sculptured with numerous, evenly spaced, weak, delicate, squamous, round-crested radial riblets (c. 10 per cm in adult stage near ventral margin). Antimarginal microsculpture in radial interspaces in early radial stage and on postero-lateral area of disc. Anterior auricles much larger than posterior ones, with squamous radial riblets (c. 12 on lv, 6–8 on rv); c. 4–6 weaker riblets on posterior auricles. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium well-developed, with 6–9 teeth.

**Dimensions.** Illustrated specimen: Qld, GBR, Broadhurst Reef, E of Townsville, sublittoral (AM C.132030): rv: H 50.4, L 47.1 mm; lv: H 50.9, L 46.8 mm; D 11.8 mm.

**Habitat.** Living byssally attached under coral boulders or amongst coral rubble on soft sediment (sand) in shallow water.

**Distribution.** Indo-West Pacific, from southern Japan, Philippines, Indonesia, Papua New Guinea, Solomon Islands to northeastern Australia (Raines & Poppe, 2006: 204); Philippines to Australia, 2–60 m (Huber, 2010: 208); Philippines, 150–200 m (?) and 4–28 m (Raines, 2010: 620; Dijkstra, 2013: 68); Papua New Guinea (Dijkstra, 1998a: 33). Maximum depth range of live-taken specimens is 2–60 m. The bathyal records in Raines (2010: 620) are incorrect. The present material from Australia so far has been collected only dead from the subtidal zone to 29 m.

**Remarks.** The present specimens of *Laevichlamys mollita* from Australia are indistinguishable from the type material. Juveniles could easily be confused with other small specimens of congeneric multiradial species such as *Laevichlamys andamanica*, *L. cuneata*, and *L. squamosa*.

### *Laevichlamys squamosa* (Gmelin, 1791)

Figs 69C,E, 70, 71E–H

*Ostrea squamosa* Gmelin, 1791: 3319, no. 17.

*Ostrea anonyma* Gmelin, 1791: 3329, no. 73.

*Pecten squamosus* (Gmelin).—Bosc, 1802: 263; G. B. Sowerby II, 1842: 69, pl. 13, figs 48–50; Reeve, 1853: sp. 65, pl. 18, figs 65a–b.

*Pecten hybridus* (Gmelin).—Lamarck, 1819: 177, no. 56 (misidentification).

*Pecten serratus* G. B. Sowerby II.—Reeve, 1853: sp. 46, pl. 12, figs 46a–b (misidentification as *P. serratus* G. B. Sowerby II, 1842; junior primary homonym of *Pecten serratus* Nilsson, 1827).

*Pecten dissimilis* Fischer, 1858: 341 (in part) (junior primary homonym of *Pecten dissimilis* Fleming, 1828).

*Pecten (Chlamys) squamosa* [sic] (Gmelin).—Dautzenberg & Bavay, 1912: 14; Adam & Leloup, 1939: 58; Wilkins, 1953: 14–15, pl. 5, figs 16–18.

*Mimachlamys grossiana* Iredale, 1939: 352, pl. 5, figs 23–23a.

*Chlamys squamosa* (Gmelin).—Waller, 1972a: 237, fig. 3, pl. 3, figs 38–41; Abbott & Dance, 1982: 312, fig; Dijkstra, (1983–1994) 1984: 16, figs; Wells & Bryce, 1988: 158, pl. 60, fig. 584; Dijkstra et al., 1989: 24; Dijkstra et al., 1990: 4–5, figs; Dharma, 1992: 84, pl. 20, fig. 4; Bernard et al., 1993: 49; Wells, Slack-Smith & Bryce, 2000: 42; Dharma, 2005: 248, pl. 99, figs 3a–c; Xu & Zhang, 2008: 83, fig. 228.

*Chlamys (Mimachlamys) squamosa* (Gmelin).—Rombouts, 1991: 30, pl. 12, fig. 2.

*Chlamys (Chlamys) squamosa* (Gmelin).—Springsteen & Leobrer, 1986: 329, pl. 93, fig. 16; Dijkstra, 1990a: 11; Lamprell & Whitehead, 1992: [18], pl. 7, fig. 39; Subba Rao & Dey, 2000: 222.

*Laevichlamys squamosa* (Gmelin).—Waller, 1993: 203–204; Dijkstra, 1997: 322, figs 13–17; Dijkstra, 1998a: 33, pl. 6, figs 1–4; Slack-Smith & Bryce, 2004: 237; Raines & Poppe, 2006: 208, 211, upper figs; pl. 151, figs 1–3, 5–6; pl. 152, figs 1–7; pl. 296, fig. 2; Dijkstra & Moolenbeek, 2008: 19; Huber, 2010: 208; Raines, 2010: 624, pl. 1003, figs 1–7; Dijkstra, 2013: 69, pl. 19, figs 1a–d, pl. 20, figs 4a–b.

*Chlamys (Laevichlamys) squamosa* (Gmelin).—Hayami, 2000: 899, pl. 447, fig. 11.

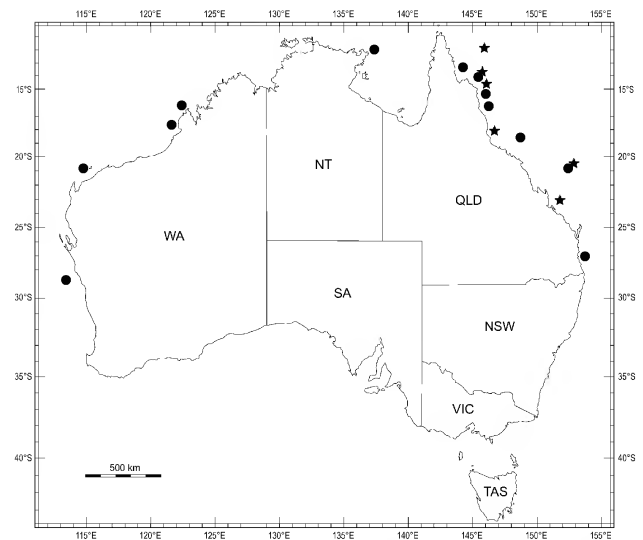
**Comments on synonymy.** Gmelin (1791: 3329) referred only to Lister (1687: pl. 184, sp. 21) in the description of *Ostrea anomyma*. This is the same reference as he cited for *O. squamosa*. Therefore, these names are objective synonyms. As first revisers, we select the name *Ostrea squamosa* as the name to be used for the species named both *Ostrea squamosa* and *Ostrea anomyma* by Gmelin (1791).

**Type data.** *Ostrea squamosa* Gmelin: lectotype (lv) NHMUK (Sloane collection), refigured by Wilkins (1953: pl. 5, figs 16–18), designated by Dijkstra (1991: 32). Type locality: unknown. Designated as Queensland, Australia by Dijkstra (1998a: 33). Gmelin referred only to Lister (1687: pl. 184 fig. 21) for both species, so the same specimen is the lectotype of both *Ostrea squamosa* and *O. anomyma* of Gmelin (1791).

*Mimachlamys grossiana* Iredale: holotype (pr) AM C.019177 (Fig. 71G–H). Type locality: Australia, QLD, Moreton Bay, Stradbroke Island.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m, 1 v (1 v, C.030272; 4 v, C.030273; 1 v, C.161012); Reef 13-074, 13°29'S 144°02'E, dead, 7–10 m (1 v, C.338905); Lizard Island, Watsons Bay, 14°40'S 145°27'E, dead, 5 m (1 pr, C.133009); between Palfrey & Lizard Islands, 14°41'S 145°27'E, in lagoon, dead, 1 m (1 pr, C.107857); Lizard Island, Bird Islet, 14°41'S 145°28'E, dead, 0–24 m (3 v, C.338907); Lizard Island, No. 1 Bommie, 14°41'S 145°28'E, lagoon, alive, 0–15 m (1 pr, C.339122); W of Lizard Island, Eyrie Reef, E reef slope, 14°42'S 145°23'E, dead, 3–11 m (1 v, C.338906); Ruby Reef, NW side, 15°44'S 145°47'E, dead, 8–16 m (1 pr, C.157610); Low Isles, 16°23'S 145°34'E, dead, 16–22 m (2 v, C.119530); NE of Townsville, Wheeler Reef, N side, 18°46'S 147°31'E, dead, 11 m (1 pr, C.338909); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, dead, subtidal (1 pr, C.131213); E of Townsville, Little Broadhurst Reef, 18°59'S 147°43'E, dead, subtidal (1 pr, C.132033); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, alive, subtidal (1 pr, C.132034; 1 pr, C.132035; 1 pr, C.132036; 1 pr, C.132037; 2 pr, C.132038; 1 pr, C.132039; 1 pr, C.338912); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, dead, sublittoral (1 pr, C.132040); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, alive, 10–15 m (1 pr, C.338911); Swain Reefs, 20 mls N of Herald's Prong No. 1 Reef, 21°10'S 151°24'E, alive (2 pr, C.119531); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 6–10 m (1 v, C.161839); Swain Reefs, Mystery Reef, 21°23'S 152°02'E, alive, 3–6 m (1 pr, C.339124); Swain Reefs, Reef 21-189, 21°27'S 151°41'E, dead, 9–10 m (1 pr, C.338910); Swain Reefs, Thomas Cay, 21°36'S 152°21'E, dead, intertidal (1 v, C.338908); Moreton Bay, Stradbroke Island, 27°35'S 153°28'E, dead (1 pr, C.019177). WESTERN AUSTRALIA: Abrolhos Islands, Pelsaert Group, Mangrove Islands, 28°52'S 113°58'E, dead (1 pr, C.119529); Montebello Islands, 20°26'S 115°32'E, alive (1 pr, C.049665); Broome, Entrance Point, 18°01'S 122°12'E, alive (1 v, C.119528; 2 pr, C.121356); Beagle Bay, 16°59'S 122°40'E, dead (15 v, C.119494); King Sound, 16°50'S 123°30'E, alive (1 pr, C.097429); Cape Leveque, 16°24'S 122°55'E, dead (1 v, C.160997 [in part]). NORTHERN TERRITORY: Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (3 v, C.060179); Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (1 v, C.338904). —KENYA: Mombassa, Old Port, 4°03'S 39°41'E, alive (1 pr, C.339125). —MAURITIUS: off west coast, alive, 27 m (1 pr, ZMA Moll.142947). —THAILAND: off west coast, Kantang, Khor Muk, alive, 25–40 m (9 pr, ZMA Moll.143669). —MALAYSIA: off east coast, alive, 20–30 m (8 pr, ZMA Moll.140361). —PHILIPPINE ISLANDS: Cebu, Mactan Island, off Buoyong Beach, 10°05'N 124°0'E, dead, 7–30 m (1 v, C.143059); Bohol, Pamilacan Island, 9°30'N 123°55'E, dead, 1–3 m (2 v, C.161933); Mindanao, Davao Gulf, Talikud Island, alive, 20–28 m (8 pr, ZMA Moll.144473). GUAM: off Orote Cliffs, alive, 20–25 m (1 pr, ZMA Moll.142471). —INDONESIA: Lombok, Gili Trawangan Isle, alive, 3 m (1 pr, ZMA Moll.142952). —PAPUA NEW GUINEA: Madang, Kranket Island, 5°11'S 145°51'E, alive, intertidal (1 pr, C.339123); Port Moresby, Quayles Reef, alive, 20 m (1 pr, ZMA Moll.142954). —SOLOMON ISLANDS: W coast Malaita Island, S of Aoki [Auki], Laulasi Island, Lee Reef, 8°52'S 160°44'E, dead, 6–11 m (1 pr, C.096475). CORAL SEA: Osprey Reef, 13°53'S 146°31'E, dead, 10–17 m (1 pr, C.159356). —NEW CALEDONIA: Poindimie, 20°05'N 124°0'E, dead (12 v, C.103837); Aquarium de Nouméa, 22°19'S 166°27'E, alive (5 pr, C.080825). VANUATU: S coast of Efate Island, Erakor Lagoon, 17°45'S 168°20'E, dead (1 v, C.338914). —FIJI ISLANDS: Viti Levu, Nadi Bay [Tomba Ko Nandi], 17°44'S 177°25'E, dead, 9–35 m (12 v, C.067853); Viti Levu, Nadi Bay [Tomba Ko Nandi], 17°44'S 177°25'E, alive (2 pr, C.338913). —SAMOA ISLANDS: Tutuila, Utelei, alive, 6 m (1 pr, ZMA Moll.142470). TONGA: Tongatapu, Fafa Island, off Nuku'alofa, alive, 2–3 m (3 pr, ZMA Moll.142472).

**Description.** Shell up to 96 mm high (Huber, 2010), most specimens under 45 mm; thin, flattened, subcircular to oblong, right valve slightly more inflated than left, inequivalve, almost equilateral, auricles highly unequal in size and shape, umbonal angle c. 90°; colour variable, found in almost all colours, with zigzag pattern, paler radial streaks, and/or blotched, a few specimens uniform in colour.



**Figure 70.** Distribution of *Laevichlamys squamosa* (Gmelin) (circles) and *L. wilhelmiana* (Bavay) (stars).

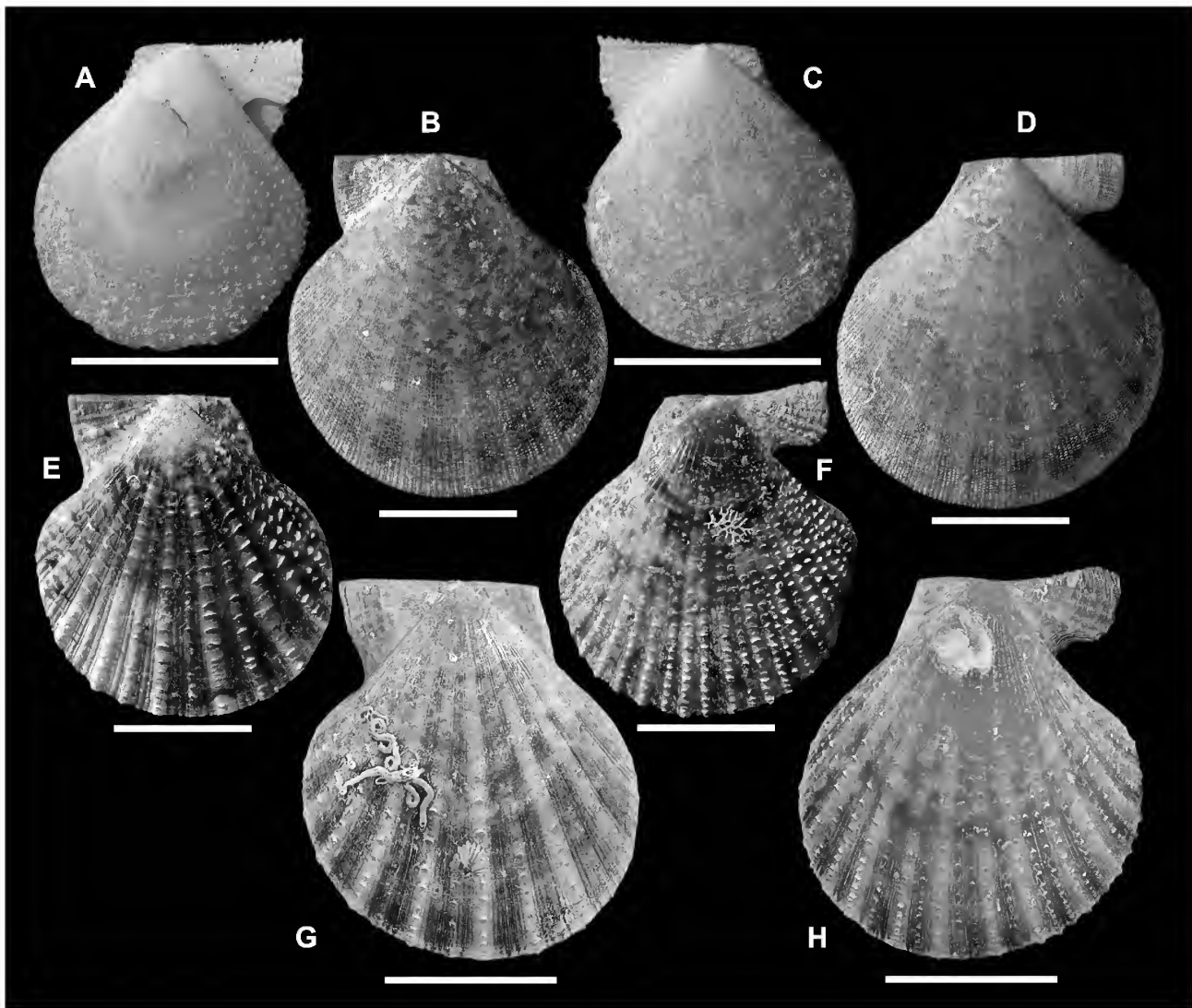
Radial sculpture of left valve irregular in prominence and unevenly spaced, with 9–12 low, coarsely scaly radial costae; 1–5 weak squamous secondary riblets intercalated in each radial interspace; some specimens with almost smooth interspaces. Sculpture on right valve of more even prominence, with c. 25–35 closely spaced, narrow, squamous radial riblets. Antimarginal microsculpture in interspaces in early growth stage, shagreen microsculpture lacking. Anterior auricles much larger than posterior ones, bearing c. 6 scaly radial riblets, almost smooth on left valve, more prominent on right valve. Posterior auricles smooth or weakly sculptured with a few commarginal lamellae. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–8 teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, Broadhurst Reef, E of Townsville, sublittoral (AM C.132040): rv: H 46.6, L 43.8 mm; lv: H 45.6, L 42.0 mm; D 10.8 mm. Iredale (1939: 352) stated the dimensions of the holotype of *Mimachlamys grossiana* as H 44, L 40 mm.

**Habitat.** Living in the littoral to upper bathyal zones, byssally attached to undersides of rock or coral boulders or amongst coral rubble on soft sediment (muddy sand or sand).

**Distribution.** Tropical Indo-West Pacific, from southern Japan to northern Australia, westwards into the Indian Ocean to Kenya and Mauritius (not recorded from the Arabian Sea), eastwards into the central Pacific to Tonga (not known from the Hawaiian Islands or French Polynesia) (Waller, 1972: 239; Raines & Poppe, 2006: 210); Japan to Mascarenes, 5–55 m (Huber, 2010: 208); Philippines, 4–38 m (Raines, 2010: 624; Dijkstra, 2013: 72); Indonesia, 0–16 m (Dijkstra, 1991: 32); Papua New Guinea, 3–30 m (Dijkstra, 1998a: 33–34); Vanuatu, 0–60 m (Dijkstra & Maestrati, 2012: 399). Maximum depth range of live-taken specimens is from the intertidal zone to 60 m. Present specimens from Australia alive from the intertidal zone to 15 m.

**Remarks.** The present specimens from Australia are identical to the type material of *Laevichlamys squamosa*. This species has often been attributed incorrectly to different nominal taxa in the past (see Iredale, 1939: 353) from



**Figure 71.** *A, C*, *Laevichlamys wilhelminae* (Bavay), pair, AM C.157604, Ham Cay, GBR, QLD, rv exterior (A), lv exterior (C). *B, D*, *Laevichlamys mollita* (Reeve), specimen in Fig. 69D, I, lv exterior (B), rv exterior (D). *E–H*, *Laevichlamys squamosa* (Gmelin), (E, F) specimen in Fig. 69C, E, lv exterior (E), rv exterior (F); (G, H) pair, holotype of *Mimachlamys grossiana* Iredale, AM C.019177, Stradbroke Island, Moreton Bay, QLD, lv exterior (G), rv exterior (H). Scale bars represent 10 mm.

outside Australia. Therefore, Iredale (1939: 352) considered the Queensland specimens to be distinct. However, the lectotype of *Laevichlamys squamosa*, Sloane's specimen (lv) illustrated in Lister (1687), preserved in NHMUK, is morphologically indistinguishable from Iredale's material of *Mimachlamys grossiana*.

#### *Laevichlamys wilhelminae* (Bavay, 1904)

Figs 70, 71A,C, 72B–C

*Chlamys wilhelminae* Bavay, 1904a: 200, pl. 6, figs 13–14; Dautzenberg & Bouge, 1933: 428; Dijkstra, (1983–1994) 1987: 3, figs; Dijkstra, 1989: 14, 18, figs.

*Chlamys wilhelminae* var. *maculata* Bavay, 1904a: 201, pl. 6, figs 3–4.

*Pecten (Chlamys) wilhelminae* (Bavay).—Dautzenberg & Bavay, 1912: 17.

*Chlamys marshallensis* Waller, 1972a: 236, pl. 2, figs 26–33, 36–37, text figs 3, 16, table 4.

*Chlamys (Chlamys) wilhelminae* Bavay.—Dijkstra *et al.*, 1989: 24; Dijkstra, 1990: 6–7, figs; Dijkstra, 1990a: 9;

Rombouts, 1991: 21, pl. 24, fig. 9; Lamprell & Healy, 1998: 238, fig. 709.

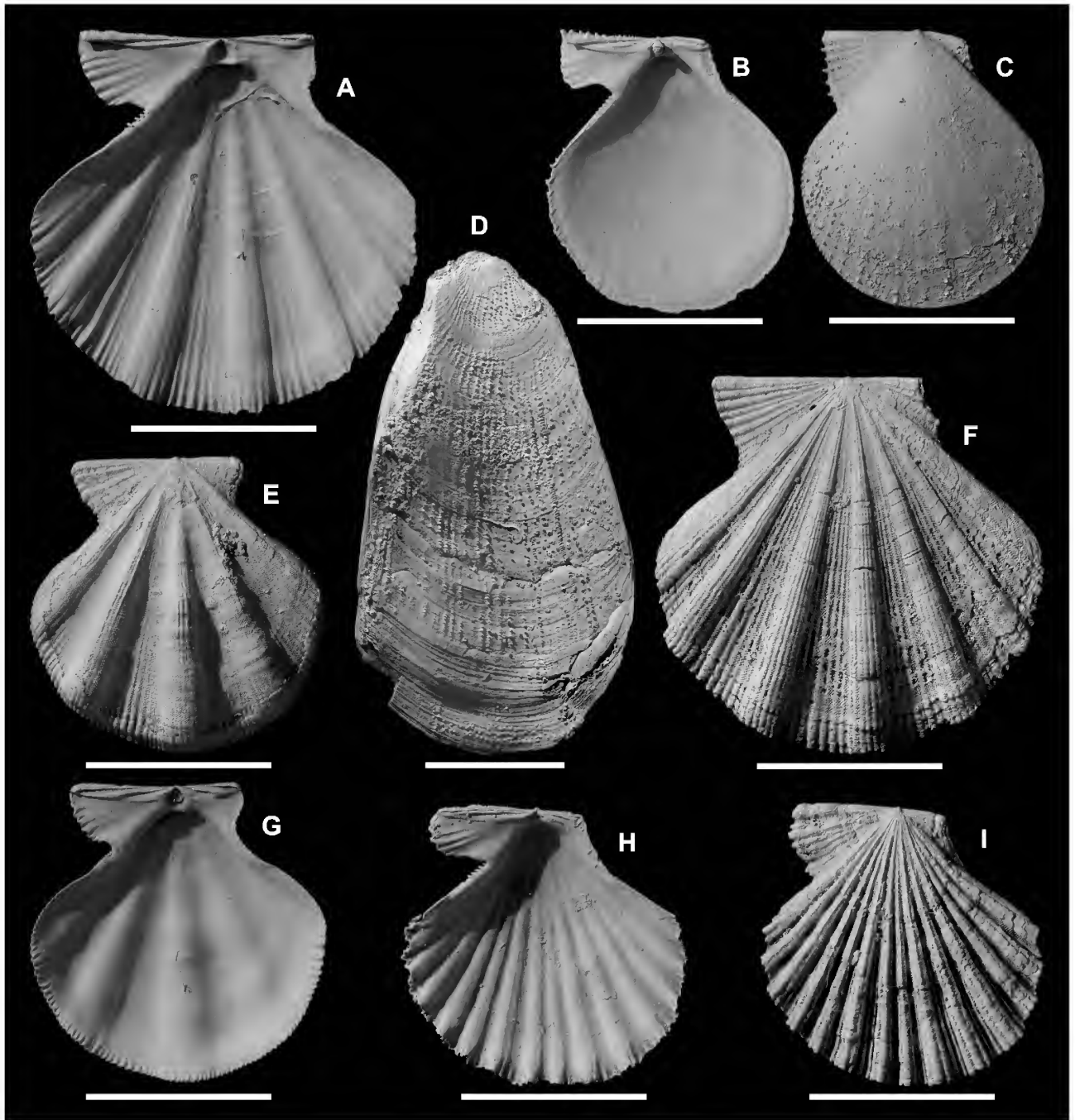
*Laevichlamys wilhelminae* (Bavay).—Waller, 1993: 204; Dijkstra, 1997: 323; Raines & Poppe, 2006: 212–213, lower figs; pl. 154, figs 1–7; Dijkstra & Moolenbeek, 2008: 20; Huber, 2010: 208; Raines, 2010: 622, pl. 1002, figs 4–6; Dijkstra, 2013: 72, pl. 19, figs 2a–d, pl. 20, figs 5a–b.

**Comments on synonymy.** *Chlamys wilhelminae* var. *maculata* is only a colour variant of *L. wilhelminae* (see description).

Waller (1972a: 237) compared *Chlamys marshallensis* with the closely related congeneric species *Laevichlamys squamosa* (Gmelin, 1791) and *Laevichlamys irregularis* (G. B. Sowerby II, 1842), but overlooked *L. wilhelminae*, which is morphologically identical to *C. marshallensis* (see also Waller 1993: 202).

**Type data.** *Chlamys wilhelminae* Bavay: holotype (pr) ZMA Moll.3.04.003, 7 paratypes (pr): 2 MNHN Moll21204–5, 2 NMW1955.158.01309, 3 ZMA Moll.3.04.004. Type locality: “Moluques” [Maluku, Indonesia].





**Figure 72.** *A, E–G*, *Notochlamys hexactes* (Lamarck), 2 pairs; (*A, F*) AM C.119739, large *tasmanica* form, Tasmania, ex J. C. Cox collection; rv interior (*A*), lv exterior (*F*); (*E, G*) AM C.375079, *anginea* form, King George Sound, WA; lv exterior (*E*), rv interior (*G*). *B, C*, *Laevichlamys wilhelminae* (Bavay), specimen in Fig. 71A, C; rv interior (*B*), lv exterior (*C*). *D*, *Pedum spondyloideum* (Gmelin), lv of pair, AM C.041556, beach, Lizard Island, QLD; lv exterior. *H, I*, *Pascahinnites coruscans coruscans* (Hinds), pair, AM C.332575, Wistari Reef, Capricorn group, GBR, QLD; rv interior (*H*), lv exterior (*I*). Scale bars represent 20 mm (*A, E–G*), 10 mm (*B, C, H, I*), 30 mm (*D*).

*Chlamys wilhelminae* var. *maculata* Bavay: lectotype NMW1955.158.596, herein designated, 1 paralectotype ZMA Moll.3.04.005. Type locality: not mentioned explicitly, herein designated as Loyalty Islands (see Bavay, 1904a: 201).

*Chlamys marshallensis* Waller: holotype (pr) USNM 701200, 5 paratypes (pr): 1+1 v USNM701196 (stn EMBL 6), 1 v USNM701197 (stn EMBL 20), 1 USNM701198 (stn EMBL 21), 1 USNM701199 (stn EMBL 12). Type locality: Marshall Islands, Eniwetok Atoll, lagoon, 11°24'12"N 162°22'E, stn EMBL 21, 65 ft [20 m], living deep within a

crevice in a head of *Porites*, scuba, leg. T. Waller, 27 Sep 1969.

**Comments on type data.** The original description of *Chlamys wilhelminae* and *C. wilhelminae* var. *maculata* by Bavay (1904a: 201) was based on material of different sources:

- (a) Material in Bavay's private collection, donated by M. Bouge from the Loyalty Islands. Bavay's Pectinidae collection was auctioned by P. G eret at Paris (original list in NMW) and most material was purchased by Tomlin (now in Melvill-Tomlin collection in NMW) and Dautzenberg (now

in KBIN). The figured specimen of *Chlamys wilhelminae* var. *maculata* (Bavay, 1904a: pl. 6, figs 3–4), not mentioned by Oliver (1982: 9), was found in the Melvill-Tomlin collection (NMW1955.158.596). During a visit to the NMW (August 1987) the senior author also examined two specimens of *C. wilhelminae*, formerly belonging in Bavay's private collection, which also belong to the type series, with two handwritten labels by Bavay glued on the back of a small pillbox and one handwritten label by Tomlin. A yellow variety of *Chlamys wilhelminae* from Lifou (Loyalty Islands), identified as "*Pecten wilhelminae* var. *lutea*" [manuscript name] by Bavay, is also preserved in the Dautzenberg collection (KBIN). However, Bavay did not indicate this colour variation in his original description. This specimen is not part of the type series.

- (b) Material of *Chlamys wilhelminae* in MNHN from New Caledonia (2 specimens) with one handwritten label by Bavay also belongs to the type series (card file by B. Métivier in MNHN).
- (c) Material of *Chlamys wilhelminae* in the ZMA [ex Heukelom collection, leg. Van der Hucht] from "Molukken" [= Maluku] (4 specimens), of which one is the figured specimen (Bavay, 1904a: pl. 6, figs 13–14) (ZMA Moll.3.004.003), and one specimen of *C. wilhelminae* var. *maculata* from the same sample (ZMA Moll.3.004.005). All material was examined and determined by Bavay and also belongs to the type series.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, 9°44'S 142°21'E, alive (1 pr, ZMA Moll.147090); Reef N of Single Rock Entrance, inside of reef, 12°01'S 143°55'E, dead, 4–13 m (1 v, C.160959); Ham Cay, 13°02'S 145°52'E, alive, 10–12 m (1 pr, C.157604); Lizard Island, Rocky Point, 14°40'S 145°26'E, dead, 7.5 m (1 v, C.161011); Lizard Island, 14°40'S 145°28'E, alive (1 pr, C.125133); Lizard Island, Yonge Reef, 14°60'S 145°61.7'E, alive (1 pr, C.125134); Lizard Island, between South Island & Bird Island, 14°41'S 145°28'E, alive, 4.5 m (1 pr, C.344008); Reef 14-151, 14°55'S 145°41'E, dead, 8–13 m (1 v, C.157656); No. 9 Ribbon Reef, 14°57'S 145°42.5'E, alive, 11 m (1 pr, C.165226); No. 10 Ribbon Reef, 14°57'S 145°42'E, alive, 8–10 m (2 pr, C.165227); No. 7 Ribbon Reef, NW end, 15°08'S 145°44'E, dead (1 v, C.157598); Ruby Reef, NW side, 15°44'S 145°47'E, dead (1 v, C.157614); Orpheus Reef, Pioneer Bay, 18°35'S 146°29'E, alive, 3–4 m (2 pr, ZMA Moll.146237); Swain Reefs, Big Sandy Cay, 21°80'S 151°86.7'E, alive, 9 m (1 pr, C.161007); Swain Reefs, No. 1 Herald Prong Reef, 21°16.7'S 151°40'E, alive, 20 m (1 pr + 1 v, C.119507); Swain Reefs, Mystery Reef, 21°22'S 152°01'E, dead, 6–10 m (1 pr, C.332600); Swain Reefs, Finger Reef, 21°22'S 152°01'E, alive, 30 m (4 pr, ZMA Moll.143861); Swain Reefs, Reef 21-184, 21°23'S 151°42'E, alive, 10–11 m (1 pr, C.165569); Swain Reefs, Reef 21-189, 21°27'S 151°41'E, alive, 9–10 m (1 pr, C.165570); Swain Reefs, 3 km NE of W side of Gillett Cay, 21°42'S 152°26'E, dead, 64–73 m (1 v, C.161010); Swain Reefs, 22°12'S 152°37'E, dead (1 pr, C.157609); Capricorn Group, Heron Island, 23°26'S 151°57'E, alive (1 pr, C.344007). —PHILIPPINE ISLANDS: Bohol, Balicasag Island, alive, 130 m (1 pr, ZMA Moll.139563). —MARSHALL ISLANDS: Kwajalein Atoll, Shell Island, inside lagoon, alive, 6 m (1 pr, ZMA Moll.143070); Majuro Atoll, alive, 2–5 m (2 pr, ZMA Moll.139737). CORAL SEA: Chesterfield Islands, 19°34'S 158°15'E, alive, 32 m (1 pr, ZMA Moll.143075); Saumarez Reef, off North East Cay, 21°38'S 153°46'E, dead, 12–18 m (1 pr, C.157594). —NEW CALEDONIA: Koumac, 20°41.4'S 164°14.8'E, alive, 20–30 m (1 pr, ZMA Moll.139678). LOYALTY ISLANDS: Lifou, 20°53'S 167°13'E, dead (1 v, C.332601). —FIJI ISLANDS: Viti Levu, 16°57'S 178°47'E, dead, 9–35 m (2 v, C.067849); Viti Levu, Beqa Island, alive, 9 m (4 pr, ZMA Moll.143069); Viti Levu, Mbenga Island (Beqa Island), alive, 36 m (1 pr, ZMA Moll.143969). TONGA: Nukua-lofa, Makaha'a, 21°07'S 175°10'W, alive, 0.5–1 m (3 pr, ZMA Moll.143072).

**Description.** Shell small, up to 35 mm high, most specimens 20–25 mm; thin, semi-translucent to opaque, oblong, somewhat prosocline, moderately inflated, right valve slightly more convex than left to equally convex, almost equivalve, inequilateral, auricles highly unequal, umbonal angle c. 85–90°; colour variable, whitish or cream with pink radial streaks or radially arranged maculations (visible on the interior); some specimens uniform yellow, orange or pink; interior white, glossy.

Both valves sculptured with numerous (c. 60–70) weak, low, rounded, squamous radial riblets, uneven in spacing and prominence. Antimarginal microsculpture commences in radial interspaces in early radial stage and spreads laterally; lacking on central disc. Anterior auricles much larger and differing in shape from posterior ones, bearing 6–8 radial riblets on left valve and 5 more prominent ones on right valve. Posterior auricles strongly declined dorsally, bearing 2–3 weak radial riblets. Byssal notch relatively deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 4–6 teeth. Resilifer narrowly triangular.

**Dimensions.** Illustrated specimen: QLD, GBR, Ham Cay (AM C.157604): rv: H 15.1, L 13.7 mm; lv: H 15.1, L 13.1 mm; D 4.2 mm.

**Habitat.** Living in shallow water (subtidal to c. 40 m), byssally attached to rocks or *Acropora* corals, or amongst coral rubble on soft sediment (mainly sand) (see also Waller 1972a: 238).

**Distribution.** Tropical Indo-West Pacific, from the Philippines to northern Australia, Coral Sea, Marshall Islands, New Caledonia, and eastwards to the Society Islands (French Polynesia) (Raines & Poppe, 2006: 121); Indonesia to Polynesia, 5–140 m (Huber, 2010: 208); Philippines, 4–100 m (Raines, 2010: 622; Dijkstra, 2013: 73); Marshall Islands, intertidal zone to 54 m (as *Chlamys marshallensis* Waller, 1972; Waller, 1972: 239); Indonesia, 10–25 m, dead (Dijkstra & Moolenbeek, 2008: 20); Vanuatu, 5–45 m (Dijkstra & Maestrati, 2012: 399). Maximum depth range of live-taken specimens is from the intertidal zone to 140 m. Present specimens from Australia alive at 3–30 m.

**Remarks.** The present specimens from Australia are morphologically indistinguishable from the type material.

Juveniles of *Laevichlamys wilhelminae* could easily be confused with small specimens of *L. cuneata*. The two species have almost identical sculpture, but differ in shape and colour (*Laevichlamys wilhelminae* is wider and more inflated with more strongly declined posterior auricles, slightly weaker in sculpture, and more translucent and more brightly coloured than *L. cuneata*).

## *Notochlamys* Cotton, 1930

*Notochlamys* Cotton, 1930: 233. Type species (by original designation): *Chlamys anguineus* [sic] Finlay, 1927 (replacement name for *Pecten undulatus* G. B. Sowerby II, 1842, junior homonym of *P. undulatus* Nilsson, 1827) (= *Pecten hexacetus* [Péron] Lamarck, 1819); Recent, southwestern Australia.

**Diagnosis.** Strongly plicate, medium-sized Pedini with obvious shagreen microsculpture throughout ontogeny, and with obvious sculpture of few, major radial plicae; most specimens with secondary radial riblets; with highly unequal auricles (anterior much longer than posterior), moderately prominent resilial and dorsal teeth, internal costae with carinate edges near ventral margin, byssal notch deep, ctenolium well-developed.

**Distribution.** ?Pliocene–Recent (Beu & Darragh, 2001). Southwestern, southern and southeastern Australia, living in the subtidal to sublittoral zones beneath rocks or amongst rubble. Earlier (Eocene–Miocene) members assigned to the genus provisionally by Beu & Darragh (2001) are of uncertain taxonomic position.

**Discussion.** Hertlein (1969: N366) considered *Notochlamys* to be a junior synonym of the subgenus *Mesopeplum* Iredale, 1929, placed in *Semipallium* Jousseaume in Lamy, 1928. Waller (1991: 31) suggested that these three groups are not synonyms or even closely related and have very different ancestries. *Mesopeplum* (with entirely far-set commarginal microsculpture) is now placed in Mesopeplini, and *Notochlamys* and *Semipallium* (both of which have shagreen microsculpture) are considered to be distinct genera in Pedini (Waller, 1991: 31; Beu & Darragh, 2001: 58; Waller, 2006a: 20).

### *Notochlamys hexactes* (Lamarck, 1819)

Figs 72A,E–G, 73, 74A–D

*Pecten hexactes* [Péron] in Lamarck, 1819: 178, no. 59; Deshayes, 1836: 154, no. 59; Dijkstra, 1994: 492, pl. 30, figs 130–131 [holotype].

*Pecten undulatus* G. B. Sowerby II, 1842: 60, pl. 19, figs 206–207; Reeve, 1852: sp. 73, pl. 20, fig. 73; Smith, 1885: 299; Tate & May, 1901: 441; Bavay, 1905b: 22, 27; Hedley, 1916a: 157; Thiele, 1930: 591 (junior primary homonym of *Pecten undulatus* Nilsson, 1827).

*Pecten tasmanicus* A. Adams & Angas, 1863: 428, pl. 37, figs 21a–b; Smith, 1885: 299; Bavay, 1905b: 27.

*Pecten mariae* Tenison Woods, 1876: 158; 1878a: 33.

*Chlamys undulatus* [sic] (Sowerby).—Pritchard & Gatliff, 1904a: 263; Iredale, 1924: 194.

*Chlamys anguineus* [sic] Finlay, 1927: 527 (replacement name for *Pecten undulatus* Sowerby, 1842).

*Notochlamys anguineus* [sic] (Finlay).—Cotton, 1930: 233; Cotton & Godfrey, 1938: 94, fig. 80; Macpherson & Chapple, 1951: 145; Cotton, 1961: 98, fig. 83.

*Notochlamys tasmanica* (A. Adams & Angas).—Cotton & Godfrey, 1938: 95, fig. 81; Waller, 1991: 30, pl. 3, figs 11–12; Rombouts, 1991: 48, pl. 18, fig. 1; Richmond, 1992: 85, fig. 122.

*Notochlamys anguinea* (Finlay).—Iredale & McMichael, 1962: 11; Rombouts, 1991: 47, pl. 16, figs 7–7c.

*Mesopeplum tasmanicum* (A. Adams & Angas).—Macpherson & Gabriel, 1962: 305, fig. 347; Lamprell & Whitehead, 1992: [32], pl. 14, fig. 81.

*Decopecten* [sic] *anguineus* (Finlay).—Coleman, 1975: 89, fig. 266.

*Semipallium* (*Mesopeplum*) *anguineus* [sic] (Finlay).—Dijkstra, (1983–1989) 1983: 3, figs.

*Mesopeplum anguineum* (Finlay); Lamprell & Whitehead, 1992: [30], pl. 13, fig. 80.

*Notochlamys hexactes* (Lamarck); Beu & Darragh, 2001: 65, figs 17A–G; Raines & Poppe, 2006: 220, 221, pl. 169, figs 1–7; Huber, 2010: 206.

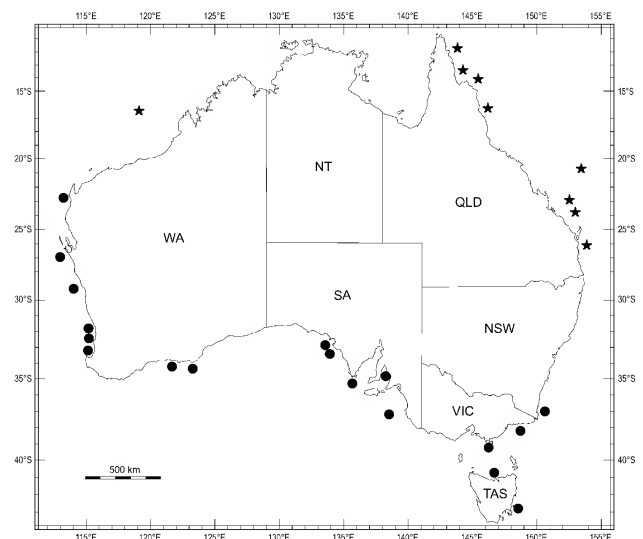
**Type data.** *Pecten hexactes* Lamarck: holotype (rv) MNHN Moll21196. Type locality: “Habite les mers de la Nouvelle Hollande, au port du Roi Georges” [Western Australia, Albany, King George Harbour].

*Pecten undulatus* Sowerby: syntypes (1 pr + 2 lv + 1 rv) NHMUK [not registered]. Type locality: “Mediterranean?”. This locality is incorrect, herein designated as Tasmania [this locality is written on the board of the type specimens].

*Pecten tasmanicus* A. Adams & Angas: holotype (pr) NHMUK 1950.5.23.1. Type locality: Tasmania, Oyster Bay.

*Pecten mariae* Tenison Woods: holotype (lv) TMH5749. Type locality: Tasmania, east coast.

**Comments on type data.** See Dijkstra (1994: 492) and Beu & Darragh (2001: 66).

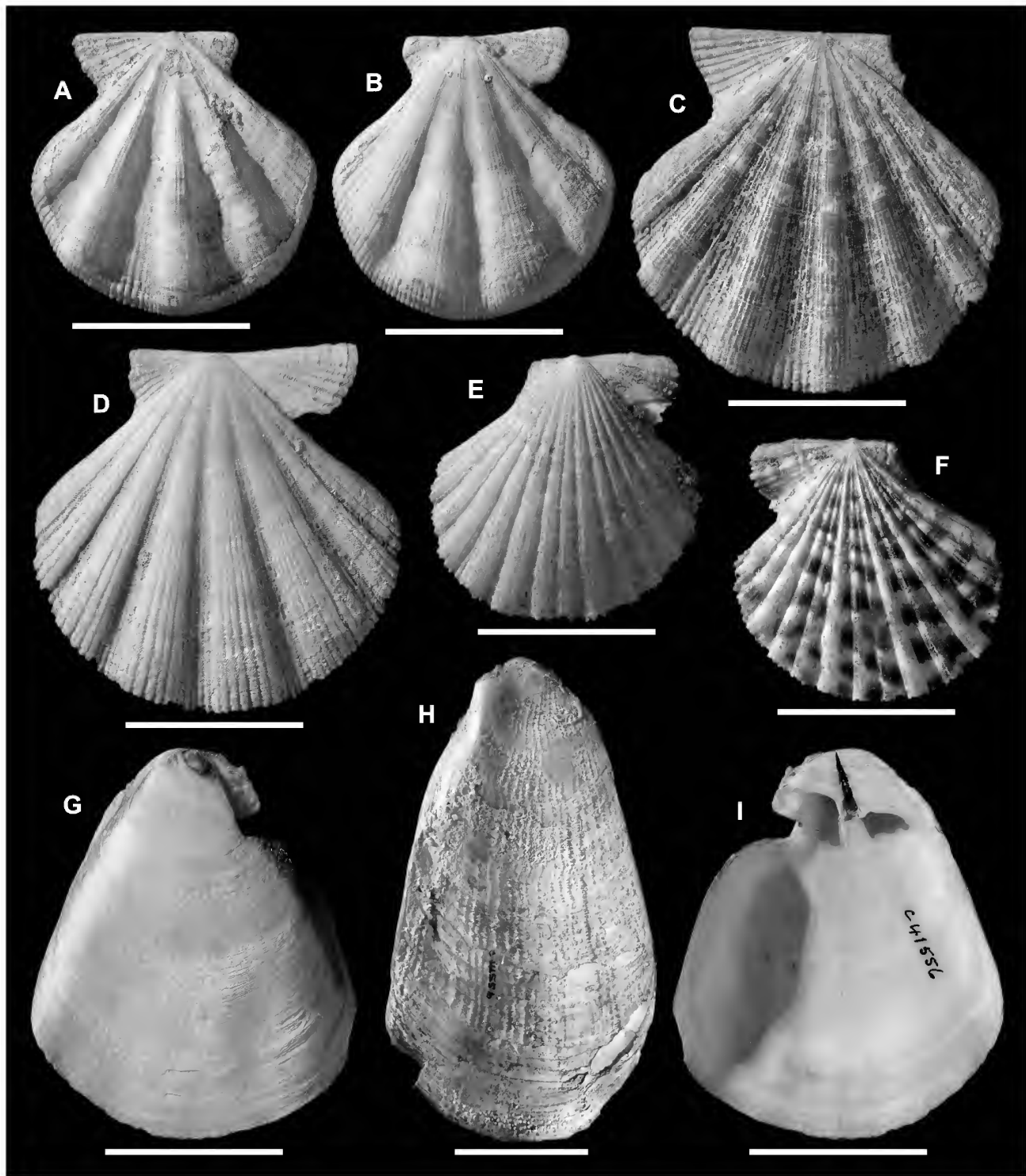


**Figure 73.** Distribution of *Notochlamys hexactes* (Lamarck) (circles) and *Pseudischnura coruscans* (Hinds) (stars).

**Additional material examined.** —AUSTRALIA: **NEW SOUTH WALES:** Twofold Bay, 37°05.13'S 149°55.35'E, dead (1 v, C.049885). **VICTORIA:** off Lakes Entrance, 38°03'S 148°03.5'E, dead, 36–46 m (9 v, C.132129; 1 v, C.375060); between Cape Howe & Lakes Entrance, 38°13'S 149°06'E, dead, 146–158 m (3 v, C.096256); Torquay, 38°21'S 144°18'E, dead (6 v, C.097550); off Wilsons Promontory, 39°10'S 146°23'E, alive, 54 m (2 pr, C.097549). **TASMANIA:** Black River Beach, near Stanley, 40°51'S 145°18'E, dead (3 v, C.097501); 41°09'S 146°10'E, alive (2 pr, C.119739); Swansea, 42°08'S 148°04'E, alive (1 pr, C.017687); Port Arthur, 43°09'S 147°51'E, alive, 15 m (4 v, C.097502); Cox Bight, 43°30'S 146°15'E, dead (1 v, C.375084). **SOUTH AUSTRALIA:** 50 ml SE of Kangaroo Island, 37°0'S 138°33'E, dead, 77 m (12 v, C.375083); Largs North Beach, c. 19 km N of Adelaide, 34°49'S 138°29'E, dead (1 v, C.375086); Nuys Archipelago, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (4 v, C.375087); St Vincents Gulf, 35°0'S 138°0'E, dead (4 v, C.001422); Neptune Islands, 35°17'S 136°05'E, dead, 73 m (4 v, C.019244). **WESTERN AUSTRALIA:** Great Australian Bight, c. 50 km SSW of St Francis Island, 33°0'–33°05'S 133°05'–133°10'E, dead, 64 m (1 v, C.375085); Great Australian Bight, 50 ml SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (1 v, C.375082); Recherche Archipelago, Cape Le Grand & New Island, 34°01'S 122°07.5'E, dead, 26–33 m (1 v, C.300344); Esperance, between Sandy Hook Island & Cape Le Grand, 34°02'S 122°0'E, alive, 31–35 m (1 pr, WAM); Esperance, 33°51'S 122°53'E, alive (1 pr, WAM); Esperance, 33°51'S 122°53'E, jetty, dead, 10 m (1 v, WAM); Esperance area, 33°52'S 121°54'E, dead (2 v, C.375081); Great Australian Bight, E of Hood Point, 34°21'S 121°16'E, dead, 82 m (5 v, C.300343); Bremer Bay, beach between John Cove and James Cove, 34°24'S 119°25'E, dead, beach (1 v, WAM); E of Cheyne Bay, 34°55'S 119°0'E, dead, 71–76 m (6 v, C.375080); E of Albany, Cheyne Beach, approx. 34°36'E 118°46'E, dead (1 v, WAM); Oyster Harbour via Albany, Emu Point, 35°0'S 117°57'E, dead, 9 m (1 v, WAM); King George Sound, 35°03'S 117°58'E, dead (1 v, C.043570; 1 pr, C.375079); S of Cape Leeuwin, 34°25'–34°45'S 114°40'–115°0'E, dead, 73–144 m (2 v, C.102077); Cape Naturaliste, Eagle Bay, 33°33'S 115°04'E, dead, 9 m (1 pr, WAM); Dunsborough, 33°36'S 115°06'E, alive, 0–3.6 m (1 pr + 2 v, C.101042); NW of Bunbury, 32°57.05'S 114°48'E, dead, 122–139 m (3 v, WAM); Warnboro Sound, 32°16.15'S 115°39.09'E, dead, 17 m (2 v, WAM); Cockburn Sound, 32°16.04'S 115°38.09'E, dead, 20–22 m (3 v, WAM); Fremantle, Cockburn Sound, off Woodmans Point, 32°12'S 115°44'E, dead (2 v, WAM; 1 v, WAM); Perth, Cottesloe Beach, 31°59'S 115°45'E, dead (1 v, C.010573; 14 v, C.075259; 7 v, C.097551; 1 v, C.103825; 3 v, C.130898; 3 v, C.130899); Perth, off Cottesloe, 31°59'S 115°45'E, dead (11 v, WAM); W of Swanbourne, 31°58.42'S 115°39.07'E, dead, 18.3 m (1 v, WAM); Perth, City Beach, 31°56'S 115°45'E, dead (1 v, C.069272); W of Dongara, 29°11'S 114°26'E, dead, 49.9 m (5 v, WAM); 80 km W of Dongara, 29°07.06'S 114°04.08'E, dead, 64 m (1 v, WAM); NW of Rottnest Island, 32°01'S 115°30'E, dead, 146 m (1 v, WAM); NW of Bluff Point, 27°40'S 113°03'E, dead, 128 m (1 v, WAM); NW of Cape Naturaliste, 23°40'S 114°28'E, dead, 137 m (1 v, WAM).

**Description.** Shell up to 67 mm high (Huber, 2010), most specimens under 40 mm; solid, weakly and almost equally inflated, subcircular, slightly wider than high, inequivalve, almost equilateral, auricles unequal, umbonal angle c. 110–115°; colour variable, white, yellow, orange, red, purple, brown to almost black; some specimens uniformly coloured or with paler blotches, or dark radial streaks between radial riblets.

Both valves sculptured with 5–11 plicae, weaker posterior anterior and posterior ends of disc, prominent and relatively narrow with wide interspaces on left valve, weaker and with



**Figure 74.** A–D, *Notochlamys hexactes* (Lamarck), specimens in Fig. 72A, E–G, lv exteriors (A, C), rv exteriors (B, D), *E*, *F*, *Paschalimites coruscans* (Hinds), specimen in Fig. 72H, I, rv exterior (E), lv exterior (F). G–I, *Pedum spondyloideum* (Gmelin), 2 valves in AM C.041556, beach, Lizard Island, QLD; (G, I) immature rv, exterior (G), interior (I); (H) specimen in Fig. 72D, lv exterior. Scale bars represent 20 mm (A–D), 10 mm (E, F), 30 mm (G–I).

narrower interspaces on right valve, with numerous radial riblets on plicae and in interstices (Tasmanian morph), riblets very weak or almost lacking (typical morph), covered with shagreen microsculpture throughout. Anterior auricles larger and longer than posterior ones, with 6–9 prominent radial costae; riblets much weaker and fewer on posterior auricles. Byssal notch moderately deep, byssal fasciole rather narrow. Functional ctenolium with c. 6 teeth in most specimens,

lacking in some adults. Internal costae with weakly carinate edges in a narrow zone just inside ventral margin.

**Dimensions.** Illustrated specimens: *tasmanica* form, Tasmania, ex J. C. Cox collection (AM C.119739): rv: H 40.8, L 41.6 mm; lv: H 40.7, L 41.8 mm; D 9.7 mm; *anguinea* form, WA, King George Sound (AM C.375079): rv: H 32.2, L 31.9 mm; lv: H 31.8, L 31.9 mm; D 11.8 mm.

**Habitat.** In Western Australia living in the littoral zone, free amongst the roots of sea grass, where currents have exposed the roots in gullies. Usually requires calmer, almost estuarine conditions. In Tasmania amongst shell rubble on soft sediment (sand and/or mud).

**Distribution.** Southern Western Australia (from W of Dongara, 29°07.06'S), South Australia, Victoria, Tasmania to southernmost New South Wales (Twofold Bay). Present specimens alive in the intertidal zone to 54 m.

**Remarks.** *Notochlamys hexactes* inhabits only the temperate waters of southern Australia and is extremely variable in shape (left valve flat and right valve weakly convex to equally inflated and pyxoid), sculpture (arrangement, number and prominence of primary radial plicae and secondary radial ribs) and colour (typically highly variable and brightly coloured, Tasmanian morph usually only purple). The “western” (typical or *anguinea* morph) and “eastern” populations (*tasmanica* morph) intergrade completely and are not distinguishable geographical forms (see also Beu & Darragh, 2001: 66). As noted above under *Equichlamys bifrons*, *Notochlamys hexactes* has lecithotropic development, and the great range of variation presumably results from the poor exchange of genes between distant populations.

### *Paschinnites* Dijkstra & Raines, 1999

*Paschinnites* Dijkstra & Raines, 1999: 200. Type species (by original designation): *Pecten (Chlamys) [sic] pasca* Dall, 1908; living, Easter Island.

**Diagnosis.** Small subcircular chlamydoid shells up to c. 20 mm high. Some species (including the type species) byssate in juvenile stage, cemented to hard substrates after a height of c. 9–11 and growing irregularly thereafter; others living byssally attached to hard substrates throughout life, without cementation. External prismatic layer lacking from early right dissoconch; antimarginal microsculpture in early pre-radial stage; shagreen microsculpture and radial macrosculpture present throughout; commarginal sculpture lacking. Byssal notch and functional ctenolium prominent in juvenile stage, absent in cemented adults.

**Distribution.** Pleistocene (Oliver, 1911: 527; 1915: 554; Deyrell Islet, Kermadec Islands; Waller, 1972a: 234; Midway I., Hawaii; Taylor, 1978; Aldabra) and Recent. Tropical and temperate Indo-West Pacific; Kermadec Islands and Easter Island, at sublittoral depths.

**Remarks.** For several years the following species has been included in *Semipallium*, but Paulay (2003), following advice from T. R. Waller, included it in *Paschinnites*. The similarity of “*Pecten (Chlamys) pasca* Dall to “*Chlamys coruscans* has been commented on previously by Rehder (1980: 109, pl. 13, figs 3–6) (again, following advice from T. R. Waller) and Bernard (1986: 71). The style of radial sculpture, with each pair of high, narrowly rounded costae separated by a single relatively wide secondary costa, the presence of shagreen microsculpture, the lack of a pre-radial external prismatic calcite layer in the right valve, and the relatively wide, acline shape confirm that *Pecten coruscans* Hinds, 1845 is related phylogenetically to *Paschinnites pasca* (Dall) rather than to the dorsoventrally elongate, prosocline species included in *Semipallium*. See also Dijkstra & Marshall (2008: 51).

### *Paschinnites coruscans coruscans* (Hinds, 1845)

Figs 72H–I, 73, 74E–F

*Pecten coruscans* Hinds, 1845: 61, pl. 17, fig. 3; Reeve, 1853: sp. 149 (not sp. 143; Reeve, 1853, errata), pl. 33, fig. 149; Küster & Kobelt, 1888: 259, pl. 67, fig. 9.

*Pecten cuneolus* Reeve, 1853: sp. 131, pl. 29, fig. 131.

*Pecten schmeltzii* [“Dunker ms”] Kobelt in Küster & Kobelt, 1888: 272, pl. 71, figs 5–6.

*Pecten sulphureus* [“Dunker ms”] Kobelt in Küster & Kobelt, 1888: 276, pl. 72, figs 5–6 (junior primary homonym of *Pecten sulphureus* of Bosc, 1802, and of Lamarck, 1819).

*Pecten kermadecensis* “Watson” [sic].—Oliver, 1911: 527; Oliver, 1915: 554 (misidentification as *P. kermadecensis* E.A. Smith, 1885).

*Chlamys cellularis* Oliver, 1915: 554, pl. 12, fig. 46.

*Pecten eucosmia* Turton, 1932: 222, pl. 57, fig. 1549.

*Chlamys coruscans* (Hinds).—Dautzenberg & Bouge, 1933: 426; Waller, 1972a: 231, pl. 1, figs 1–19, figs 2, 12, 14, table 2; Kilburn & Rippey, 1982: 171, pl. 38, fig. 10; Dijkstra, (1983–1994) 1984: 9, figs; Dijkstra, 1989: 12, figs; Dijkstra, 1990: 3, figs; Dijkstra *et al.*, 1989: 24; Rombouts, 1991: 10, pl. 23, figs 7–7b; Lamprell & Whitehead, 1992: [26], pl. 8, fig. 47; Dijkstra & Marshall, 1997: 99, pl. 8, figs 7–10; Brook & Marshall, 1998: 212; Dijkstra, Drivas & Jay, 1998: 5, fig. 3.

*Chlamys schmeltzi* (“Dunker”) [sic].—Kira, 1962: 137, pl. 49, fig. 10.

*Chlamys (Argopecten) coruscans coruscans* (Hinds).—Dijkstra, (1983–1989) 1983: 3, figs.

*Bractechlamys schmeltzi* (“Dunker”) [sic].—Wang, 1983b: 531–534, figs 4–7.

*Bractechlamys schmeltzii* (Kobelt).—Bernard *et al.*, 1993: 50. *Bractechlamys [sic] coruscans* (Hinds).—Hayami, 2000: 905, pl. 450, fig. 41, unnumbered figs pp. 904–905.

*Semipallium coruscans coruscans* (Hinds).—Dijkstra & Kilburn, 2001: 294, figs 31–32; Raines & Poppe, 2006: 236–237 upper figs; pl. 186, figs 1, 4–6, 8–9.

*Paschinnites coruscans coruscans* (Hinds).—Paulay, 2003: appendix (not paginated); Dijkstra & Marshall, 2008: 51, figs 35, 48A, D; Dijkstra & Moolenbeek, 2008: 20; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2010: 346; Huber, 2010: 209; Raines, 2010: 630, pl. 1006, figs 1–2; Dijkstra, 2013: 73, pl. 19, figs 3a–d.

*Bractechlamys coruscans* (Hinds).—Xu & Zhang, 2008: 85, figs 236a–d.

*Paschinnites coruscans* (Hinds).—Dijkstra & Maestrati, 2013a: 371.

**Comments on synonymy.** For remarks on synonymy see Bavay (1905b: 30; *Pecten cuneolus* Reeve and *P. schmeltzii* Dunker), Waller (1972a: 233; *P. cuneolus* Reeve and *P. sulphureus* Dunker), Kilburn & Rippey (1982: 171, 216; *P. eucosmia* Turton) and Dijkstra & Marshall (1997: 101; *Chlamys cellularis* Oliver).

**Type data.** *Pecten coruscans* Hinds: lectotype (pr) NHMUK19709 (Waller, 1972a: 231). Type locality: Port Anna Maria, Nukuhiva, Marquesas Islands, 13 m.

*Pecten cuneolus* Reeve: lectotype (pr) NHMUK1969140 (Waller, 1972a: 231). Type locality: “Durban, Natal”.

*Pecten schmeltzii* Küster & Kobelt: holotype LMA (not traced). Type locality: “Viti-Inseln” [Fiji Islands].

*Pecten sulphureus* Küster & Kobelt: holotype (pr) ZMB Moll.114.609, H 10.0, L 9.0 mm. Type locality: “Viti-Inseln” [Fiji Islands] (Dijkstra & Köhler, 2008: 42, fig. 4d).

*Chlamys cellularis* Oliver: holotype (lv) CMC M.688. Type locality: beach, Sunday [= Raoul] Island, Kermadec Islands.



*Pecten eucosmia* Turton: holotype (pr) OUZM Turton No. 1549. Type locality: Port Alfred, Zululand, South Africa.

**Comments on type data.** Dijkstra & Köhler (2008: 41) stated that the description of *Pecten schmeltzii* was based explicitly on a single specimen in Loebbecke's collection, now in LMA. This is therefore considered to be the holotype. Dijkstra & Köhler (2008: 41, fig. 4g) pointed out that other specimens were distributed by Godeffroy under Dunker's manuscript name, but not all are conspecific; several specimens in ZMB belong in this category, and are not type material.

The figured type specimen of *Pecten sulphureus* is present in the systematic collection of the ZMB (10 May 1989). Bavay also examined this specimen (as stated on the label) and treated it as a junior synonym of *Pecten coruscans*.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Yule Detached Reef, 11°59'S 143°58'E, S end, dead (1 v, C.332596); Reef 13-119, S end, 13°40'S 144°08'E, dead, 5–13 m (1 v, C.332581); No. 5 Sandbank Reef (13-120), SW end, 13°45'S 144°16'E, dead, 8–10 m (1 v, C.332598); GBR, Carter Reef, 14°32'S 145°35'E, inside reef, off "Platform Bonnie", dead, 18 m (1 v, C.332594); off Lizard Island, Carter Reef, 14°33'S 145°36'E, dead, 1–2 m (1 pr, C.332595); E of Lizard Island, Yonge Reef, outside N end, 14°35'S 145°37'E, alive (1 pr, C.344021); Yonge Reef, E of Lizard Island, outer face, N end, 14°35'S 145°37'E, dead, 15–17 m (5 v, C.160956); Lizard Island, SW end of South Island, 14°42'S 145°27'E, dead, 9–12 m (1 v, C.161015 [in part]); No. 9 Ribbon Reef, NW end, lagoon, 14°57'S 145°42'E, dead, 9–11 m (1 v, C.157592); Michaelmas Cay, 16°36'S 145°59'E, dead (6 v, C.332580); Swain Reefs, Sanctuary Reef, 22°03'S 152°40'E, dead, 6–14 m (1 v, C.332582); GBR, Capricorn Group, Tryon Island, 23°15'S 151°47'E, dead (1 pr, C.332576); Capricorn Group, North West Island, 23°18'S 151°42'E, alive (1 pr, C.332577); Capricorn Group, Wilson Island, 23°18'S 151°57'E, alive (many, C.303772); Capricorn Group, Wilson Island, N side, 23°18'S 151°57'E, alive (1 pr, C.344020); Capricorn Group, Heron Island, off middle of island on N side, 23°26'S 151°57'E, alive (1 pr, C.344019); Capricorn Group, Wistari Reef, 23°28'S 151°53'E, alive (2 pr, C.332575; 1 pr, C.302343); Bunker Group, off Lady Musgrave Island, 23°54'S 152°25'E, alive, 47 m (1 pr, C.332578); Alexandra Head, 26°40'S 153°07'E, dead (1 v, C.332579). WESTERN AUSTRALIA: Rowley Shoals, Mermaid Reef, 17°10'S 119°37'E, NE corner, dead, 12 m (1 pr, ZMA Moll.146210). —KENYA: Watamu, 3°23'S 40°0'E, alive, 3 m (1 pr, ZMA Moll.139603). SEYCHELLES: Mahé Island, North Point, 4°33'S 55°27'E, alive, 13 m (1 pr, ZMA Moll.143609). RÉUNION: Cap la Houssaye, 21°00'S 55°14'E, alive, 4 m (1 pr, ZMA Moll.142140). MOZAMBIQUE: Inhaca Island, 26°01'S 32°58'E, alive, 12 m (1 pr, ZMA Moll.139896). CHRISTMAS ISLAND: Flying Fish Cove, 10°30'S 105°40'E, dead, 12 m (1 pr, ZMA Moll.146210). —JAPAN: Okinawa, Maeda Misaki, alive, 4 m (1 pr, ZMA Moll.144333). —MARSHALL ISLANDS: Kwajalein Atoll, 9°15'N 167°30'E, ocean side west reef, alive, 9 m (3 pr, ZMA Moll.145878); Majuro Atoll, 7°05'N 171°08'E, alive, 1–2 m (1 pr, ZMA Moll.139739). TUVALU: Niutao, W Channel, 6°07'S 177°17'E, dead, 9 m (1 v, C.167701; 1 v, C.167702). CORAL SEA: Osprey Reef, 13°53'S 146°31'E, alive, 10–17 m (1 pr, C.344023); Osprey Reef, SE end, outer face, 13°59'S 146°40'E, dead, 8–15 m (1 v, C.332591); North East Herald Cay, 16°56'S 149°11'E, dead (46 v, C.332574); North East Herald Cay, 16°56'S 149°11'E, dead (1 v, C.332585); North East Herald Cay, 16°56'S 149°11'E, dead, 4 m (3 v, C.333758); Marion Reef, 19°07'S 152°23'E, dead (1 v, C.357991); Chesterfield Islands, 19°28'S 158°27'E, alive, 44–45 m (1 pr, ZMA Moll.142149); Kenn Reef, 21°15'S 155°44'E, dead (2 pr, C.332586); Saumarez Reef, 21°50'S 153°39'E, dead, 12–15 m (1 v, C.332597); Saumarez Reef, 21°52'S 153°27'E, dead, 13 m (1 v, C.157592); Saumarez Reef, 21°52'S 153°37'E, alive, 9–12 m (1 pr, C.157593). —FIJI ISLANDS: Viti Levu, Nadi Bay, 16°57'S 178°47'E, dead, 9–35 m (15 v, C.332588); Viti Levu, Nadi Bay, 16°57'S 178°47'E, dead (1 v, C.332589); S Viti Levu, Deuba, 18°15'S 178°05'E, dead (9 v, C.332590). —NEW CALEDONIA: Koumac, 20°39.7'S 164°14.9'E, alive, 15 m (1 pr, ZMA Moll.139675); Loyalty Islands, Lifou Island, Doking, 20°42'S 167°10'E, alive, 0–1.5 m (1 pr, C.344022); Loyalty Islands, Lifou, 20°53'S 167°13'E, dead (15 v, C.332587); Loyalty Islands, Lifou Island, behind Cap des Pins, 21°04'S 167°28'E, dead (1 v, C.332599); off Nouméa, Goeland Reef, S point, 22°16'S 166°26'E, alive, 1 m (2 pr, ZMA Moll.142123). —LINE ISLANDS: Christmas Island, Bay of Wrecks, 1°50'N 157°20'W, alive, 9 m (2 pr, ZMA Moll.142087). —SAMOA ISLANDS: Upolu Island, Mulinu'u, Apia, 13°48'S 171°45'W, alive, 0.6 m (13 v, ZMA Moll.142089). —SOCIETY ISLANDS: NW Moorea, Tiahura Island, 17°29'S 149°55'W, dead, 8–10 m (6 v, C.167696; 3 v, C.167695; 1 pr + 3 v, C.167697). —TUAMOTU ISLANDS: Arutua Atoll, 15°15'S 146°45'W, alive, 1 m (14 pr, ZMA Moll.141200). —SOCIETY ISLANDS: Huahine Island, Tefarerii, 16°45'S 151°0'W, alive, 0.5–2 m (6 pr, ZMA Moll.142107); NW Moorea Island, Tiahura Islet, E side, 17°29'S 149°55'W, dead (1 v, C.332592); NE Moorea Island, Point Aroa ou de Tiaia, 17°28'S 149°46'W, dead (1 v, C.332593); W Moorea Island, Paevaeva, 17°32'S 149°53'W, dead, 4–11 m, on outside of reef, 2 v (2 v, C.344025). —NEW ZEALAND: Kermadec Islands, Raoul Island, 29°15'S 177°52'E, dead (9 v, C.300125). TASMAN SEA: Middleton Reef, NE outer slope, 29°26'S 159°08'E, dead, 6–13 m (1 v, C.332584); Middleton Reef, S side, 29°29.10'S 159°08.10'E, dead, 10 m (1 v, C.384095); Elizabeth Reef, NE slope, 29°55'S 159°04'E, dead, 10–18 m (1 pr, C.157589); Elizabeth Reef, W outer reef slope, 29°57'S 159°01'E, alive, 15 m (1 pr, C.332583); Elizabeth Reef, W outer reef slope, 29°57.2'S 159°01.2'E, dead, 12 m (1 v, C.357992); Lord Howe Island, Admiralty Islands, Roach Island, 31°30'S 159°04'E, alive, 25 m (1 pr, C.344024); off NE side, 31°31'S 159°05'E, 27 m, dead (1 v, C.300124); 31°54.2'S 159°07.8'E, dead (1

pr, C.027753; 3 v, C.059651); 31°54.2'S 159°07.8'E, dead (4 v, C.059652); Erscott's, Hole, 31°55'S 159°08.3'E, lagoon, dead, 3 m (1 v, C.157580); Erscott's, Hole, 31°55'S 159°08.3'E, lagoon, dead, 8 m (1 v, C.300126); Lord Howe Rise, 31°38.2'S 159°03'E, dead, 44 m (1 v, C.300123; 1 v, C.160968). —MARQUESAS ISLANDS: Tahuata Island, 9°58'S 139°05'W, dead, 48 m (1 pr, ZMA Moll.144622).

*Pascahinnites coruscans hawaiiensis* (Dall, Bartsch & Rehder, 1938): —HAWAIIAN ISLANDS: Oahu, Ewa Beach, 21°18'N 158°01'W, alive, 6 m (4 pr, ZMA Moll.144055); Oahu, Waikiki Beach, 21°17'N 157°52'W, alive, 0.8 m (3 pr, ZMA Moll.140961). —JOHNSTON ISLAND: 16°45'N 169°32'W, in lagoon, alive, 6 m (4 pr, ZMA Moll.144059).

**Description.** Shell small, most specimens 10–15 mm high, a few larger, to 23.8 mm (Huber, 2010); subcircular to more elongate, almost equivalve, equilateral (juvenile) to more prosocline (mature), right valve somewhat more convex than left, auricles unequal, umbonal angle c. 90°; colour highly variable, most specimens whitish, cream or tawny, with opaque white, red or brown maculations; a few specimens uniform bright yellow, purplish or orange.

Both valves sculptured with 14–15 primary radial plicae, commencing in early growth stage (c. 0.5 mm), with 50–70 (most specimens with c. 60) squamose secondary radial riblets on and between plicae, giving plicae a tripartite or fasciculate appearance towards ventral margin. Antimarginal microsculpture in pre-radial stage, replaced by intercostal shagreen microsculpture in radial stage on disc and auricles. Anterior auricles much larger than posterior, with 5–8 prominent, unevenly developed radial riblets; riblets narrower and weaker on posterior auricles. Postero-dorsal margin somewhat declined. Byssal fasciole broad, byssal notch shallow. Functional ctenolium with 4–6 teeth. Resilifer narrowly triangular. Hinge with weak resilial teeth and more prominent dorsal teeth. Interior plicate.

**Dimensions.** Illustrated specimen: QLD, GBR, Capricorn Group, Wistari Reef (AMC.332575): rv: H 14.9, L 15.4 mm; lv: H 14.7, L 15.1 mm; D 5.1 mm.

**Habitat.** Living in the intertidal and littoral zones (to c. 30 m), most specimens byssally attached to corals or rocks or amongst coral rubble on soft sediment (sand).

**Distribution.** Throughout the (sub)tropical Indo-West Pacific from East Africa (except the Red Sea), Seychelles, Mauritius, Réunion, Maldives, Cocos-Keeling Islands, Christmas Island, southern Japan, China, Philippines, Indonesia, western and eastern Australia, eastwards to the Marquesas Islands, Tuamotu Archipelago and Austral Islands (French Polynesia) and Pitcairn Island (Waller, 1972: 234–236; Raines & Poppe, 2006: 236); Africa to Hawaii Islands, 0–45 m (Huber, 2010: 209); Mozambique, 15 m, South Africa, 5–20 m (Dijkstra & Kilburn, 2001: 295–296); Philippines, 3 m (Dijkstra, 2013: 74); Vanuatu, 5–7 m (Dijkstra & Maestrati, 2012: 400); Austral Islands, 2–52 m (Dijkstra & Maestrati, 2010: 346). Maximum depth range of live-taken specimens is from the intertidal zone to 60 m (unpublished data, HHD). Present specimens from Australia alive at 47 m.

**Remarks.** Dijkstra & Marshall (2008: 51) pointed out that *Pascahinnites coruscans* is distinctive among Recent Pectinidae in having a primary tripartite radial sculpture, each tripartite costa flanked by 1 or 2 intercostal radial riblets, and shagreen microsculpture. Unlike *Pascahinnites pasca* (Dall, 1908) from Easter Island, *P. coruscans* lives byssally attached rather than cemented by the right valve.

*Paschahinnites coruscans hawaiiensis*, a closely related subspecies from the Hawaiian Islands and Johnston Island, differs from *P. coruscans coruscans* in having 14–15 primary radial plicae (15–17 in *P. coruscans coruscans*), somewhat smaller auricles, a narrower umbonal angle, 4–5 posterior auricular denticles rather than 3 more prominent dorsal teeth, and a weaker colour pattern.

*Paschahinnites coruscans* material from western and eastern Australia is morphologically identical to the type material.

Oliver (1911: 527; 1915: 554) recorded one valve of *Paschahinnites coruscans coruscans* of Pleistocene age from Deyrell Islet, Kermadec Islands (Dijkstra & Marshall, 1997: 101), and Taylor (1978) recorded Pleistocene fossils from Aldabra atoll, Indian Ocean. Fossil records of *Paschahinnites coruscans hawaiiensis* of probable Pleistocene age were reported by Waller (1972a: 234) from Midway Island, in the Hawaiian chain. No fossils of *Paschahinnites coruscans* are known from Australia.

### *Pedum* Bruguière, 1792

*Pedum* Bruguière, 1792: pl. 178, figs 1–4 (ICZN, 1999: 17, Article 12.2.7; P. Bouchet, MNHN, pers. comm.). Type species (by subsequent monotypy, Lamarck, 1799: 88): *Ostrea spondyloidea* Lamarck, 1799 (ICZN, 1999: 73, Article 69.3) (= *Ostrea spondyloidea* Gmelin, 1791); Recent, tropical Indo-West Pacific.

**Diagnosis.** Coral-embedded, dorso-ventrally elongate Pedini with a flattened left valve and weakly convex right valve; microsculpture of numerous scabrous radial riblets and closely arranged commarginal lamellae; anterior auricle strongly curved in late ontogeny, posterior auricle almost absent; hinge teeth lacking, resilial insertions high and narrow, ligament migrating strongly in postero-ventral direction; byssal fasciole broad, byssal gape very wide; ctenolium present early in ontogeny, absent late in ontogeny.

**Distribution.** Pleistocene and Recent; Pleistocene of Massaua, Eritrea (Selli, 1973). Tropical Indo-West Pacific, living in the littoral zone embedded in massive hard corals.

**Discussion.** Hertlein (1969: N364) placed *Pedum* in the suprageneric *Hinnites* group, Vaught (1989: 119) in Hinnitini. Habe (1977: 92) established a new subfamily Peduminae [sic, emended to Pedinae] of Pectinidae. Waller (1993: 200, 203) placed *Pedum* in Chlamyidini and reduced Pedinae to a synonym, but we here adopt Pedinae and Pedini as the valid senior synonyms.

### *Pedum spondyloidea* (Gmelin, 1791)

Figs 72D, 74G–I, 75, 76A,C–D

*Pedum* Bruguière, 1792: pl. 178, figs 1–4 (no included species).

*Ostrea spondyloidea* Gmelin, 1791: 3335, no. 109; Dillwyn, 1817: 280.

*Ostrea pedum* Röding, 1798: 170.

*Pedum spondyloidea* [sic] (Gmelin).—Lamarck, 1799: 88.

*Pedum spondyloides* [sic] (Gmelin).—Lamarck, 1801: 136; Bosc, 1802: 250; Bosc, 1824: 245, pl. 10, figs 3–4; Defrance, 1825: 248.

*Pedum spondyloidea* (Gmelin).—Lamarck, 1819: 154; Reeve, 1841: 154, pl. 111, figs 1–5; Reeve, 1860: 61, pl.

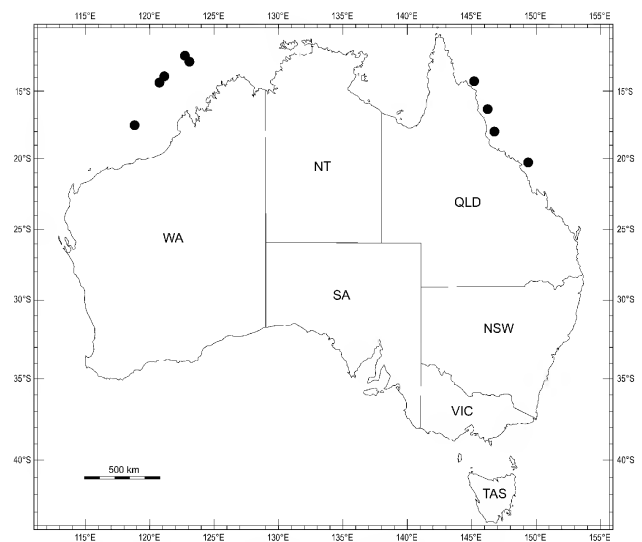


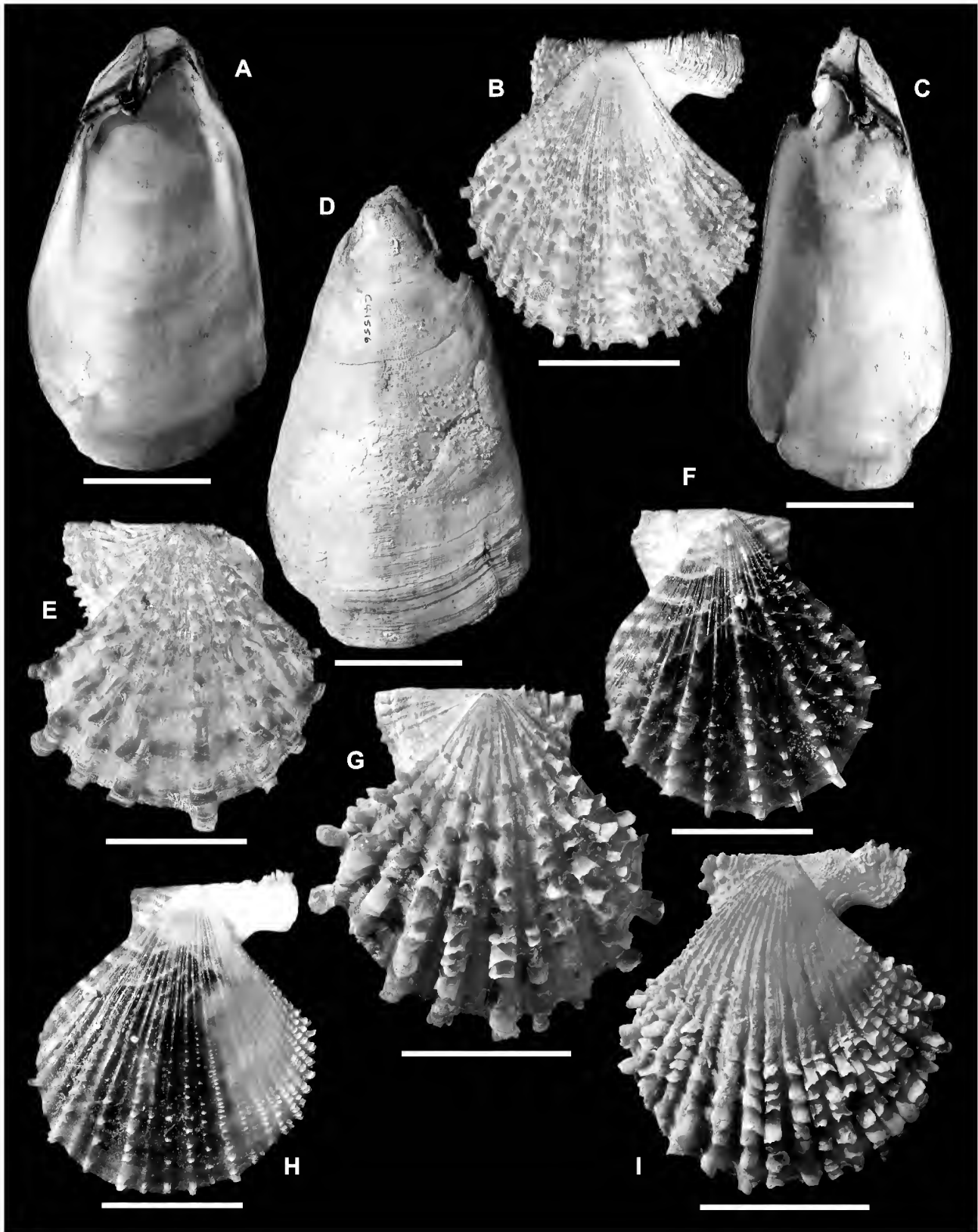
Figure 75. Distribution of *Pedum spondyloideum* (Gmelin).

28, fig. 164, pl. N, fig. 3; G. B. Sowerby II, 1842: 438, pl. 91, figs 1–4; Chenu, 1843: 1, pl. 1, figs 1–3; Sganzin, 1843: 11; Mörch, 1853: 61; Chenu, 1862: 189, fig. 961; Issel, 1869: 105; McAndrew, 1870: 450; Martens, 1880: 313; Cooke, 1886: 136; Shopland, 1896: 235; Shopland, 1902: 179; Sturany, 1905: 141; Lamy, 1928: 220; Cox, 1929: 207; Kuroda, 1931: 82; Lamy, 1935: 306; Viader, 1937: 62; Yonge, 1967: 311, figs 1–8; Hertlein, 1969: N364, figs C.86.1a–b; Habe, 1964b: 174, pl. 53, fig. 15; Waller, 1972a: 226, 230, 254, pl. 8, figs 136–143, figs 21B–22; Habe, 1977: 92; Mastaller, 1978: 138; Mastaller, 1979: 142; Mergner, 1979: 481, 500; Oliver, 1982: 14; Abbott & Dance, 1982: 315, fig; Nielsen, 1986: 8, figs 3A–B [holotype]; Wells & Slack-Smith, 1986: 54; Dijkstra, (1983–1994) 1987: 9, figs; Dijkstra *et al.*, 1989: 24; Dijkstra *et al.*, 1990: 4; Dijkstra, 1991: 40; Lamprell & Whitehead, 1992: [34], pl. 15, fig. 86; Oliver, 1992: 69, 78, text-fig. 1, pl. 14, figs 5a–c; Bernard *et al.*, 1993: 53; Dijkstra, 1997: 332, fig. 41; Dijkstra, 1998a: 34; Dijkstra & Knudsen, 1998: 79, pl. 5, figs 23–24; Savazzi, 1998: 413–421, figs 1–5; Hayami, 2000: 911, pl. 453, fig. 64; Dijkstra & Kilburn, 2001: 293, figs 29–30, Wang, 2002: 247, text-fig. 103; Dharma, 2005: 250, pl. 100, figs 15a–b; Raines & Poppe, 2006: 224–225, pl. 171, figs 1–5; pl. 296, fig. 1; Xu & Zhang, 2008: 93, fig. 263; Huber, 2010: 204; Raines, 2010: 626, pl. 1004, figs 1–2; Dijkstra, 2013: 74, pl. 19, figs 6a–d, pl. 20, figs 6a–b, pl. 32, figs 2a–b. *Pedum spondyloidea* [sic] (Gmelin).—Quoy & Gaimard, 1835: 447, pl. 76, figs 15–21. *Pedum spondyloidea* (Gmelin) var.—P. Fischer, 1858: 340. *Pedum pedum intensum* Iredale, 1939: 340. *Pedum* sp. Mastaller, 1978: 127, 138. *Pedum pedum* (Röding).—Roberts *et al.*, 1982: 116, pl. 34, figs 7–7a.

**Type data.** *Ostrea spondyloidea* Gmelin: holotype (pr) ZMUC BIV-57. Type locality: India.

*Ostrea pedum* Röding: type material lost. Type locality: not indicated. We designate the holotype of *Ostrea spondyloidea* Gmelin, 1791, ZMUC BIV-57, as the neotype of *Ostrea pedum* Röding, 1798.

*Pedum pedum intensum* Iredale: holotype (pr?) AM C.090353. Type locality: Australia, N QLD, GBR, Low Isles, anchorage, in *Porites*. Iredale (1939: 341) stated that “a nice specimen [presumably the holotype of *Pedum pedum intensum*] ... taken in *Porites* in the Anchorage [at Low



**Figure 76.** *A, C, D*, *Pedum spondyloideum* (Gmelin), pair, specimen in Figs 72D, 74H, lv interior (A), rv interior (C), rv exterior (D). *B, E, G, I*, *Scaeo-chlamys livida* (Lamarck), 2 pairs; (B, E) one of three syntypes of *Pecten foliaceus* Quoy & Gaimard, MNHN Moll21186, King George Harbour, Albany, WA; rv exterior (B), lv exterior (E) (MNHN photos by Barbara Buge); (G, I) AM C.097513, off Peel Island, Moreton Bay, QLD, 9 m; lv exterior (G), rv exterior (I). *F, H*, *Scaeo-chlamys squamea* Dijkstra & Maestrati, pair, HM, south passage, Shark Bay, WA, 12–15 m; lv exterior (F), rv exterior (H). Scale bars represent 30 mm (A, C, D, G, I), 20 mm (B, E, F, H).

Isles], measures” H 55, L 44 mm. However, the two valves in C.090353 are different sizes and shapes, the rv being taller and considerably wider than the lv rather than the other way around, as is usual; they apparently represent two specimens.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Lizard Island, 14°40'S 145°28'E, dead (1 pr + 1 v, C.041556); Lizard Island, S side of South Island, 14°42'S 145°27'E, dead, 3–18 m (1 pr, C.375133); Low Isles anchorage, 16°23'S 145°33.8'E, alive (pr [holotype of *Pedum pedum intensum* Iredale, 1939], C.090353); Palm Islands, Orpheus Island, Pioneer Bay, 18°36'S 146°29'E, alive, 3 m (1 pr, C.099281); GBR, Whitsunday Islands, Hayman Island, 20°03.6'S 148°53.5'E, alive (1 pr, C.132393). WESTERN AUSTRALIA: Hugh Morrison (pers. comm., Aug. 2000) has observed live specimens *in situ* in *Porites* at Rowley Shoals, Scott Reef, Seringapatam Reef, Ashmore Reef, Hibernia Reef, and Cartier Reef. —RED SEA: Gulf of Aqaba, Elat, alive, 10–15 m (2 pr, ZMA Moll.142936). —DJIBOUTI: Gulf of Aden, alive, 10–18 m (7 pr, ZMA Moll.143582). —MAURITIUS: 20°11'S 57°32'E, dead (1 pr, C.004966; 2 pr, C.110093; 2 pr, C.132394). —CHAGOS ARCHIPELAGO: Diego Garcia, 6°34'S 72°24'E, dead (3 pr, C.132395). —THAILAND: Phuket Island, Kho Kao Yao, alive, 15–25 m (3 pr, ZMA Moll.145486). —CHINA: Hainan, alive, 0–20 m (1 pr, ZMA Moll.145739). —PHILIPPINE ISLANDS: Cebu Island, 10°17'N 123°56'E, alive (2 pr, C.084282); Mactan, Tambuli, alive, 8–25 m (2 pr, ZMA Moll.146158). —INDONESIA: Moluccas, Ceram, alive, 8 m (1 pr, ZMA Moll.142937). —PAPUA NEW GUINEA: off Madang, N end of Kranket Island, 5°11'S 145°51'E, alive, intertidal (4 pr, C.375348); Madang Harbour, E side of Beliau Island, 5°12'S 145°50'E, alive (1 pr, C.375349). —NEW CALEDONIA: Nouméa, Ile St. Marie, 22°18'S 166°29'E, dead (1 pr, C.375134); idem, NW & W side, dead, 0–2 m (1 pr, C.375135).

**Description.** Shell up to 110 mm high, most specimens 50–70 mm; shape rendered extremely variable by mode of life, transversely oblong in juvenile stage, dorsoventrally elongate in mature stage, left valve flattened, right valve weakly inflated, laterally curved; strongly inequivalve and inequilateral, auricles of left valve not clearly differentiated, of right valve more distinct and unequal than in left valve; whitish or cream, with lateral and umbonal purple spots on right valve, left valve with purple or brown patches or streaks.

Left valve sculptured with numerous delicate, unevenly spaced, scabrous radial riblets, very weak or lacking near ventral margin in mature stage. Right valve with microscopic, closely spaced scabrous radial riblets in early growth stage and closely spaced commarginal lamellae laterally, more prominent near antero-marginal area. Dorsal margin of anterior auricle strongly declined. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium lacking. Outer ligament strongly developed in ventral direction. Resilial insertion elongate, narrow and deflecting. Hinge teeth lacking.

**Dimensions.** Illustrated specimens: QLD, Lizard Island, beach (AM C.041556): tall, narrow pr, rv: H 108.5, L 62.7 mm; lv: H 105.2, L 57.2 mm; D 14.3 mm, D (including curvature of entire specimen) 16.5 mm; smaller single rv: H 66.0, L 55.5 mm.

**Habitat.** Living in tropical shallow waters, embedded in massive heads of scleractinian corals.

**Distribution.** Throughout the tropical Indo-West Pacific, from southern Japan to northern Australia, westwards into the Indian Ocean, into the Red Sea and southwards to South Africa, eastwards into the central Pacific to French Polynesia (not recorded from the Hawaiian Islands) (Waller, 1972: 258; Raines & Poppe, 2006: 224); Red Sea to Japan, 1–24 m (Huber, 2010: 204); Philippines, 3–10 m (Raines, 2010: 626; Dijkstra, 2013: 76); Vanuatu, intertidal zone to 55 m (Dijkstra & Maestrati, 2012: 400). Maximum depth range of live-taken specimens is from the intertidal zone to 55 m. Present specimens from Australia alive at 3–25 m (unpublished data, HHD).

**Remarks.** The present specimens from Australia are morphologically identical to the type material of *Pedum spondyloideum*. This coral-dwelling species is highly variable in shape, due to xenomorphic development in fissures of massive heads of the coral *Porites*.

For information on the functional morphology and ecology of *Pedum* see Yonge (1967), Waller (1972a), Nielsen (1986), Kleemann (1990, 2001), and Savazzi (1998).

### *Scaeoclamys* Iredale, 1929

*Scaeoclamys* Iredale, 1929: 162. Type species (by original designation): *Pecten lividus* Lamarck, 1819; Recent, southwestern, southern and southeastern Australia.

**Diagnosis.** Pedini attached by byssus, prosocline or prosogyrate in form, right valve flattened (distorted in most specimens), left valve convex; macrosculpture of unevenly spaced, strongly scaly, primary radial plicae and secondary interstitial riblets at least in early ontogeny; prominent interstitial shagreen microsculpture on anterior auricle of left valve and on disc at least in early ontogeny; byssal notch deep, ctenolium well-developed. Hinge with prominent resilial and dorsal teeth. Interior weakly plicate.

**Distribution.** Pleistocene [e.g., Japan (Masuda, 1962), Red Sea (Cox, 1929)]–Recent. (Sub)tropical Indo-West Pacific to temperate waters of the NW and SW Pacific, living in the intertidal to sublittoral zones, byssally attached to rocks, gravel or other hard substrates.

**Discussion.** Hertlein (1969: N355) treated *Scaeoclamys* as a junior synonym of *Chlamys* Röding, 1798, placed in the suprageneric *Chlamys* group. Vaught (1989: 118) followed Hertlein. Waller (1993: 203) recognized *Scaeoclamys* as a genus in Chlamymini (i.e., Pedini).

### Key to species of *Scaeoclamys* from Australia

- 1 Shell c. 80 mm high, elongate, solid, lv more inflated than rv, lv with 9–11 unevenly spaced, strongly squamous radial plicae, rv with 18–26 more clustered squamous radial riblets ..... *S. livida*
- Shell with 24–30 scaly radial plicae on lv ..... 2
- 2 Shell c. 60 mm high, elongate, weakly inflated, almost equally convex to prosogyrate, lv with 24–30 and rv with 30–36 unevenly spaced, scaly radial ribs ..... *S. squamea*

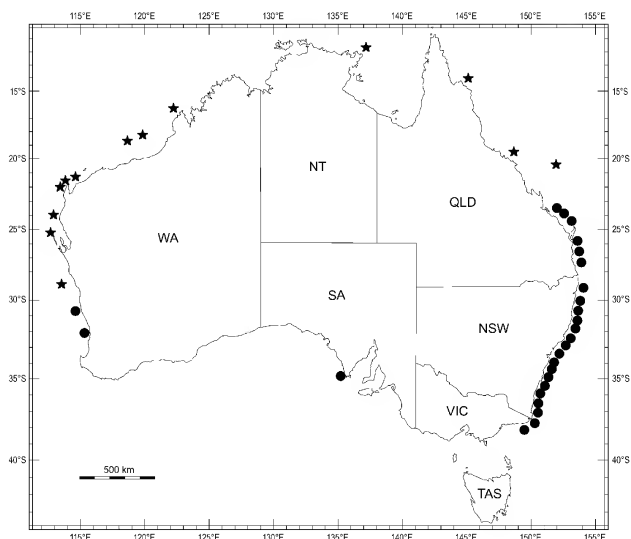


Figure 77. Distribution of *Scaeochlams livida* (Lamarck) (circles) and *S. squamea* Dijkstra & Maestrati (stars).

### *Scaeochlams livida* (Lamarck, 1819)

Figs 76B,E,G,I, 77, 78A,C

*Pecten lividus* Lamarck, 1819: 178; DeFrance, 1825: 246; Deshayes, 1836: 154; Chenu, 1844: 6, pl. 22, figs 2–2b; Dijkstra, 1994: 492, figs 125–129 [holotype].

*Ostrea tegula* Wood, 1828: 7, pl. 2, fig. 3.

*Pecten foliaceus* Quoy & Gaimard, 1835: 445, pl. 76, figs 4–6.

*Pecten tegula* (Wood).—Reeve, 1853: sp. 136, pl. 30, fig. 136; Küster & Kobelt, 1888: 99, pl. 27, fig. 8.

*Chlamys tegula* [sic] (Wood).—Hedley, 1902: 307.

*Scaeochlams livida* (Lamarck).—Iredale, 1939: 354; Allan, 1950: 280, pl. 37, fig. 9; Dijkstra, 1991: 35; Lamprell & Whitehead, 1991: [24], 175, pl. 10, fig. 59; Raines & Poppe, 2006: 230, 231, upper figs; pl. 179, figs 1–5; Morrison & Wells, 2008: 107–110, figs 1A–B; Huber, 2010: 207.

*Scaeochlams livida peroniana* Iredale, 1939: 355; Dijkstra, (1983–1994) 1983: 19, figs.

*Scaeochlams peroniana* Iredale. —Iredale & McMichael, 1962: 11.

*Chlamys* (*Scaeochlams*) *livida* (Lamarck).—Rombouts, 1991: 33, pl. 12, fig. 9.

*Chlamys lividus* [sic] Lamarck.—Coleman, 1982: 89, pl. 269.

*Chlamys* (*Chlamys*) *livida* (Lamarck).—Dijkstra, 1990a: 8.

**Type data.** *Pecten lividus* Lamarck: holotype (pr) MNHN Moll21190. Type locality: “Habite les mers de la Nouvelle Hollande, au port du Roi Georges” [Western Australia, Albany, King George Harbour].

*Ostrea tegula* Wood: holotype not in NHMUK, not traced. Type locality unknown.

*Pecten foliaceus* Quoy & Gaimard: three syntypes (pr) MNHN Moll21186 (one in Fig. 76B, E). Type locality: “Habite le port du Roi-Georges, à la Nouvelle-Hollande” [Western Australia, Albany, King George Harbour]. The specimens are now labelled “N<sup>elle</sup> Zélande”, with the comment that in the “voyage of the Astrolabe”, the locality is indicated as port du Roi-Georges, à la Nouvelle-Hollande; this species certainly does not occur in New Zealand.

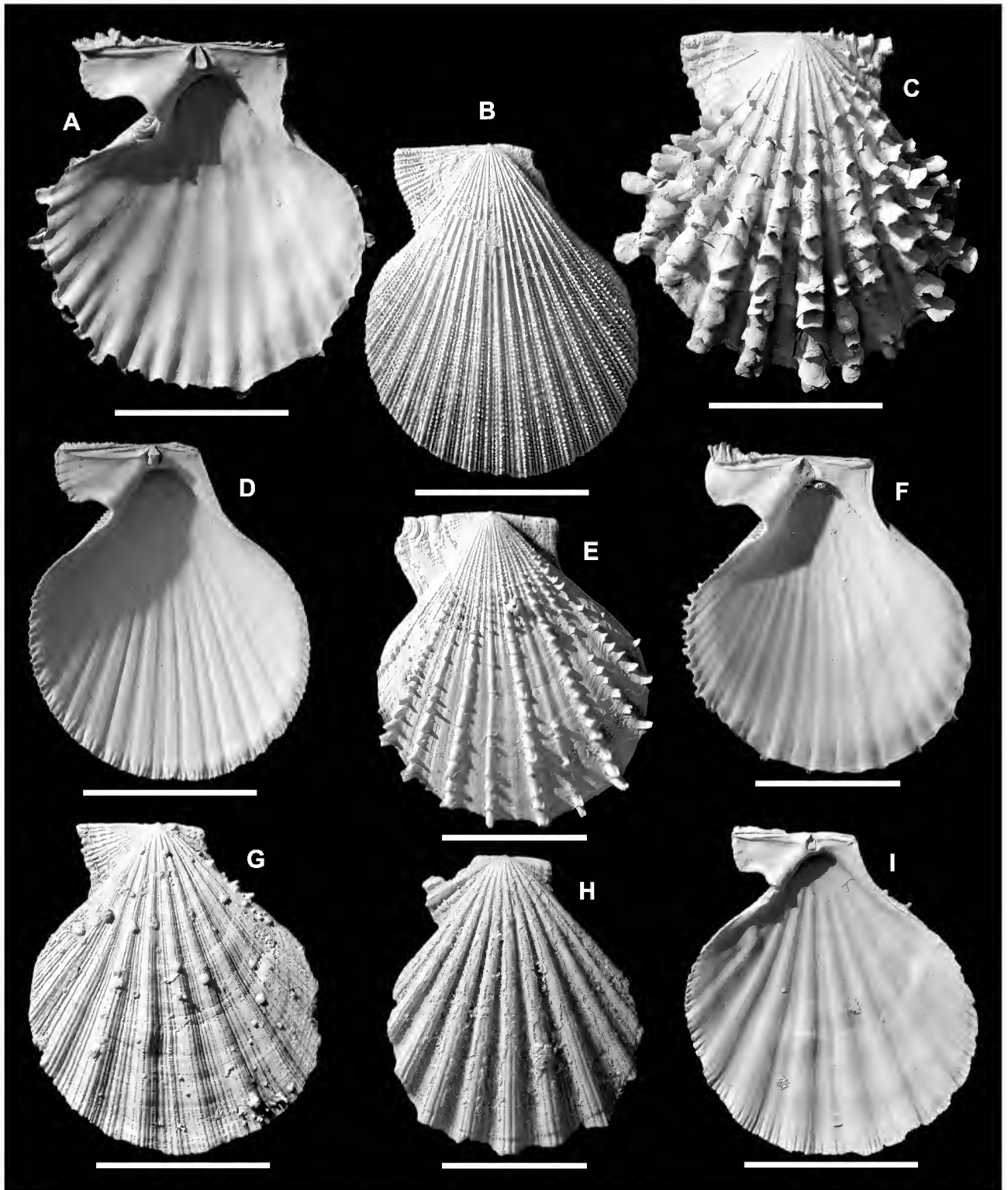
*Scaeochlams livida peroniana* Iredale: holotype AM (not traced). Type locality: Sydney Harbour.

**Comments on type data.** For remarks on type locality and original label of *Pecten lividus* see Dijkstra (1994: 492).

### Additional material examined.

—AUSTRALIA: QUEENSLAND: Off Yeppoon, 22°30'S 151°26'E, dead, 55 m (4 v, C.345816); off Yeppoon, off North Keppel Island, 23°02'S 151°10'E, alive, 51 m (1 pr, C.346599); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, dead (1 v, C.119479); Keppel Bay, Yeppoon, 23°08'S 150°44'E, dead (2 v, C.132009); 1.5 ml NW of South Keppel Island, 23°08'S 150°56'E, alive, 13–20 m (1 pr, C.346600); Keppel Bay, between Outer Rock & Man & Wife, NE of South Keppel Island, 23°08'S 150°56'E, dead, 24–26 m (1 v, C.345829); Capricorn Channel, 4 mls E of North Reef, 23°09'S 151°58'E, dead, 64 m (2 v, C.345817); Capricorn Group, Tryon Island, 23°15'S 151°47'E, alive (2 pr, C.345828); Capricorn Group, North West Island, 23°18'S 151°42'E, alive, 4–5 m (9 v, C.058374; 3 v, C.058374 [in part]; 1 pr, C.345821; 1 pr + 1 v, C.345809); Capricorn Group, off North West Island, 23°18'S 151°42'E, alive, 31 m (2 pr, C.345820); Keppel Bay, 23°25'S 150°55'E, dead (12 v, C.119478); Keppel Bay, 23°25'S 150°55'E, alive, 46 m (5 pr, C.097514); Capricorn Group, Heron Island, 23°26'S 151°57'E, dead (1 v, C.345808); Capricorn Group, One Tree Island, 23°30'S 152°05'E, dead, 55 m (8 v, C.124009; 1 v, C.161005); Capricorn Group, Masthead Island, 23°32'S 151°45'E, dead, 31–37 m (16 v, C.018845; 5 v, C.021214); GBR, 11.5–14 mls SE of Cape Capricorn, 23°36'S 151°24'E, alive, 22–24 m (1 pr, C.075256); Bunker Group, Fairfax Island, 23°51'S 152°22'E, dead (2 v, C.345818); Bunker Group, Lady Musgrave Island, 23°54'S 152°25'E, dead (1 v, C.345819); Port Curtis, 23°55'S 151°23'E, alive, 16–22 m (1 pr, C.012159; 1 pr, C.119489; 1 pr, C.345830); Port Curtis, off Jenny Lind Buoy, 23°55'S 151°23'E, alive (1 pr, C.036985); off Burnett Heads, 24°49'S 152°24'E, dead, 37 m (1 pr, C.153555); Bargara, near Bundaberg, 24°49'S 152°28'E, dead (1 pr, C.345831); off Frazer Island, 25°09'S 153°34'E, dead, 48 m (1 v, C.133006); Hervey Bay, Point Vernon, 25°15'S 152°49'E, dead (1 v, C.119490); Hervey Bay, Pialba, 25°17'S 152°50'E, dead (1 v, C.070047); Hervey Bay, Torquay, 25°17'S 152°52'E, dead (many v, C.346567); Dundowran, 25°18'S 152°46'E, dead, beach (4 v, C.089484); Hervey Bay, Dundowran Beach, 25°18'S 152°46'E, dead (3 v, C.070048; 1 pr, C.083782; 1 pr, C.097522); Hervey Bay, S of Woody Island, 25°18'S 152°56'E, alive, 9 m (2 pr, C.097520); off S end Frazer Island, 25°48'S 153°46'E, dead, 73 m (3 v, C.126657); Tin Can Bay, NE of Gympie, 25°55'S 153°01'E, alive, 18 m (1 pr, C.071595; 2 pr, C.073238; 5 v, C.111787); off S end Frazer Island, 25°57'S 153°34'E, dead, 58–60 m (9 v, C.115069); Mooloolabah, N of Caloundra, 26°41'S 153°08'E, dead (1 v, C.345811); Caloundra, 26°49'S 153°10'E, alive (13 v, C.012776; 20 v, C.054634; 2 pr, C.097521; 3 v, C.132010; 2 v, C.345812); Moreton Bay, 27°15'S 153°15'E, alive (3 pr, C.075246); Moreton Bay, Stradbroke Island, 27°29'S 153°25'E, dead (1 pr, C.346592); Moreton Bay, off Peel Island, 27°30'S 153°21'E, alive, 9–11 m (2 pr, C.097513; 1 v, C.345810); Moreton Bay, off Peel Island, 27°30'S 153°21'E, alive, 3 m (1 pr, C.303767); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, dead, 5–7 m (1 v, C.345807); NEW SOUTH WALES: off Tweed Heads, 28°17'S 153°44'E, dead, 73 m (1 v, C.117650); Cape Byron, 28°37'S 153°38'E, dead (2 v, C.005239); Flat Rock, North Richmond River entrance, 28°52'S 153°34'E, dead (21 v, C.050863); Evans River at South Evans Head, 29°06'S 153°25'E, alive (1 pr, C.344176; 1 v, C.339172); Iluka, Clarence River, 29°24'S 153°21'E, dead (2 v, C.345365); NE of Grafton, Clarence River, Iluka, 29°24.3'S 153°21.1'E, alive (2 pr, C.375775); Clarence River mouth, 29°25'S 153°21'E, dead (4 v, C.345387); SE of Yamba, 29°28'–29°33'S 153°30'–153°25'E, dead, 51–55 m (1 pr, C.345388); Angourie Point, 29°29'S 153°22'E, alive (11 v, C.345391; 15 v, C.346541; 3 pr, C.375776); Minnie Water, E of Grafton, 29°46'S 153°18'E, Middle reef, dead (1 v, C.077062); Woolli, SE of Grafton, 29°52'S 153°15'E, alive (1 pr, C.097519); Woolli Woolli River at Woolli, 29°53'S 153°15'E, rocks & Sargassum, alive (1 pr, C.344177); Redbank (Corindi) River at Red Rock, 29°59'S 153°13'E, alive (1 pr, C.339250); Arrawarra Headland, 30°03'S 153°12'E, dead (6 v, C.124156); Woolgoolga, 30°06'S 153°12'E, alive (3 v, C.119534; 2 v, C.345395; 5 v, C.375773); South West Solitary Island (= Groper Island), W side, 30°09'S 153°13'E, alive, 12–18 m (1 pr, C.345622); S end of Emerald Beach, N of Coff's Harbour, 30°10'S 153°11'E, dead (1 v, C.345397); Coff's Harbour, 30°17'S 153°08'E, alive, 3 m (1 pr, C.346817); Trial Bay, South West Rocks Beach, 30°53'S 153°02'E, dead (1 v, C.345396); Port Macquarie, 31°26'S 152°55'E, dead (many v, C.030636; many v, C.051090); Camden Haven Inlet, 31°38'S 152°49'E, alive (2 pr, C.344179); Crowdy Bay, W of Crowdy Head, 31°50.5'S 152°44.9'E, dead, 50 m (1 v, C.339171); 4–6.5 mls off Manning River, 31°57'–31°59.6'S 152°44'–152°46'E, alive, 40 m (1 pr, C.016861); Point Halliday, near Forster, 32°04'S 152°33'E, dead (15 v, C.345410); Smiths Lake Sand Bar, 32°24'S 152°31'E, dead (1 v, C.345626; 1 v, C.348352; 1 v, C.349345); Broughton Island, near Port Stephens, 32°37'S 152°18'E, dead, 64 m (1 pr, C.083533); Port Stephens, near Hawks Nest, 32°41'S 152°10'E, dead, 5.5 m (3 v, C.345415); Port Stephens, Soldiers Point, 32°42'S 152°04'E, alive (1 pr, C.345366); Port Stephens, 32°42'S 152°05'E, dead, 5.5–13 m (1 v, C.345416); off Port Stephens, 32°42'S 152°15'E, dead, 45 m (1 pr, C.097516); Port Stephens, Wanda Wanda Head, 32°43'S 152°04'E, alive (1 pr, C.346829); Nelson Bay, Port Stephens, 32°43'S 152°08'E, dead (1 pr, C.078670); Port Stephens, off Nelson Head, 32°43'S 152°09'E, alive (5 pr, C.345411); Fingal Bay, Port Stephens, 32°45'S 152°10'E, dead (1 v, C.345412); Nelson Bay, Port Stephens, 32°47'S 152°08'E, alive, 9.2 m (7 pr, C.080081); Newcastle, Merewether Beach, dead (3 v, C.345417); Lake Macquarie, Wangi Wangi Point, 33°05'S 151°36'E, dead (1 v, C.345418); Swansea, Blacksmiths Beach, 33°05'S 151°39'E, dead (16 v, C.089810); Swansea Breakwater, Lake Macquarie, 33°05'S 151°39'E, alive (1 pr, C.115069); Catherine Hill Bay, S end, 33°09'S 151°38'E, alive (2 pr, C.088880); SE of Toukley, Norah Head, 33°17'S 151°34'E, dead (1 v, C.098807); Blue Lagoon Beach, S of The Entrance, 33°22'S 151°29'E, dead (1 v, C.103342); Terrigal, 33°26'S 151°27'E, alive (1 pr, C.087799); Terrigal, 33°27'S 151°27'E, alive (3 pr, C.375777); Broken Bay, Ettalong Beach, 33°30'S 151°20'E, dead (1 v, C.096984); Brooklyn Channel, Hawkesbury River, 33°32'S 151°14'E, dead, 9 m (2 v, C.345430); Broken Bay, Patonga, 33°33'S 151°16'E, dead (7 v, C.103818; 1 v, C.345424); Broken Bay, Challenger Head, 33°35'S 151°14'E, dead (1 v, C.346558); Sydney, Palm Beach, 33°35'S 151°19'E, dead (3 v, C.345437); Sydney N, Pittwater, The Basin, 33°36'S 151°17'E, alive (1 pr, C.345439); Sydney, Broken Bay, Pittwater, 33°37'S 151°18'E, dead (6 v, C.119475); Sydney, Narrabeen Beach, 33°42'S 151°18'E, dead (1 v, C.074067); Sydney N, Collaroy, Long Reef, 33°44'S 151°18'E, alive (4 pr, C.058573; 1 pr, C.073872; 2 pr, C.077395; 3 pr, C.119476; 11 v, C.345442; 1 pr, C.345444; 1 pr, C.346560; 1 pr, C.345624; 5 pr, C.346520; 6 pr, C.346546); Sydney, Long Reef, N side of platform, near Fishermans Beach, 33°44'S 151°18'E, alive (1 pr, C.346805); Sydney, Collaroy Beach, 33°44'S 151°18'E, dead (many v, C.094873); Sydney, Collaroy Beach,





**Figure 78.** *A, C*, *Scaeoclamys livida* (Lamarck), specimen in Fig. 76G, I; rv interior (A), lv exterior (C). *B, D*, *Sempallium aktinos* (Petterd), pair, AM C.303773, under rock slabs, Port Stanvac, SA; lv exterior (B), rv interior (D). *E, F*, *Scaeoclamys squamea* Dijkstra & Maestrati, specimen in Fig. 76F, H; lv exterior (E), rv interior (F). *G, I*, *Sempallium dringi* (Reeve), pair, HM, in rubble at base of coral wall, near NE entrance, Mermaid Reef, Rowley Shoals, off Broome, WA, 33 m; lv exterior (G), rv interior (I). *H*, *Sempallium diana*e (Crandall), lv only, AM C.331999, No. 8 Sand Cay, GBR, QLD, 4–21 m; lv exterior. Scale bars represent 30 mm (A, C), 20 mm (B, D, G, I), 10 mm (E, F, H).

S end, 33°44'S 151°18'E, dead (13 v, C.345443); Sydney, Long Reef, SE side, 33°44'S 151°19'E, alive (2 pr, C.345623); Sydney N, Collaroy, Long Reef, 33°44.6'S 151°18.6'E, alive (3 pr, C.375779); Sydney, off Chinamans Beach, 33°48'S 151°14'E, dead, 2–15 m (1 v, C.345538; 1 v, C.345529; 1 v, C.345530; 3 v, C.346447); Sydney, Clontarf Beach, 33°48'S 151°15'E, dead (1 v, C.345540); Sydney, Port Jackson, North Harbour, 33°48'S 151°16'E, alive (3 v, C.119471; 11 v, C.345471; 4 pr, C.345541; 1 pr, C.346503; 21 v, C.346505); Sydney, North Harbour, Fairlight, 33°48'S 151°16'E, alive (1 pr, C.345621); Sydney, North Harbour, SE side of Reef Bay, 33°48'S 151°16'E, dead (1 pr, C.345543); Sydney, Manly Baths, 33°48'S 151°17'E, dead (2 v, C.074036); Sydney, Balmoral, 33°49'S

151°15'E, dead (16 v, C.346452); Sydney, Balmoral Beach, 33°49'S 151°15'E, dead (1 pr, C.346514); Sydney, Balmoral, N end Edwards Beach, 33°49'S 151°15'E, dead (6 v, C.346439); Sydney, Old Mans Hat Point (Inner North Head), 33°49'S 151°17'E, dead, 7.3 m (1 pr, C.345448); Sydney, Manly Beach, Ocean beach, 33°48'S 151°17'E, alive (42 v, C.345445); Sydney, Port Jackson, Mosman Bay, Sirius Cove, 33°50'S 151°14'E, dead (1 pr, C.345544); Sydney, Port Jackson, Taylors Bay, 33°50'S 151°14'E, alive (3 pr, C.346433; 1 pr, C.346498); Sydney Harbour, Watsons Bay, 33°50'S 151°16'E, alive (1 pr, C.077049); Sydney, Port Jackson, near Watsons Bay, 33°50'S 151°16'E, dead (8 v, C.345528); Sydney Harbour, Nielson Park, Bottle & Glass Rocks, 33°50'S 151°16'E,

alive (9 pr, C.097515; 1 pr, C.119466; 1 pr, C.346467; 1 pr, C.346473; 4 pr, C.346801); Sydney, Port Jackson, Sow & Pigs Reef, 33°83.8'S 151°26.7'E, dead (1 v, C.345542; 1 v, C.346575); Sydney, Port Jackson, Sow & Pigs Reef, 33°50'S 151°16'E, alive (1 pr, C.119468); Sydney Harbour, Snails Bay, Balmain, 33°51'S 151°10'E, dead (1 pr, C.346509); Sydney, Port Jackson, 33°51'S 151°14'E, dead (11 v, C.012152; 3 pr, C.119467; 4 v, C.119470; 3 pr, C.132024); Sydney, Port Jackson, Shark Island, 33°51'S 151°15'E, alive (many, C.346463); Sydney Harbour, Bradleys Head, 33°51'S 151°14'E, alive (2 pr, C.346458); Sydney Harbour, 33°51'S 151°14'E, dead (22 v, C.119465; 8 v, C.345526); Sydney Harbour, Port Jackson, Athol Bight (= Athol Bay), 33°51'S 151°14'E, alive (10 pr, C.346475); Sydney Harbour, Rushcutters Bay, 33°52'S 151°13'E, alive (2 pr, C.346474); Sydney, Woolloomooloo Bay, Graving Dock, 33°52'S 151°13'E, dead (1 v, C.346479); Sydney, Port Jackson, Double Bay, Point Piper, 33°52'S 151°15'E, dead (2 v, C.119469); Sydney, Port Jackson, W side Rose Bay, dead (1 v, C.345473); Sydney, Botany Bay, Brighton, 33°57'–33°57.74'S 151°09'–151°09.28'E, dead (2 v, C.345552); Sydney, Monterey, Botany Beach, 33°57'–33°58.53'S 151°09'–151°08.95'E, dead (2 v, C.345446); Sydney, Botany Bay, Monterey to Ramsgate, 33°58'–33°59.25'S 151°08'–151°08.85'E, dead (4 v, C.345447); Sydney, Long Bay, 33°58'S 151°15'E, dead (6 v, C.132015); Sydney, Botany Bay, 33°59'S 151°12'E, dead (10 v, C.346519); Sydney, Botany Bay, Frenchmans Beach, 33°59'S 151°13'E, dead (4 v, C.346517); Sydney, Botany Bay, Yarra Bay, 33°59'S 151°13'E, dead, beach (6 v, C.346518); Sydney, Botany Bay, Kurnell, 34°0'S 151°12'E, alive (2 v, C.345551; many, C.346515; 1 pr, C.346521; many v, C.346522; 11 v, C.346523; 1 pr, C.346531; many, C.346532; 10 v, C.346533; 3 pr, C.346535; 17 v, C.346536; 7 pr, C.346537; many v, C.346538; 4 pr, C.346539); Sydney, N of Cronulla, Boathourbar Reef, 34°02'S 151°12'E, alive (1 pr, C.345594; 1 pr, C.346570); Sydney S, Cronulla, 34°03'S 151°09'E, alive (1 pr, C.346573); Sydney, Port Hacking, off Jibbon, 34°08.3'S 151°21.7'E, dead, 75–80 m (1 v, C.165599); Sydney, Port Hacking, Gunnamatta Bay, 34°03'S 151°08'E, alive (1 pr, C.132012; 14 v, C.346430; 1 pr, C.346548); Sydney, Port Hacking, Little Turriel Point, Ship Rock, 34°04'S 151°07'E, alive, 4.6–12.2 m (many, C.068504; 2 pr, C.083928); Sydney, Port Hacking, Ship Rock, 34°04'S 151°07'E, alive, 5–10 m (4 v, C.121416; 1 pr, C.345601); Port Hacking, Ship Rock, 34°04'S 151°07'E, alive, 11 m (1 pr, C.345598); Port Hacking, South West Arm, 34°04'S 151°06'E, alive (1 pr, C.100685); Port Hacking, Ship Rock, 34°04'S 151°07'E, alive, 6–20 m (1 pr, C.345558; 1 pr, C.346823; 1 pr, C.346827; 5 pr, C.346838; 6 pr, C.346841); Port Hacking, Gunnamatta Bay, 34°04'S 151°08'E, dead (1 v, C.346502); Simpsons Bay, Port Hacking, The Basin, 34°05'S 151°08'E, dead (6 v, C.345440; 8 v, C.346552); Port Hacking, Bundeena, Simpsons Beach, 34°05'S 151°08'E, dead (13 v, C.346551; 2 v, C.346554; 5 v, C.346556); Port Hacking, Bundeena Beach, 34°05'S 151°09'E, dead (4 v, C.345557); off Botany to Wattamolla, 34°05'S 151°14'E, dead, 64 m (1 pr, C.111398); Shellharbour, 34°35'S 150°52'E, dead (1 pr, C.050133; many v, C.132011); Gerringong, 34°45'S 150°50'E, dead (33 v, C.132025); Seven Mile Beach, S of Gerringong, 34°48'S 150°46'E, dead (12 v, C.345559); 1 ml off Shoalhaven River (= Crookhaven River), 34°53'–34°52.08'S 150°46'–150°47.27'E, dead, 20–27 m (1 v, C.013195); 1 ml off Shoalhaven River, 34°55'S 150°54'E, dead, 20–27 m (1 pr, C.345560); Jervis Bay, Callala Point, 35°0'S 150°43'E, alive (3 pr, C.129700); Jervis Bay, Green Point, 35°0'S 150°44'E, alive, 12 m (6 pr, C.346850; 5 pr, C.346852; 1 pr, C.346863); Crookhaven Bight, Whale Point, 35°0'S 150°49'E, alive, 15 m (1 pr, C.096073; 1 pr, C.345569; 2 pr, C.346806); Jervis Bay, Huskisson, 35°02'S 150°40'E, dead (7 v, C.345562); Jervis Bay, 35°02'S 150°44'E, alive, 27.5 m (1 pr, C.117386; 1 pr, C.345607; 3 v, C.346574); Jervis Bay, Montagu Roadstead, 35°02'S 150°45'E, alive, 12 m (1 pr, C.346853; 2 pr, C.346856; 2 pr, C.346859); Jervis Bay, Beecroft Peninsula, Honeymoon Bay, 35°03'S 150°46'E, dead, 6–8 m (7 v, C.345561; 1 v, C.105690); Jervis Bay, Honeymoon Beach, 35°03'S 150°46'E, alive (2 pr, C.119474; 3 pr, C.345605); off Jervis Bay, 35°05'S 151°02'E, dead, 64–73 m (1 pr, C.132013; 1 v, C.132014); Jervis Bay, Captains Beach, 35°07'S 150°42'E, dead, beach (2 v, C.346565); S side Jervis Bay, Darling Point, 35°07'S 150°44'E, alive, 18 m (3 pr, C.346821); Jervis Bay, Hole in The Wall, 35°07'S 150°44'E, alive, 12 m (1 pr, C.346861); Bendalong, N of Lake Conjola, Ocean beach, 35°15'S 150°32'E, dead (5 v, C.345571); Ulladulla, Warden Head, 35°22'S 150°29'E, dead (1 v, C.101641); 150 m E of Burrill Rocks, 35°23'S 150°28'E, alive, 18 m (1 pr, C.345582); Batemans Bay, Surf Beach (= Surfside Beach), 35°42'S 150°12'E, alive (1 pr, C.345625); Narooma, 36°13'S 150°08'E, dead (19 v, C.132026); off Narooma, Montague Island, 36°15'S 150°13'E, dead (3 v, C.345574); Bernagui, 36°25'S 150°03'E, dead (2 v, C.345576); Eden, Quarantine Bay, 37°04'S 149°52'E, alive (1 pr, C.345595); Twofold Bay, Eden, 37°04'S 149°54'E, dead (2 v, C.345578; many v, C.345581); Twofold Bay, 37°05'S 149°55'E, dead, beach (3 v, C.007671); Twofold Bay, 37°05'S 149°55'E, alive (13 v, C.049894; 1 pr, C.119473); off Eden, 37°05'S 150°0'E, alive (1 pr, C.345580); 5–6 km off Eden, 37°05'S 150°0'E, dead, 46–55 m (1 v, C.050680); VICTORIA: Mallacoota, 37°34'S 149°56'E, alive (2 v, C.119472; 1 pr, C.346907); Western Port, 38°22'S 145°32'E, dead, 15–18 m (6 v, C.346908). **SOUTH AUSTRALIA:** Off Port Lincoln, 34°43'S 135°52'E, alive, 27–37 m (6 pr, ZMA Moll.140823). **WESTERN AUSTRALIA:** Cockburn Sound, S of Fremantle, 32°12'S 115°44'E, alive (2 pr, ZMA Moll. 146179); Fremantle, Woodmans Point, 32°12'S 115°44'E, alive, 5 m (1 pr, ZMA Moll.143779); Fremantle Harbour, Rous Head, 32°03'S 115°45'E, alive, 7 m (1 pr, ZMA Moll.146180); Cervantes, W of Outer Rocks, 30°26.5'S 114°59.1'E, alive, 12–16 m (6 pr, WAM S12554). —NEW CALEDONIA: Pouv, 20°13'S 164°03'E, dead (1 pr, C.346593); 21°0'S 165°0'E, alive (3 pr, C.346595); Nouméa, 22°16'S 166°27'E, alive (1 pr, C.131209); Nouméa, Ile Ste. Marie, 22°18'S 166°29'E, dead, 0–2 m (1 pr, C.346594); Nouméa, Anse Vata, 22°19'S 166°27'E, dead (9 v, C.103737); Nouméa, Anse Vata, Ile Cesar, 22°31.7'S 166°45'E, alive (2 pr, C.346597).

**Description.** Shell up to c. 80 mm high, most specimens smaller than 50 mm; solid, elongate, weakly inflated, left valve of most specimens more convex than right; inequivalve, inequilateral, auricles highly unequal in shape and size, umbonal angle c. 80–85°; most specimens brown or purple, a few specimens white, cream, yellow, orange or

red, weakly maculated with dots and/or streaks.

Left valve sculptured with 9–11 unevenly spaced, strongly squamous radial plicae, varying in prominence, with 1–4 interstitial riblets on central part of disc, reducing in prominence or lacking near ventral margin. Right valve with finer sculpture of c. 18–26 more clustered, unevenly spaced, squamous radial costae, also varying in prominence and extending to ventral margin. Shagreen microsculpture in radial interspaces early in ontogeny, and well-developed on anterior auricle of left valve, almost lacking on right valve. Antimarginal microsculpture in radial interspaces in early radial stage on both valves, also on posterior area of disc in late growth stage on left valve, and on anterior area of disc on right valve, lacking in specimens over 50 mm high. Anterior auricles much larger and longer than posterior ones, bearing 6–10 squamous radial costae on left valve and 3–5 weaker ones on right valve. Byssal notch deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–7 teeth. Hinge with resilial and dorsal teeth prominent in mature specimens.

**Dimensions.** Illustrated specimens: QLD, Moreton Bay, off Peel Island, 9 m (AM C.097513): rv: H 60.4, L 59.0 m; lv: H 61.9, L 62.9 mm; D 22.2 mm (all dimensions include the prominent scales); *Pecten foliaceus* Quoy & Gaimard (Fig. 76B, E): one of three syntypes (pr) MNHN-IM-2000-21186: lv: H 46 mm, L 45 mm, rv: H 42.6 mm, L 41.1 mm; D = 16 mm [scales included]. This specimen is figured in Quoy & Gaimard (1835: pl. 76, figs 4–6) and in Chenu (1843: pl. 22, figs 2–2b). Citations on the internet are: MNHN (MNHN, 2018) and in WoRMS: Aphia ID: 393328 = *Pecten foliaceus* Quoy & Gaimard, 1835.

**Habitat.** Living in the littoral zone, byssally attached under stones and to rocks, metal objects and jetty piles. *Scaeoclamys livida* possibly was introduced into Western Australia recently, as it did not appear in the WAM collection prior to 1967. It has now become exceedingly common in the Fremantle/Rottneest/Cockburn Sound area. It may have begun to displace *Mimachlamys asperima*, which formerly occupied these same areas. Whether the environment near Fremantle has become better suited to *Scaeoclamys livida* and less suited to *Mimachlamys asperima*, or whether recruitment of juveniles of the former species is more efficient than the latter has not yet been determined. In the eastern states, *Scaeoclamys livida* is common in similar habitats, particularly near Sydney, but most specimens do not grow as large as in Western Australia. Many specimens are distorted due to its byssal attachment to hard substrates.

**Distribution.** New Caledonia, southern Queensland, New South Wales, Victoria, South Australia and Western Australia. For colonization in Western Australia see Morrison and Wells (2008). Present specimens alive at 4–51 m.

**Remarks.** This species could easily be confused with the equal-sized, closely similar congeneric species, *Scaeoclamys squamea*, known from the tropical Indo-West Pacific. *Scaeoclamys livida* can be distinguished from *S. squamea* by its larger size (up to 80 mm high, *S. squamea* up to 60 mm), its coarser radial sculpture with hypertrophied scales (*S. squamea* has narrower costae with less developed scales), its almost lacking antimarginal sculpture in early radial stage (in *S. squamea* antimarginal microsculpture is present and prominent on most specimens), and in most specimens being brown or purple (*S. squamea* has more colour gradations and colour patterns).

*Scaeoclamys squamea*  
Dijkstra & Maestrati, 2009

Figs 76F,H, 77, 78E–F

- Chlamys lemniscata* (Reeve).—Abbott & Dance, 1982: 312, fig.; Rombouts, 1991: 15, pl. 6, fig. 2; Xu & Zhang, 2008: 81, fig. 225 (misidentification).  
*Chlamys (Azumapecten) squamata* (Gmelin).—Springsteen & Leobrera, 1986: 328, pl. 93, fig. 11 (misidentification).  
*Scaeoclamys livida* Lamarck.—Dijkstra, 1991: 35; Raines & Poppe, 2009: 230 [in part], pl. 179, fig. 1; Raines, 2010: 628, pl. 1005, figs 6–7 (misidentification).  
*Chlamys (Laevichlamys) lemniscata* (Reeve).—Hayami, 2000: 899, pl. 447, fig. 9.  
*Coralichlamys lemniscata* (Reeve).—Wang, 2002: 183, pl. 5, fig. 5.  
*Scaeoclamys* sp. Slack-Smith & Bryce, 2004: 237.  
*Scaeoclamys squamea* Dijkstra & Maestrati, 2009: 45, pl. 4, figs 32–36; Dijkstra, 2013: 76, pl. 17, figs 5a–b, pl. 20, figs 1a–d, pl. 29, figs 4a–b.  
*Scaeoclamys squamata* (Gmelin).—Raines & Poppe, 2006: 230, pl. 145, figs 6, 7, pl. 180, figs 1–10, pl. 181, figs 1, 2; pl. 182, figs 1, 2, 6, pl. 183, figs 2, 3, 4 (all misidentifications); Raines, 2010: 628, pl. 1005, figs 1–5 (misidentification).

**Type data.** Holotype (pr) NMNS5904-001, paratypes: MNHN, NMNS, 2 ZMA Moll.4.09.007. Type locality: Taiwan, 24°56.5'N 122°01.5'E, 115–170 m, beam trawl, TAIWAN 2001 stn CP 76, leg. Bouchet, Richer & Chan, 07 May 2001.

**Additional material examined.** QUEENSLAND: Lizard Island, near Bird Island, alive, 9 m (2 pr, C.125129); Lizard Island, Granite Bluff, 14°39'S 145°27'E, alive, 3–4.5 m (1 pr, C.165230); Lizard Island, Chinamans Point, 14°40'S 145°27'E, alive, 4 m (1 pr, C.125131; 1 pr, C.125132); Lizard Island, 14°40'S 145°28'E, dead (1 v, C.345814); Lizard Island, Palfrey Island, W side, 14°41'S 145°26'E, alive (1 pr, C.125128); Lizard Island, near Bird Islet, 14°41'S 145°28'E, alive, 9 m (1 pr, C.125130); Three Isles, N of Cooktown, 15°07'S 145°25'E, dead (1 v, C.345813); GBR, Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (1 v, C.028012); GBR, Green Island, near Cairns, 16°46'S 145°58'E, dead (1 v, C.345815); Sinclair Bay, Cape Gloucester, 20°07'S 148°27'E, alive (2 pr, C.097518); Seaforth, N of Mackay, 20°54'S 148°58'E, dead (6 v, C.059193); Swain Reefs, Reef 21-178, SW end, 21°20'S 152°38'E, alive, 2 m (1 pr, C.346598); Swain Reefs, Reef 21-182, 21°22'S 151°41'E, dead, 10 m (5 v, C.345823); Swain Reefs, Reef 21-184, 21°23'S 151°42'E, dead, 10–11 m (2 v, C.161879); Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, alive, 64–73 m (24 v, C.345822; 23 v, C.161008). WESTERN AUSTRALIA: Abrolhos Islands, alive, 24 m (1 pr, WAM S13776); Abrolhos Islands, West of Wallaby Island Group, alive, amongst rubble, weed & rocks (2 pr, HM); Abrolhos Islands, Goss Passage, Beacon Island, 28°28'S 113°47'E, dead (1 v, WAM 488.91); Dirk Hartog Island, S end, entrance to South Passage, alive, in rubble amongst coral & weed (1 pr, ZMA Moll.146468); Dirk Hartog Island, SW coast, alive, 35–40 m, amongst sponges (1 pr, WAM S13777); Shark Bay, Entrance to South Passage, in coral rubble and weed (1 pr, WAM S13778); Dirk Hartog Island, E side of Cape Levelain, South Bay, 25°30'S 113°02'E, dead, beach drift (2 v, WAM 493.91); Dirk Hartog Island, N end, dead, 12 m, in rubble (1 pr, HM); 3–4 miles S of Point Quobba, alive, 27 m, in rubble amongst sponges (1 pr, HM); Point Quobba, 30 miles N of Carnarvon, alive, 27 m, in rubble amongst sponges (1 pr, WAM S13779); SW of Point Cloates, 23°25'S 113°25'E, dead, 60 m (1 v, WAM S12970); S Muiron Island, off SE coast, stn #6, 21°40.86'S 114°20.55'E, dead, 4–8 m, lagoon with bombies and dead coral slabs, diverse hard and soft corals and gorgonians (2 v, WAM S12965); Onslow, W side of Peak Island, 21°36'S 114°30'E, alive, 18 m (2 pr, WAM 492.91); North West Shelf, 19°59'S 117°53'E, dead, 40–42 m, dead (1 pr, WAM 518); 67 n. miles NNE of Cape Lambert, 19°31.4'–29.9'S 117°26.0'–26.4'E, dead, 78 m, sand, flat sponges, gorgonians, long hydroids (1 v, WAM S12977; 1 v, WAM S12979); North West Shelf, 80 n.mls NNE of Port Hedland,

19°03'–19°03.4'S 119°03'–119°03.5'E, dead, 82 m, sand (16 v, C.345806); 120 km N of Broome, Lombardina Bay, near the mission station, 16°32.0'S 122°49.0'E, dead, beach (1 v, NTM P012534). NORTHERN TERRITORY: Arafura Sea, c. 210 ml NE of Croker Island, 8°18'S 133°58'E, dead, 132 m (1 v, C.160970 [in part]); Gove Peninsula, Nhulunbuy town beach, 12°11'S 136°47'E, dead (4 v, C.132629). —PHILIPPINE ISLANDS: Mindanao, off Zamboanga, alive, 12–15 m (1 pr, ZMA Moll.146544); W Samar, Capul Island, alive, shallow water (3 pr, ZMA Moll.146488). —VIETNAM: Nha Trang, Hon Lon Island, alive, 65 m (5 pr, ZMA Moll.145837). —INDONESIA: West Timor, E side of Semau Island, Kupang, dead, 25 m (1 pr, HM).

**Description.** Shell up to c. 60 mm high, most specimens under 40 mm; weakly inflated, almost equally convex to prosogyrate, elongate, inequivalve, inequilateral, auricles highly unequal in shape and size, umbonal angle c. 85–90°; colour highly variable, in almost all intergradations and patterns of white, orange, red, yellow, pink, purple and brown.

Left valve sculptured with c. 24–30 unevenly spaced, scaly radial costae, varying strongly in prominence; 8–9 costae more prominent than others, commencing with c. 8 at 1 mm shell height, increasing by intercostal intercalation and extending to ventral margin. Shagreen microsculpture present in radial interspaces in early growth stage; antimarginal microsculpture present in early radial stage and on posterior area of disc. Anterior auricle much larger and longer than posterior, bearing 6–10 weak, squamous radial riblets and shagreen microsculpture, posterior auricle almost smooth.

Right valve with c. 30–36 unevenly spaced scaly radial costae, varying less in prominence than on left valve. Anterior auricle with 4 weak radial costae, with commarginal lamellae continuous over costae, lamellae prominent dorsally. Posterior auricle almost smooth. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 5–7 teeth. Hinge with moderately weak resilial and dorsal teeth. Interior somewhat plicate.

**Dimensions.** Illustrated specimen: WA, Shark Bay, south passage, 12–15 m (HM): H 43.7, L 39.5 mm.

**Habitat.** *Scaeoclamys squamea* lives in shallow water from the subtidal zone down to the continental shelf, and is often deformed, as a result of its coral-dwelling niche.

**Distribution.** Japan southwards to Western and northern Australia. Taiwan, 75–170 m (Dijkstra & Maestrati, 2009: 45–46); Philippines, 5–50 m (as *Scaeoclamys squamata* and *Scaeoclamys livida*; Raines, 2010: 628; Dijkstra, 2013: 77). Maximum depth range of live-taken specimens is 5–170 m. Present specimens from Australia alive at 3–73 m.

**Remarks.** This species was identified as *Pecten lemniscatus* Reeve, 1853 by Abbott & Dance (1982: 312), but *P. lemniscatus* is known only from the south-western Indian Ocean and is currently placed in *Laevichlamys* (Waller, 1993, p. 204). The two species can be distinguished by the following characters: *Scaeoclamys squamea* has coarser radial macrosculpture on the right valve with fewer radial

**Table 5.** Characters distinguishing *Laevichlamys lemniscata* (Reeve) from *Scaeoclamys squamea* Dijkstra & Maestrati.

characters	<i>Laevichlamys lemniscata</i>	<i>Scaeoclamys squamea</i>
size	c. 50 mm high	c. 50 mm high
shape	flattened, weakly and nearly equally inflated	flattened, weakly and nearly equally inflated
auricles	strongly unequal	strongly unequal
sculpture LV	c. 10 primary squamose ribs	c. 10 primary squamose ribs
secondary radial riblets	3–4 narrow intercostal spinose riblets	very weak (broad) or lacking
microsculpture	commarginal and antimarginal	shagreen and antimarginal
colour	variable	variable

riblets (30–36) than *Laevichlamys lemniscata* (up to 50) and lacks antimarginal microsculpture on the right valve. Moreover, *Scaechlamys squamea* has persistent shagreen microsculpture on the left valve, but shagreen microsculpture is lacking in all species of *Laevichlamys*. Table 5 lists the characters distinguishing these two species.

A closely similar congeneric species is *Scaechlamys squamata* (Gmelin, 1791), known from Japanese waters. *Scaechlamys squamata* differs from *S. squamea* in having fewer prominent radial plicae (5–6) on the left valve (*S. squamea* has 8–9), in having weaker early radial sculpture on the right valve, and a few more radial costae (6–7) on the anterior auricle of the right valve (*S. squamea* has 4) and shagreen microsculpture throughout on both valves (*S. squamea* only on the left valve early in ontogeny). Other characters such as the opisthogyrate form and antimarginal microsculpture are identical.

*Scaechlamys squamea* is a **new record** for Australia.

## *Semipallium* Lamy, 1928

*Semipallium* [Jousseume] Lamy, 1928: 169. Type species (by original designation): *Pecten tigris* Lamarck, 1819 (= *Ostrea flavicans* Linnaeus, 1758). Recent, Indo-West Pacific.

*Belchlamys* Iredale, 1929: 164. Type species (by original designation): *Pecten aktinos* Petterd, 1886. Pleistocene and Recent, southern Australia.

**Diagnosis.** Byssate Pedini with a prosocline disc, evenly or unevenly spaced strong to weak primary radial plicae, delicate secondary radial riblets in late ontogeny of most species; shagreen microsculpture throughout ontogeny; auricles very unequal in size; inner surface plicate with edges carinate close to ventral margin; byssal notch deep, ctenolium well-developed. Hinge with moderately weak resilial and dorsal teeth.

**Distribution.** Early Oligocene–Recent. *Semipallium*

### Key to species of *Semipallium* from Australia

- 1 Shell c. 42 mm high, elongate, moderately prosocline, weakly inflated, valves almost equally convex, auricles highly unequal, lv with 9–11 narrow, widely spaced radial costae, rv more subdivided into 18–20 narrow costae, shagreen microsculpture throughout, byssal notch deep, byssal fasciole narrow, ctenolium well-developed ..... *S. aktinos*
- Shell with 8–10 radial plicae with shagreen microsculpture ..... 2
- 2 Shell c. 50 mm high, elongate, weakly inflated, lv slightly more convex than rv, auricles highly unequal, valves with 8–10 evenly spaced radial plicae with shagreen microsculpture, byssal notch deep, byssal fasciole broad, ctenolium well-developed ..... *S. dianae*
- Shell with 9 primary radial plicae with secondary riblets ..... 3
- 3 Shell c. 30 mm high, subcircular, weakly inflated, lv more convex than rv, auricles highly unequal, valves with 9 primary radial plicae, secondary radial riblets on plicae and interspaces, shagreen microsculpture in interspaces, byssal notch deep, byssal fasciole broad, ctenolium well-developed ..... *S. dringi*
- Shell with 8–10 radial plicae with scaly radial riblets ..... 4
- 4 Shell c. 60 mm high, subtriangularly ovate, prosocline, rather inflated, rv more convex than lv, auricles highly unequal, valves with 8–10 evenly spaced radial plicae, scaly radial riblets on plicae and interspaces, byssal notch deep, byssal fasciole broad, ctenolium well-developed ..... *S. flavicans*
- Shell with 9 primary radial plicae with 5 secondary radial riblets ..... 5
- 5 Shell c. 60 mm high, elongate and prosocline, weakly inflated, lv slightly more convex than rv, auricles highly unequal, valves with 9 evenly spaced primary radial plicae, secondary radial riblets on plicae and interspaces, byssal notch deep, byssal fasciole broad, ctenolium well-developed ..... *S. fulvicostatum*
- Shell with 8–9 narrow on lv and wide on rv weakly defined radial plicae ..... 6
- 6 Shell c. 55 mm high, elongate, almost equally convex, auricles unequal, valves with 8–9 evenly spaced, weakly defined primary radial plicae, narrow on lv, wide on rv, secondary radial riblets on plicae and interspaces, interstitial shagreen microsculpture, byssal notch deep, byssal fasciole broad, ctenolium weakly developed ..... *S. hallae*

*foulcheri* (Tenison Woods, 1865), occurring in the Willungan (= lower Oligocene) part of the Port Willunga Formation, South Australia, and up to Balcombian (middle Miocene) (Beu & Darragh, 2001, p. 69) is the earliest species we know of. Tropical Indo-West Pacific and temperate Australia, living in the littoral to sublittoral zones among coral or coral rubble on soft sediment (usually sand).

**Discussion.** Hertlein (1969: N365) treated *Semipallium* as an extant Indo-West Pacific genus, placed in the *Decatopecten* group. Waller (1993: 202) considered it to be a genus of Chlamyini (i.e., Pedini), and discussed the close morphological similarity to *Mamupecten* Monterosato, 1872 (Waller, 1991: 24–25).

The identical characters of *Semipallium* and *Belchlamys* were discussed for the first time by Beu & Darragh (2001: 67). Iredale (1929: 164) proposed *Belchlamys* expressly as a subgenus, along with *Talochlamys* and *Veprichlamys*, apparently of *Mimachlamys* Iredale, 1929, although the intended genus is far from obvious.

### *Semipallium aktinos* (Petterd, 1886)

Figs 78B,D, 79, 80A–B

*Pecten aktinos* Petterd, 1886: 320.

*Pecten bednalli* Tate, 1887a: 73, pl. 4, figs 3a–b.

*Chlamys bednalli* (Tate).—Hedley, 1900: 495, pl. 25, figs 10–13.

*Pecten actinos* [sic] Petterd.—Tate & May, 1901: 441.

*Chlamys aktinos* (Petterd).—Pritchard & Gatliff, 1904a: 265; Hedley, 1918a: M8; May, 1921: 10; May, 1923: pl. 3, fig. 10; Wells & Bryce, 1985: 158, fig. 580; Richmond, 1992: 85, fig. 121.

*Mimachlamys (Belchlamys) aktinos* (Petterd).—Iredale, 1929: 164.

*Scaeoclamys aktinos* [sic] (Petterd).—Macpherson & Chapple, 1951: 145.

*Chlamys (Camptonectes) aktinos* Petterd [sic].—Gabriel, 1956: 14.

*Belchlamys aktinos* [sic] (Petterd).—Cotton, 1953: 22; Cotton, 1961: 100, fig. 86.

*Mimachlamys aktinos* (Petterd).—Iredale & McMichael, 1962: 11.

*Chlamys aktinos* [sic] (Petterd).—Macpherson & Gabriel, 1962: 303, fig. 345.

*Chlamys (Chlamys) aktinos* (Petterd).—Dijkstra, (1983–1989) 1983: 3, figs; Ludbrook & Gowlett-Holmes, 1989: 642.

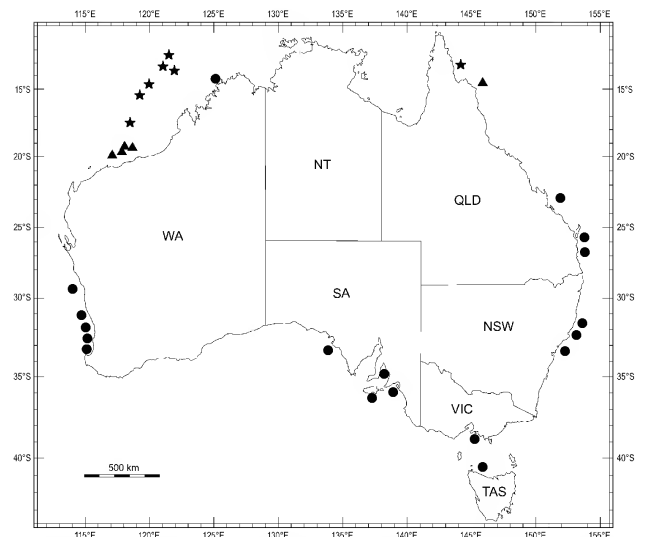
*Chlamys (Belchlamys) aktinos* (Petterd).—Rombouts, 1991: 22, pl. 8, fig. 5; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 49.

*Semipallium aktinos* (Petterd).—Beu & Darragh, 2001: 75, figs 18A–D, 21A–G; Raines & Poppe, 2006: 232–233, upper figs; pl. 184, figs 1–7; Huber, 2010: 206.

**Type data.** *Pecten aktinos* Petterd: possible syntypes (QVM9: 105—lv; 1 pr QVM9: 106—pr). Type locality: Northwest coast of Tasmania.

*Pecten bednalli* Tate: lectotype (pr) SAM D14170, herein designated, possible paralectotypes (1 pr + 5 v, SAM D16381; 1 v, SAM D15644). Type locality: South Australia, Aldinga Bay, near Adelaide.

**Comments on type data.** The articulated possible syntype QVM9:106 (H 39 mm, W 34 mm, D 14 mm) of *Pecten aktinos* is closest to the measurements of the original description (“Long. 42 mm, lat. 36 mm, alt. 15 mm”), but cannot be considered a syntype with any certainty as it does not bear a label identifying it as Petterd material.

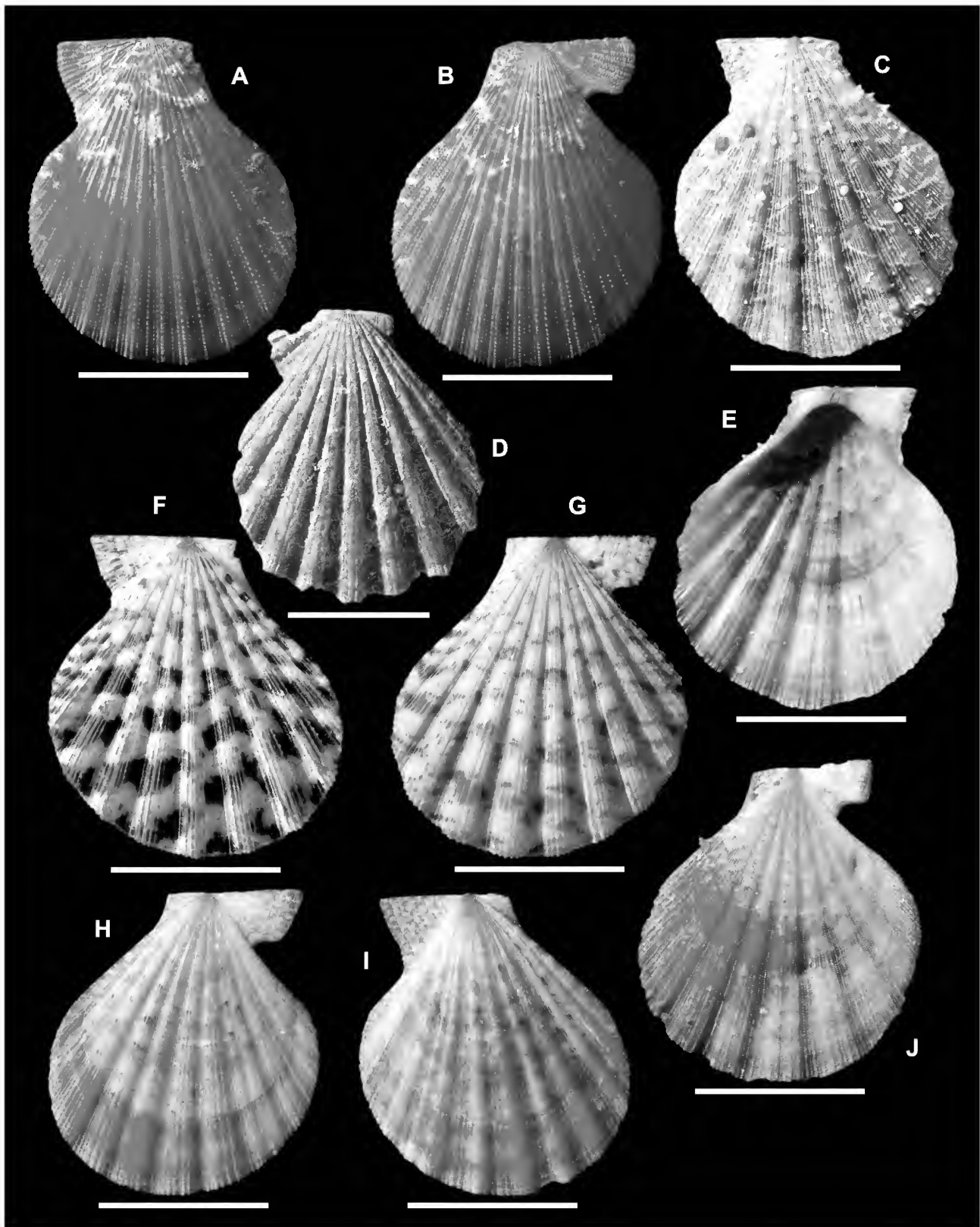


**Figure 79.** Distribution of *Semipallium aktinos* (Petterd) (circles), *S. dianae* (Crandall) (stars) and *S. dringi* (Reeve) (triangles).

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Capricorn Channel, 16.8 ml NE of North Reef, 23°08'S 152°12'E, dead, 115 m (1 v, C.345467); off S end Frazer Island, 25°48'S 153°46'E, dead, 73 m (1 v, C.345468); Alexandra Head, 26°40'S 153°07'E, dead (6 v, C.119535); Caloundra, 26°49'S 153°10'E, dead (5 v, C.345469), 1 v, C.012778; many v, C.097504; 4 v, C.119536; 1 v, C.132068; 2 v, C.132069; 1 v, C.345465); NE of Cape Moreton, 26°55'S 153°33'E, dead, 115–124 m 3 v, C.345379; 2 v, C.345466); E of Moreton Bay, 26°55'S 153°33'E, dead, 115–176 m (1 v, C.345469). NEW SOUTH WALES: Woolgoolga, 30°06'S 153°12'E, dead (1 v, C.132067); South West Solitary Island (Groper Island), 30°09'S 153°13'E, alive (2 pr, C.099833); South West Solitary Island (Groper Island), 30°09'S 153°13'E, alive, 6–9 m (2 pr, C.137033); South West Solitary Island (Groper Island), 30°16.2'S 153°22.7'E, alive, 9 m (1 pr, C.157579); Split Solitary Island, N side, 30°15'S 153°11'E, dead, 9–12 m (1 v, C.156352); Camden Haven Inlet, 31°38'S 152°49'E, alive (2 pr, C.344184); S of Port Macquarie, 32°02'S 152°40'E, dead, 47 m (3 v, C.345353); Sydney, Collaroy Beach, S end, 33°44'S 151°18'E, dead (3 v, C.119533); Sydney, Port Jackson, Watsons Bay, Green Point, 33°50'S 151°16'E, alive, 15 m (1 pr, C.008095); Sydney, Port Jackson, off Sow & Pigs Reef, 33°50'S 151°16'E, dead, 9 m (1 pr, C.097505); Sydney, Port Jackson, 33°51'S 151°14'E, dead (1 v, C.132066). VICTORIA: Sandy Point, Western Port, just N of North Arm, 38°24'S 145°14'E, dead, 7.5 m (1 v, C.127100); Rye, Port Phillip, 38°25'S 144°49'E, dead (1 v, C.345413); Western Port Bay, Flinders, 38°29'S 145°01'E, dead (2 v, C.119532). TASMANIA: Black River Beach, near Stanley, 40°51'S 145°18'E, dead (1 pr, C.097503; 1 pr, C.103821); Devonport, W of Don River mouth, 41°09'S 146°19'E, dead, 7 m (2 v, C.143410). SOUTH AUSTRALIA: Nuyts Archipelago, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (3 v, C.345414); Spencer Gulf, Tumbay Bay, 34°22'S 136°08'E, dead (2 v, C.095652); Port Stanvac, 35°06'S 138°28'E, dead (7 v, C.303773); Port Noarlunga, Horseshoe Reef, 35°08'S 138°27'E, alive, 3 m (2 pr, C.114446); Royston Head, 35°11'S 136°51'E, dead (4 v, C.008665); Neptune Islands, 35°17'S 136°05'E, dead, 73 m (1 v, C.019245); Aldinga Bay, 35°17'S 138°29'E, alive (1 pr, C.007882); S coast of Kangaroo Island, 36°0'S 137°11'E, dead (8 v, C.090610); Yorke Peninsula, Edithburgh Jetty, alive, 4–5 m (2 pr, SAM D18998); Sir Joseph Banks Group, reef NW of Hareby Island, alive, 2–6 m (1 pr, SAM D18999); Encounter Bay, Whalers Wharf, The Bluff, alive, 2 m (1 pr, SAM D19000); O'Sullivan's Reef, alive, 3 m (1 pr, SAM D19001); Gulf of St Vincent, c. 3 km N of Wirrina boat ramp, alive, 5–6 m (3 pr, SAM D19002); Nuyts Archipelago, N of St Francis Island, dead, 27–37 m (2 v, SAM D190003). WESTERN AUSTRALIA: Recherche Archipelago, off Remark Island, 34°04'S 122°0'E, dead (1 pr, C.132062); Great Australian Bight, E of Hood Point, 34°21'S 121°16'E, dead, 82 m (3 v, C.345451); off Albany, 35°14'S 118°30'E, dead, 124 m (1 v, C.345464); South Point, S side of Two Peoples Bay, near Albany, 34°58'S 118°11'E, dead (1 v, C.099888; 1 v, C.345450); off Albany, 35°09'S 117°46'E, dead, 62 m (1 v, C.345463); S of Wilson Inlet, 35°12'S 117°0'E, dead, 73–77 m (2 v, C.345449); E of Cheyne Bay, 34°55'S 119°0'E, dead, 71–76 m (1 v, C.117452); Windy Harbour, 34°50'S 116°0'E, dead (1 v, C.345455); South Cowaramup, 33°53'S 114°59'E, dead, beach (2 v, C.345454); Geographe Bay, 33°37'S 115°18'E, dead (3 v, C.018016); Dunsborough, 33°36'S 115°06'E, alive, 0–3.6 m (1 pr + 1 v, C.345456); Garden Island, S of Perth, 32°14'S 115°41'E, dead, beach (3 v, C.345457); Fremantle, 32°03'S 115°44'E, dead (1 v, C.345458); Fremantle, Hall Bank, 32°02'S 115°43'E, alive, 8 m (2 pr, C.345459); Perth, Cottesloe Beach & nearby beaches, 31°98.3'S 115°75'E, dead (many v, C.345476); Scarborough, near Perth, 31°54'S 115°44'E, dead (1 v, C.345458); Triggs, near Perth, 31°52'S 115°45'E, dead (1 v, C.345452); W of Jurien Bay, 30°16'–30°17.9'S 114°39.0'–114°39.9'E, dead, 82 m (1 v, C.345462); W of Green Head, 30°04'S 114°47'E, dead, 51 m (1 v, C.300339); W of Green Head, 29°45'S 114°42'E, dead, 50 m (1 v, C.345461); approx. 24 km SW Dongara, 29°20'–29°21'S 114°43'–114°42'E, dead, 40 m (2 v, C.345460); Kimberley, Long Reef, S side, 14°01'S 125°44'E, dead (1 v, WAM 522).

**Description.** Shell up to c. 42 mm high, most specimens under 30 mm; elongate, moderately prosocline, weakly





**Figure 80.** *A, B*, *Semipallium aktinos* (Petterd), specimen in Fig. 78B, D, lv exterior (A), rv exterior (B). *C, E, J*, *Semipallium dringi* (Reeve), specimen in Fig. 78G, I, lv exterior (C), lv interior (E), rv exterior (J). *D*, *Semipallium diana* (Crandall), specimen in Fig. 78H, lv exterior. *F, G*, *Semipallium flavicans* (Linnaeus), AM C.131558, subtidal, Broadhurst Reef, E of Townsville, GBR, QLD; lv exterior (F), rv exterior (G). *H, I*, *Semipallium fulvicostatum* (A. Adams & Reeve), AM C.131560, subtidal, Broadhurst Reef, E of Townsville, GBR, QLD; rv exterior (H), lv exterior (I). Scale bars represent 20 mm (A–C, E–J), 10 mm (D).

inflated, valves almost equally convex, auricles highly unequal in shape and size, umbonal angle c. 85°; colour variable, yellow, purple, pink to reddish and brown, with patches and streaks, interior shining white or tinted pink.

Left valve sculptured with 9–11 low, narrow, widely spaced primary radial costae or weak plicae, variable in prominence, more subdivided on right valve into 18–20 narrow costae, increasing by intercalation to 60–80 delicate,

narrow, closely spaced, weakly squamous radial riblets near ventral margin. Shagreen microsculpture present throughout. Anterior auricles much larger and longer than posterior, bearing c. 8–10 radial riblets on left valve and c. 6 on right; posterior auricles bearing fewer, weaker riblets. Byssal notch relatively deep, byssal fasciole rather narrow. Functional ctenolium well-developed, with c. 5 teeth. Internal plicae with carinate edges around ventral margin. Hinge with moderately prominent resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: SA, Port Stanvac, under rock slabs (AM C.303773): rv: H 38.4, L 32.4 mm; lv: H 38.6, L 31.5 mm; D 11.5 mm.

**Habitat.** Living cryptically in the littoral zone, byssally attached under rocks or on ledges, and hidden in reef crevices, many specimens covered with sponges.

**Distribution.** This endemic species is most common in temperate waters, and is not recorded from the tropical Indo-West Pacific outside Australia. Present specimens alive in the intertidal zone to 15 m.

**Remarks.** A closely similar congeneric cryptically living species is *Semipallium hallae* (Cotton, 1960), known only from South Australia. *Semipallium hallae* differs from *S. aktinos* in its larger size (up to c. 55 mm high, *S. aktinos* up to 42 mm), in having a more nearly circular shape (*S. aktinos* is more elongate), in having larger posterior auricles (in *S. aktinos* very small, almost rudimentary), in having 7–8 broad primary radial plicae on both valves (*S. aktinos* has 9–11 narrow plicae on the left valve, more subdivided on the right valve), and in its purplish, almost monochrome coloration (*S. aktinos* is more polychrome).

### *Semipallium diana* (Crandall, 1979)

Figs 78H, 79, 80D

*Chlamys diana* Crandall, 1979: 114, figs 3–8; Matsukuma *et al.*, 1991: 137, 185, pl. 135, fig. 9; Lan, 1993: 161, 219, fig. *Semipallium diana* (Crandall).—Dijkstra, 1991: 38; Rombouts, 1991: 59, pl. 5, figs 3–3b; Dijkstra & Kastoro, 1997: 270, figs 135–137; Dijkstra, 1998a: 36, pl. 6, figs 5–8; Hayami, 2000: 901, pl. 448, fig. 19; Raines & Poppe, 2006: 238–239, lower figs; pl. 188, figs 1–6; Huber, 2010: 206; Raines, 2010: 632, pl. 1007, figs 1–6; Dijkstra, 2013: 80, pl. 21, figs 2a–d, pl. 25, figs 5a–b, pl. 30, figs 2a–b.

**Type data.** Holotype (pr) National Taiwan Museum, Taipei, TM7911, 3 paratypes (pr): PRC collection, 2 TCL collection. Type locality: Japan, Ryukyu Islands, alive, c. 30 m.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: N side No. 8 Sandy Cay, 13°21'S 143°57'E, dead, 4–21 m (1 v, C.138324). WESTERN AUSTRALIA: Rowley Shoals, Clerke Reef, off N end of reef, approx. 17°10'S 119°20'E, outer reef slope, dead, 9–18 m (1 v, WAM1615.82); Scott Reef, approx. 14°0'S 121°45'E, dead, 34 m (2 v, WAM); Scott Reef, N of North Entrance, approx. 14°0'S 121°45'E, dead, 42 m (5 v, WAM); Scott Reef, NE side, approx. 14°0'S 121°45'E, dead, 18 m (1 v, WAM); Seringapatam Reef, 13°40'S 122°05'E, dead (1 v, WAM); Cartier Island, 12°32'S 123°33'E, dead, 10–20 m (2 v, WAM); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 20–25 m (1 v, WAM); Ashmore Reef, NE corner, 12°17'S 123°02'E, dead, 20 m (1 v, WAM); Hibernia Reef, approx. 11°58'S 123°19'E, dead, 15–18 m (1 v, WAM); Hibernia Reef, approx. 11°58'S 123°19'E, in lagoon, dead, 3 m (1 v, WAM).—JAPAN: Kagoshima, Amami Islands, Uke Islet, alive, 20–24 m (5 pr, ZMA Moll.146226); Okinawa, Seragaki, alive, 35 m (5 pr, ZMA Moll.141057).—PHILIPPINE ISLANDS: Cebu, Punta Engano, alive, 80–180 m (4 pr, ZMA Moll.144551); Cebu, off Sogod, alive, 120–180 m (1 pr, ZMA Moll.144553).—PAPUA NEW GUINEA: Port Moresby, Quayles Reef, alive, 6 m (1 pr, ZMA Moll.141103).—SOLOMON ISLANDS: Guadalcanal, Bonegi, alive, 30 m (2 pr, 3 v, ZMA Moll.141936); Russell Islands, alive, 18 m (2 pr, 1 v, ZMA Moll.142218).

**Description.** Shell up to 70 mm high (Huber, 2010), most specimens under 35 mm; elongate, weakly inflated, left valve

slightly more convex than right, equivalve, subequilateral, auricles very unequal in size, umbonal angle 80–90°; colour highly variable, brown, orange, red, purple or yellow, many specimens creamy-yellowish with brown and milky white dots and streaks.

Both valves with 8–10 (most specimens with 9) evenly spaced radial plicae, covered with shagreen microsculpture. Delicate radial riblets develop on plicae and in interspaces near ventral margin, more prominent on right valve. Anterior auricle with 5–6 radial riblets, posterior with 2–4. Dorsal margin straight on anterior, somewhat declined on posterior auricle. Inner surface plicate, striated near ventral margin of some specimens. Resilifer narrowly triangular. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–7 teeth. Internal plicae with carinate edges around ventral margin. Hinge with weak resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, No. 8 Sand Cay, 4–21 m (AM C.331999), single lv: H 41.5, L 35.4 mm.

**Habitat.** Living in the littoral zone to the uppermost bathyal zone, byssally attached to the undersides of coral or amongst coral rubble on sandy bottoms.

**Distribution.** Western and southwestern Pacific, from southern Japan southwards to the Philippines, Indonesia and northwestern Australia, and eastwards to the Solomon Islands (Raines & Poppe, 2006: 238); Japan, Okinawa to Indonesia, 10–150 m (Huber, 2010: 206); Philippines, 20–200 m, dead; 80–120 m, alive (Raines, 2010: 632; Dijkstra, 2013: 80); Papua New Guinea (Dijkstra, 1998a: 36). Maximum depth range of live-taken specimens is 10–200 m. Present specimens from Australia dead at 3–34 m. *Semipallium diana* is a **new record** for Australia.

**Remarks.** The present specimens are indistinguishable in all characters from the type material. The most closely similar congeneric species is *Semipallium crouchi* (Smith, 1892), known from the western Indian Ocean. *Semipallium crouchi* differs from *S. diana* in having narrower, more prominent radial plicae and in its colour (brownish-purplish maculated, *S. diana* brightly polychrome).

### *Semipallium dringi* (Reeve, 1853)

Figs 78G,I, 79, 80C,E,J

*Pecten dringi* Reeve, 1853: sp. 152, pl. 33, fig. 152b; E.A. Smith, 1884: 115 (in part); Küster & Kobelt, 1888: 207, pl. 55, figs 7–8 (in part).

*Chlamys dringi* (Reeve).—Dautzenberg & Bouge, 1933: 426 (in part).

*Semipallium kengaluorum* Dijkstra, 1986: 24, figs.

*Semipallium fuvicostatum* (A. Adams & Reeve, 1850).—Wagner, 1989b: 114 (lectotype designation; misidentification).

*Semipallium dringi* (Reeve).—Dijkstra, 1991: 39; Raines & Poppe, 2006: 240–241, upper figs; pl. 191, figs 1–7; Dijkstra & Moolenbeek, 2008: 20; Huber, 2010: 207; Raines, 2010: 634, pl. 1008, figs 1–7; Dijkstra, 2013: 81, pl. 21, figs 3a–d, pl. 30, figs 3a–b.

*Chlamys (Complicachlamys) dringi* (Reeve).—Wells, Slack-Smith & Bryce, 2000: 42.

*Complicachlamys dringi* (Reeve).—Dharma, 2005: 250, pl. 100, figs 11a–d.

**Type data.** *Pecten dringi* Reeve: lectotype (pr) NHMUK 1950.11.14.28, designated by Wagner (1989b: 114, fig.

5), 2 paralectotypes (pr) NHMUK1950.11.14.29–30. Type locality: Australia, Northern Territory, Bathurst Island.

*Semipallium kengaluorum* Dijkstra: holotype (pr) ZMA Moll.386024, 8 paratypes (pr): NHMUK1987056, 1 MNHN21273, 1 RMNH.MOL.55994, 1 USNM859393, 4 ZMA Moll.3.86.025 (2), 3.86.026 (2). Type locality: Solomon Islands, Russell Island, alive, 35 m.

**Comments on type data.** For information on type material of *Semipallium dringi* and comparison with *S. kengaluorum* see Dijkstra (1991: 39).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, S end of Lizard Island, The Lagoon, coral reef near South Island, dead, 2–3 m (1 pr, R. C. Willan colln). WESTERN AUSTRALIA: North West Shelf, 45 n.ml NNE of Port Hedland, 19°55.2'–19°55.6'S 117°56.0'–117°55.6'E, dead, 40 m (1 v, C.157712); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30.9'–19°28.2'S 118°49.2'–118°55.4'E, dead, 36–37 m (1 v, C.157681; 1 v, C.157682); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04.6'–19°04.3'S 118°47.4'–118°47.6'E, dead, 82 m (1 v, C.149223); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04.4'–19°04.2'S 119°04.4'–119°00.7'E, dead, 82 m (1 v, C.157692); North West Shelf, 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (many v, C.146786); in rubble at base of vertical wall of coral, near NE entrance, Mermaid Reef, Rowley Shoals, off Broome, dead, 33 m (1 pr, HM). —CHRISTMAS ISLAND: 10°30'S 105°40'E, dead (1 pr, C.374866); sand and rubble, Flying Fish Cove, dead, 8 m (1 pr, HM). CORAL SEA: Flinders Cay, dead, dredged 35–50 m (1 pr, HM). —PHILIPPINE ISLANDS: Masbate, alive, 15–20 m (1 pr, ZMA Moll.146369). —INDONESIA: Alor Islands, Ternate Island, S end, dead, 5 m (1 pr, ZMA Moll.146198; 1 pr, HM). —MARSHALL ISLANDS: Kwajalein Atoll, alive, 12 m (1 pr, ZMA Moll.146546). —PAPUA NEW GUINEA: Port Moresby, Bootless Bay, 9°30'S 147°15.5'E, alive, 20 m (1 pr, NTM P005577). —FIJI ISLANDS: Viti Levu, Beqa Island, alive, 27 m (1 pr, ZMA Moll.144567).

**Description.** Shell up to 66 mm high (Huber, 2010), most specimens smaller, to 30 mm; weakly inflated, left valve slightly more convex than right, subcircular, somewhat higher than wide, almost equivalve and equilateral, auricles highly unequal in shape and size, umbonal angle c. 90°; colour variable, creamy-orange with purple, yellow or pale cream blotches, right valve paler and with yellow blotch near umbo.

Both valves sculptured with 9 evenly spaced radial plicae; plicae each bear 5 prominent secondary radial riblets; 3–4 weaker secondary riblets in interplial spaces. Secondary riblets on right valve bear delicate, closely spaced commarginal lamellae. Shagreen microsculpture present in radial interspaces. Anterior auricles larger and longer than posterior, bearing 8–10 radial costae on left valve and 5–6 on right; posterior auricles almost smooth. Byssal notch moderately deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–7 teeth. Internal plicae with edges carinate around ventral margin. Hinge with weak resilial and dorsal teeth.

**Dimensions.** Illustrated specimens: In rubble at base of vertical coral wall, 33 m, near NE entrance, Mermaid Reef, Rowley Shoals, off Broome, WA, dead (pr, HM); rv: H 38.3, L 35.0 mm; lv: H 38.8, L 34.1 mm; D 8.2 mm. Other large specimen: sand and rubble, Flying Fish Cove, Christmas Island, dead, 8 m (pr, HM); rv: H 42.2, L 39.6 mm; lv: H 43.3, L 39.4 mm; D 11.4 mm.

**Habitat.** Living in the littoral to sublittoral zones, byssally attached to undersides of coral slabs or boulders or amongst coral rubble on clean sandy bottoms.

**Distribution.** Tropical Indo-West Pacific, from the Philippines southwards to northern Australia and eastwards into the central Pacific to the Marshall and Fiji Islands (Raines & Poppe, 2006: 240); Philippines to Indonesia, 18–56 m (Huber, 2010: 207); Philippines, 7–80 m (Raines, 2010: 634; Dijkstra, 2013: 81); Indonesia (Dijkstra & Moolenbeek, 2008: 21). Maximum depth range of live-taken

specimens is 7–80 m. Present specimens from Australia dead at 2–82 m.

**Remarks.** *Semipallium dringi* has been identified under different names by several previous authors, before Wagner (1989b) designated a lectotype for *Pecten dringi*. The type lot includes specimens of two nominal taxa, *Semipallium dringi* and *Complicachlamys wardiana* Iredale, 1939. *Semipallium dringi* was also synonymized with *S. fulvicostatum* (A. Adams & Reeve, 1850) by Wagner (1989b), but *S. fulvicostatum* differs from *S. dringi* by having a more strongly prosocline shape (*S. dringi* is subcircular), coarser and more prominent shagreen microsculpture throughout (intercostal only in *S. dringi*), antimarginal microsculpture laterally (lacking in *S. dringi*), and in its coloration (*S. dringi* is more polychrome).

### *Semipallium flavicans* (Linnaeus, 1758)

Figs 80F–G, 81, 82A–B

*Ostrea flavicans* Linnaeus, 1758: 698, no. 173; Dijkstra, 1999: 425, figs 9C–D (lectotype).

*Pecten tigris* Lamarck, 1819: 171, no. 30; DeFrance, 1825: 243; G. B. Sowerby II, 1842: 68, pl. 14, figs 95–96; Philippi, 1845: 101, pl. 1, figs 6a–c; Reeve, 1853: sp. 77, pl. 20, fig. 77; Küster & Kobelt, 1888: 129, pl. 35, fig. 10; Dijkstra, 1994: 482, pl. 17, figs 70–74; Dijkstra, 1994: 482, pl. 17, figs 70–73 (lectotype).

*Pecten (Pallium) tigris* Lamarck.—Adam & Leloup, 1939: 60. *Complicachlamys tigris* (Lamarck).—Habe, 1964b: 174, pl. 53, fig. 14.

*Semipallium (Semipallium) tigris* (Lamarck).—Hertlein, 1969: N365, figs C.87.3a–b; Wang, 1985: 502, fig. 1.

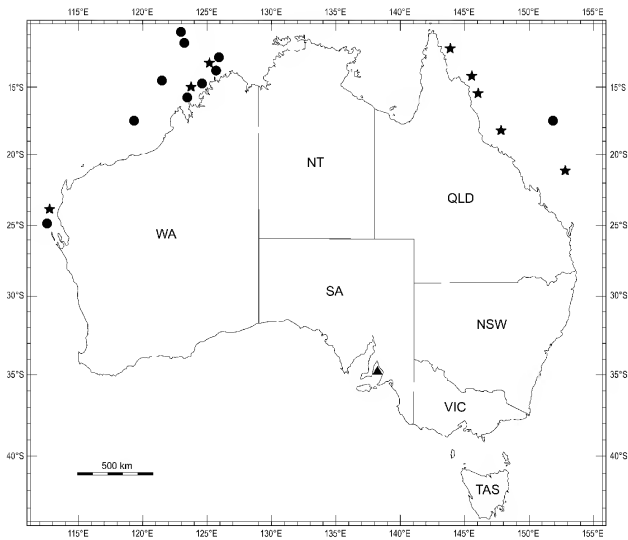
*Semipallium tigris* (Lamarck).—Abbott & Dance, 1982: 308, fig; Wells & Slack-Smith, 1986: 54; Dijkstra, 1991: 40; Rombouts, 1991: 59, pl. 22, figs 1–1a; Dharma, 1992: 84, pl. 20, figs 13–13a; Lamprell & Whitehead, 1992: [28], pl. 12, fig. 69; Bernard *et al.*, 1993: 49; Dijkstra, 1997: 334, figs 46–49; Dijkstra, 1998a: 38, pl. 7, figs 6–9; Dijkstra, Drivas & Jay, 1998: 9, fig. 15; Hayami, 2000: 901, pl. 448, fig. 20; Dharma, 2005: 250, pl. 100, figs 10a–c; Xu & Zhang, 2008: 87, fig. 246; Dijkstra, 2013: 84, pl. 22, figs 1a–d, pl. 30, figs 4a–b.

*Semipallium flavicans* (Linnaeus).—Dijkstra, 1999: 426; Raines & Poppe, 2006: 240–241, lower figs; pl. 192, figs 1–5; Huber, 2010: 206; Raines, 2010: 636, pl. 1009, figs 4–7.

**Type data.** *Ostrea flavicans* Linnaeus: lectotype (pr) UUZM [not registered], designated by Dijkstra (1999: 426, figs 9C–D), 2 possible paralectotypes (lv + rv) UUZM [not registered]. Type locality: “O. australiore” [Indo-West Pacific].

*Pecten tigris* Lamarck: lectotype (pr) MNHN Moll21194, designated by Dijkstra (1994: 483, figs 70–73), paralectotype (pr) MNHN Moll21195. Type locality: “l’Océan indien” [Indian Ocean].

**Additional material examined.** —AUSTRALIA: QUEENSLAND: GBR, Marion Reef, 19°17'S 152°13'E, dead, 10 m (1 pr, NTM P012670). WESTERN AUSTRALIA: S Muiron Island, 21°39.86'S 114°20.06'E, dead, 13–15 m (1 v, WAM); Rowley Shoals, approx. 17°10'S 119°20'E, dead (1 v, WAM); Rowley Shoals, Clerke Reef, 17°10'S 119°20'E, dead, 9–18 m (1 v, WAM 1617.81; 1 v, WAM 1545.81); Macleay Island, 15°56.02'S 123°62.03'E, dead (2 v, WAM); Churchill Reef, 15°31'S 123°17'E, dead (1 v, WAM); Kimberley, NW of Buffon Island, 14°55'S 124°41'E, dead (1 v, WAM); E Montelivet, 14°16.31'S 125°17.59'E, dead (1 pr, WAM); Kimberley, Long Reef, S side, 14°01'S 125°44'E, dead (1 pr + 1 v, WAM522); Scott Reef, approx. 14°0'S 121°45'E, dead (1 v, WAM); Cassini Island, 13°56'S 125°38'E, dead (1 pr + 3 v, WAM); Cassini Island, 13°56'S 125°38'E, dead, 20 m (5 v, WAM); Seringapatam, 13°40'S 122°05'E, dead (1 v, WAM); Seringapatam, 13°40'S 122°05'E, dead, 15–17 m (3 v, WAM); Cassini Island, 13°56'S 125°38'E, W side, dead, 20 m (1 v, WAM; 3 v, WAM); Cartier Island, 12°31'S 123°29'E, dead, 10–20 m (1 v, WAM); Hibernia Reef, in lagoon, 11°58'S 123°19'E, dead, 5 m (1 v, WAM); Hibernia Reef, 11°58'S



**Figure 81.** Distribution of *Semipallium flavicans* (Linnaeus) (circles), *S. fulvicostatum* (A. Adams & Reeve) (stars) and *S. hallae* (Cotton) (triangle).

123°19'E, dead (1 v, WAM). —MOZAMBIQUE: Nacale, alive, 10–12 m (3 pr, ZMA Moll.146134). —MAURITIUS: off west coast, alive, 18–25 m (3 pr, ZMA Moll.143017). —THAILAND: Andaman Sea, Phuket Island, Kaea Noi Island, alive, 20 m (1 pr, ZMA Moll.143678). —PHILIPPINE ISLANDS: Sulu Sea, off Zamboanga, alive, 4–10 m (2 pr, ZMA Moll.140478). —INDONESIA: off NW coast of Sumatra, alive, 2–3 m (5 pr, ZMA Moll.143738). —PAPUA NEW GUINEA: Madang Harbour, Tab Island, S side, 5°11'S 145°50'E, alive, 11 m (1 pr, C.375063); off Madang, N end of Kranket Island, 5°11'S 145°51'E, alive, intertidal (1 pr, C.375062). CORAL SEA: North East Herald Cay, 16°56'S 149°11'E, dead, beach (1 fragm., C.331993). —SOLOMON ISLANDS: Russell Group, Pavuvu Island, Samata, alive, 6–12 m (3 pr, ZMA Moll.143012). —SAMOA ISLANDS: Tutuila Island, Fagasa Bay, alive, 9 m (1 pr, ZMA Moll.143011).

**Description.** Shell up to 76 mm high (Huber, 2010), rather inflated, right valve more convex than left, subtriangularly ovate, prosocline, inequivalve, inequilateral, auricles very unequal in size, umbonal angle c. 80°; cream with dark brown or reddish brown maculations or bands, yellowish near umbo; right valve paler, interior yellowish, dark brown near resilial pit; red spot on anterior auricle.

Both valves with 8–10 prominent, evenly spaced radial plicae; scaly secondary radial riblets on and between primary plicae; covered with shagreen microsculpture; microsculpture of commarginal lamellae in early growth stage. Dorsal margin straight, somewhat declined on posterior side of auricle. Byssal notch deep, ctenolium well-developed. Internal plicae with edges carinate around ventral margin. Hinge with weak resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: QLD, GBR, Broadhurst Reef, E of Townsville, subtidal (AM C.131558): rv: H 38.2, L 35.5 mm; lv: H 38.5, L 34.9 mm; D 9.7 mm.

**Habitat.** Living in the littoral to sublittoral zones, byssally attached to undersides of coral slabs or boulders or amongst coral rubble on clean sandy bottoms.

**Distribution.** Tropical Indo-West Pacific, from southern Japan southwards to northern Australia and westwards into the Indian Ocean to Mozambique and South Africa (not recorded from the northwestern Indian Ocean), and eastwards into the central Pacific to Samoa (Raines & Poppe, 2006: 240); East Africa to Japan, 3–40 m (Huber, 2010: 206); Mozambique, 10–12 m alive, South Africa, 78 m, dead (Dijkstra & Kilburn, 2001: 298); Philippines, 2–52 m (Raines, 2010: 636; Dijkstra, 2013: 84); Indonesia (as *Semipallium tigris*; Dijkstra, 1991: 40); Papua New

Guinea, 3–30 m (as *Semipallium tigris*; Dijkstra, 1998a: 38–39); Vanuatu, 21 m (Dijkstra & Maestrati, 2012: 400). Maximum depth range of live-taken specimens is from the intertidal zone to 52 m. Present specimens from Australia dead at 5–20 m.

**Remarks.** The present specimens from offshore reefs of Australia are indistinguishable from the type material of *Semipallium flavicans*.

### *Semipallium fulvicostatum* (A. Adams & Reeve, 1850)

Figs 80H–I, 81, 82C,I

*Pecten fulvicostatus* A. Adams & Reeve, 1850: 74, pl. 21, fig. 11; Reeve, 1853: sp. 123, pl. 28, fig. 123.

*Pecten luculentus* Reeve, 1853: sp. 59, pl. 16, fig. 59; Küster & Kobelt, 1888: 170, pl. 47, fig. 3.

*Pecten (Chlamys) fulvicostatus* A. Adams & Reeve.—Dautzenberg & Bavay, 1912: 16 (in part).

*Complicachlamys fulvicostata* (A. Adams & Reeve).—Iredale, 1939: 363.

*Complicachlamys luculenta* (Reeve).—Iredale, 1939: 363.

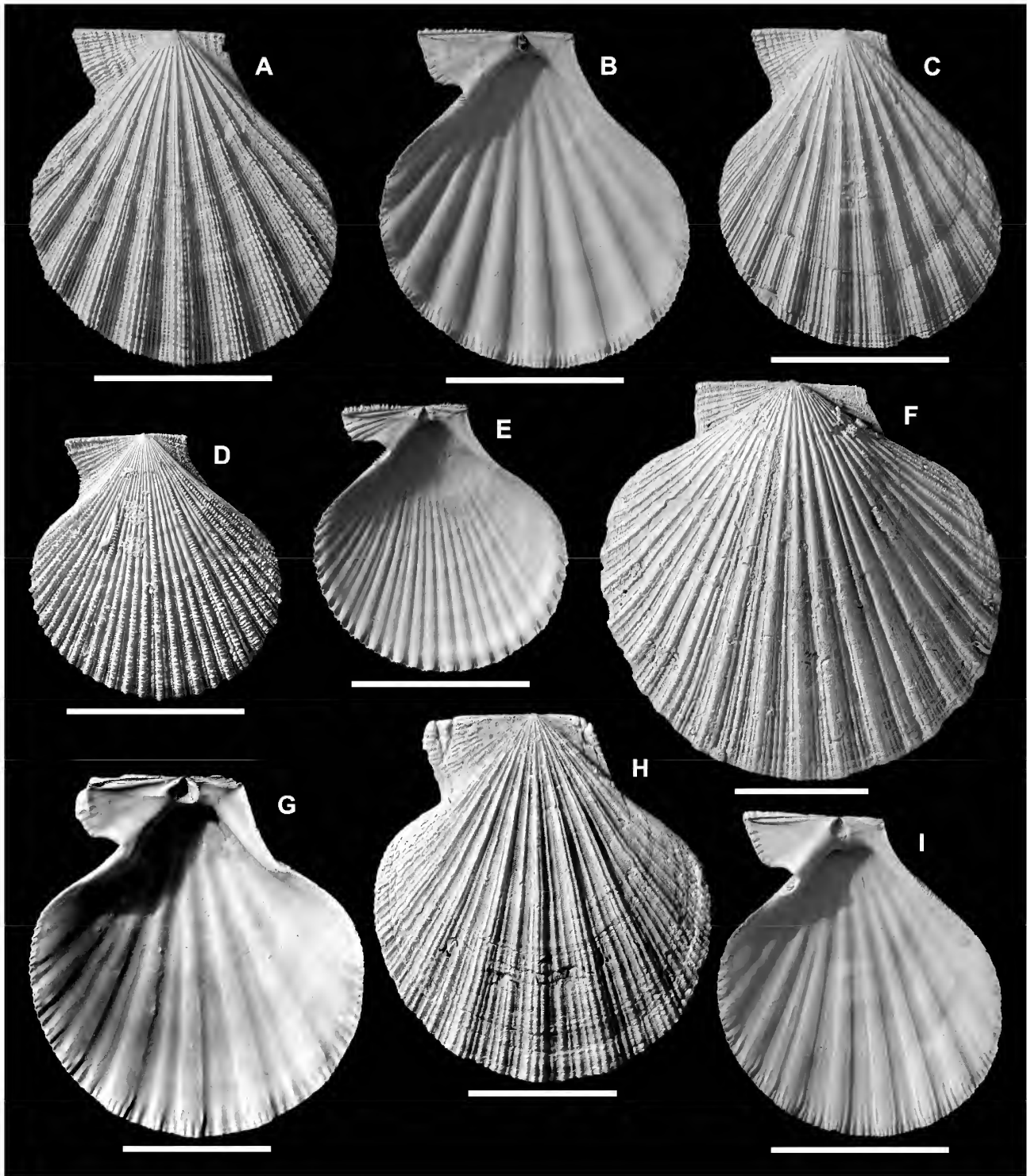
*Semipallium fulvicostatus* [sic] (A. Adams & Reeve).—Dijkstra, 1989: 16, figs; Dijkstra, 1990a: 9, 12; Dijkstra, 1991: 38; Rombouts, 1991: 59, pl. 20, fig. 13; Dijkstra, 1998a: 38, pl. 7, figs 2–5.

*Semipallium fulvicostatum* (A. Adams & Reeve).—Raines & Poppe, 2006: 242–243, upper figs; pl. 194, figs 1–3, 5–6, 8–9; Dijkstra & Moolenbeek, 2008: 21; Huber, 2010: 207; Raines, 2010: 636, pl. 1009, figs 1–3; Dijkstra, 2013: 84, pl. 22, figs 2a–d, pl. 25, figs 7a–b, pl. 31, figs 1a–b.

**Type data.** *Pecten fulvicostatus* A. Adams & Reeve: holotype (pr) NHMUK1950.11.14.31 (see Wagner, 1989b: 112, fig. 1). Type locality: “Sooloo Archipelago” [Philippine Islands, Sulu Archipelago].

*Pecten luculentus* Reeve: lectotype (pr) NHMUK1984 046/1 (see Wagner, 1989b: 112, fig. 2). Type locality: Australia, Northern Territory, Bathurst Island.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (1 v, C.030275); GBR, Eel Reef at wreck at N end, 12°24'S 143°22'E, dead, 4–8 m (1 v, C.138389); off Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29'E, alive, 6–17 m (1 pr, C.370425); Macgillivray Cay, NW side, 14°39'S 145°29.5'E, dead, 9–15 m (1 v, C.138393); No Name Reef, SW end, 14°40'S 145°39'E, alive, 15–20 m (1 v, C.157655; 1 pr, C.370444); Lizard Island, No. 1 Bommie, 14°41'S 145°28'E, dead, 9 m (1 pr, C.124249); Lizard Island, No. 2 Bommie, 14°41'S 145°28'E, dead, 9–12 m (1 v, C.369558); Lizard Island, SE of Bird Ilet, 14°41'S 145°28'E, dead, 0–24 m (1 v, C.369559); Lizard Island, South Island, E side, 14°42'S 145°27'E, dead, 0.5–12 m (1 v, C.369563); Reef 14-151, 14°55'S 145°41'E, dead, 8–13 m (1 pr, C.153321); Ruby Reef, NW side, 15°44'S 145°47'E, dead, 8–18 m (1 v, C.147662; 1 v, C.157612; 1 v, C.157613); N side of Wheeler Reef, NE of Townsville, 18°46'S 147°31'E, alive, subtidal–11 m (1 v, C.161016; 1 v, C.319884; 1 pr, C.369562); Wheeler Reef, W side, dead, 18 m (1 v, C.332000); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, alive, subtidal (1 pr, C.131559; 1 pr, C.131560; 1 pr, C.332001; 1 pr, C.369554); E of Townsville, Broadhurst Reef, SW side, 18°57.4'S 147°44'E, alive, 3–12 m (3 pr, C.370432; 1 pr, C.370443); Swain Reefs, Reef 21-230 (Blue Hole), 21°12'S 152°20'E, dead, 13–15 m (1 pr, C.148191); Swain Reefs, Centenary Reef, 21°17'S 152°20'E, dead, 10–11 m (1 v, C.153205); Swain Reefs, Reef 21-176, N side, 21°20'S 151°36'E, dead, 10 m (1 v, C.369560); Swain Reefs, Reef 21-182, 21°22'S 151°41'E, dead, 10 m (1 v, C.161860); Swain Reefs, Reef 21-468, NW side, 21°30'S 152°25'E, dead, 11–13 m (1 pr, C.161816); Swain Reefs, Gannet Cay, E of reef, 21°59'S 152°29'E, dead, 3–18 m (1 pr, C.161831). —WESTERN AUSTRALIA: Carnarvon, 6 mls N of Quobba, 24°19'S 113°24'E, dead, beach (1 v, WAM); Macleay Island, 15°56.02'S 123°42.03'E, dead, 30 m (11 v, WAM); Kimberley, Lucas Island, SW corner, 15°13'S 124°31'E, dead (1 v, WAM 496.91); Cassini Island, 13°56'S 125°38'E, dead, 40–50 m (5 v, WAM). —JAPAN: Okinawa, Seragaki, alive, 49 m (1 pr, ZMA Moll.144565). —PHILIPPINE ISLANDS: Cebu, Mactan Island, off Buyong Beach, 10°05'N 124°00'E, dead, 7–30 m (7 v, C.143079); Mindanao, 6–10°S 122–127°E, dead (1 pr, C.303786). —CHRISTMAS ISLAND (Indian Ocean): Flying Fish Cove, opp. small boat ramp, dead, 0–25 m (1 pr + 1 v, WAM513). —INDONESIA: Sulawesi, W side of Manado Tua Island, dead, 25 m (1 pr, ZMA Moll.146196); Bali, Menjangan Island, dead, 7 m (1 pr, ZMA Moll.146197). —SOLOMON ISLANDS: Malaita Island, S of Aoki (Auki), Laulais



**Figure 82.** *A, B*, *Semipallium flavicans* (Linnaeus), specimen in Fig. 80F, G; lv exterior (A), rv interior (B). *C, I*, *Semipallium fulvicostatum* (A. Adams & Reeve), specimen in Fig. 80H, I; lv exterior (C), rv interior (I). *D, E*, *Talochlamys pulleineana* (Tate), AM C.142144, E of Broken Bay, NSW, 410–506 m, lv exterior (D), rv interior (E). *F*, *Zygochlamys delicatula* (Hutton), lv only, AM C.346889, E of Gabo I, VIC, 208–223 m, lv exterior. *G, H*, *Semipallium hallae* (Cotton), ZMA Moll.143774, limestone reef offshore from Glenelg, SA, 34.9667°S 138.5167°E; rv interior (G), lv exterior (H). Scale bars represent 20 mm (A–E, G–I), 30 mm (F).

Island, 8°52'S 160°44'E, alive, 6–7.5 m (1 pr, C.370442). —PAPUA NEW GUINEA: Port Moresby, Horseshoe Reef, 9°28'S 147°10'E, dead, 25 m (1 v, C.157586); Quayles Reef, alive, 6 m (2 pr + 1 v, ZMA Moll.144554). TASMAN SEA: Lord Howe Rise, 31°37.1'S 159°13'E, dead, 51–55 m (1 v, C.332002, 1 v, C.332003); Lord Howe Rise, 31°38.2'S 159°03.6'E, dead, 44 m (1 v, C.332004). —SOCIETY ISLANDS: Tahiti, Arue, alive, 2–3 m (1 pr, ZMA Moll.144602). —TUAMOTU ISLANDS: Apataki Island, dead, 16 m (1 v, ZMA Moll.144606).

**Description.** Shell up to c. 60 mm high, most specimens c. 40 mm; weakly inflated, left valve slightly more convex than right, elongate and prosocline, inequivalve and inequilateral, auricles highly unequal in shape and size, umbral angle c. 85°; cream with yellowish plicae and darker maculations on left valve, right valve paler, with yellow blotch near umbo.



Both valves sculptured with 9 evenly spaced, relatively low radial plicae; 5 prominent secondary radial riblets on each plica; 3–4 weaker riblets in interplical spaces near ventral margin. Secondary riblets on right valve bear delicate closely spaced commarinal lamellae. Shagreen microsculpture throughout. Anterior auricles larger and longer than posterior ones, bearing 8–10 radial riblets on left valve and 5–6 on right; posterior auricles almost smooth. Byssal notch moderately deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–7 teeth. Internal plicae with carinate edges near margin. Hinge with weak resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: QLD, Broadhurst Reef, E of Townsville, subtidal (AM C.131560): rv: H 35.7, L 32.3 mm; lv: H 36.2, L 32.1 mm; D 7.7 mm.

**Habitat.** Living in the littoral to sublittoral zones, byssally attached to undersides of coral slabs or boulders or amongst coral rubble on clean sandy bottoms.

**Distribution.** Tropical Indo-West Pacific, from southern Japan southwards to northern Australia, and eastwards into the central Pacific to the Tuamotu Archipelago. Not recorded from the Indian Ocean (Raines & Poppe, 2006: 242); Japan to Australia, 5–90 m (Huber, 2010: 207); Philippines, 20–62 m (Raines, 2010: 636; Dijkstra, 2013: 85); Indonesia, 75–90 m (Dijkstra, 1991: 39; Dijkstra & Moolenbeek, 2008: 21); Papua New Guinea, 10 m (Dijkstra, 1998a: 38); Vanuatu, intertidal to 24 m (Dijkstra & Maestrati, 2012: 401). Maximum depth range of live-taken specimens is from the intertidal zone to 90 m. Present specimens from Australia alive in the subtidal zone to 20 m.

**Remarks.** The present specimens from Australia are almost indistinguishable from the type material of *Semipallium fulvicostatum*, although more colourful. Juveniles of *Semipallium fulvicostatum* could easily be confused with juveniles of *S. flavicans* and *S. dringi*. All these species live in similar habitats. The differences between these three species are shown in Table 6.

## *Semipallium hallae* (Cotton, 1960)

Figs 81, 82G–H, 84A–C

*Notochlamys hallae* Cotton, 1960: [1], 2 unnumbered figs; Cotton, 1961: 99, fig. 85; Rombouts, 1991: 47.

*Semipallium hallae* (Cotton).—Lamprell & Whitehead, 1992: [28], pl. 12, fig. 71 (holotype); Raines & Poppe, 2006: 242–243, lower figs; pl. 185, fig. 3.

**Type data.** Holotype (pr) SAM D16541. Type locality: South Australia, Largs Bay, Semaphore Beach.

**Comments on type data.** The listed and figured articulated paratype (H 50 mm, W 44 mm) is not in the SAM collection, but is possibly in the Hall collection.

**Additional material examined.**—AUSTRALIA: SOUTH AUSTRALIA: Yorke Peninsula, Edithburgh Jetty, alive, 4–5 m (1 pr, SAM D19012); Adelaide, West Beach, c. 34°56'S 138°36'E, dead, beach (1 v, WAM S12924); Gulf of St Vincent, Port Adelaide, Outer Harbour, alive, 5 m (3 pr, SAM D19013); Gulf of St Vincent, Henley Beach, dead, beach (2 v, SAM D19014); offshore from Glenelg, 34°59'S 138°31'E, low limestone reef, alive (1 pr, ZMA Moll.146627).

**Description.** Shell up to c. 55 mm high, weakly inflated, almost equally convex, elongate, somewhat higher than wide, slightly inequivalve and inequilateral, anterior auricles larger and longer than posterior, umbonal angle c. 95°; most specimens purplish, umbonal area paler; right valve paler; interior deep purplish.

Both valves sculptured with 8–9 evenly spaced, weakly defined primary radial plicae (narrower on left valve, wider on right valve), less prominent towards anterior and posterior ends of disc; secondary radial riblets present on plicae (c. 3 on left valve, 4 on right valve) and in radial interspaces. Interstitial shagreen microsculpture throughout. Anterior auricles bearing c. 7–10 radial riblets, posterior bearing 4–6. Dorsal margin straight. Byssal notch moderately deep, byssal fasciole rather broad. Functional ctenolium weakly developed, with c. 6 teeth, or almost obsolete in mature stage. Internal corrugations well-defined, corresponding to external radial plicae; edges sharply defined, carinate around ventral margin. Hinge with prominent resilial and dorsal teeth.

**Table 6.** Characters distinguishing the similar *Semipallium* species: *S. dringi* (Reeve), *S. fulvicostatum* (A. Adams & Reeve) and *S. flavicans* (Linnaeus).

character	<i>Semipallium dringi</i>	<i>Semipallium fulvicostatum</i>	<i>Semipallium flavicans</i>
size	up to c. 65 mm high	up to c. 60 mm high	up to c. 75 mm high
shape	subcircular	elongate and prosocline	elongate
convexity	lv inflated, rv flattened	weakly inflated, almost equally convex	inflated, lv less convex than rv
shell thickness	thin	thin	moderately solid
anterior auricle LV	8–12 radial riblets	6–8 radial riblets	10–12 radial riblets
macrosculpture	8–9 evenly spaced primary radial plicae	8–9 evenly spaced primary radial plicae	8–10 evenly spaced primary radial plicae
plicae and interspaces LV	plicae wide, interspaces narrow	plicae and interspaces similarly wide	plicae and interspaces similarly wide
microsculpture	weak reticular (lv) in interspaces, spinous (rv)	coarse reticular both on plicae and in interspaces	coarse reticular on plicae and fine in interspaces
colour of shell	polychromatic	weakly polychromatic	creamy with purplish or brownish maculations; interior yellowish

**Dimensions.** Illustrated specimen: SA, offshore from Glenelg, 34.9667°S 138.5167°E, low limestone reef (ZMA Moll.143774): H 48.6, L 49.4, D 15.2 mm.

**Habitat.** Living in the littoral zone in crevices of limestone ledges at silty reef edges, hidden in shallow areas amongst rubble, and byssally attached to hard substrates.

**Distribution.** This species has a very limited distribution in South Australia, in particular in the Gulf of St Vincent. Present specimens alive at 4–5 m.

**Remarks.** Cotton (1960) placed this little-known species in *Notochlamys* Cotton, 1930, based mainly on the shagreen microsculpture. However, *Semipallium hallae* differs from *Notochlamys* species in several characters: more elongate in shape (*Notochlamys* more nearly circular), less clearly defined primary radial plicae (well-defined in *Notochlamys*), and great reduction in the size of the posterior auricles (in *Notochlamys* the anterior and posterior auricles are of almost identical size). *Semipallium hallae* is more appropriately placed in *Semipallium*.

Beu & Darragh (2001: 76) synonymized *Semipallium hallae* with *S. aktinos* (Petterd, 1886) with a query, having seen no material of this very restricted species. In our opinion the two are distinct and differ in the larger size, wider shape, more prominent radial plicae, and more uniform purplish colour of *S. hallae* than of *S. aktinos*.

### *Talochlamys* Iredale, 1929

*Talochlamys* Iredale, 1929: 188. Type species (by original designation): *Chlamys famigerator* Iredale, 1925 (= *Pecten pulleineanus* Tate, 1887), Recent, southern and eastern Australia.

**Diagnosis.** Small to medium-sized, byssate Pedini with unevenly spaced squamose primary radial costae or narrow plicae, and with secondary interstitial (mimachlamydid-like) riblets in late ontogeny; microsculpture of weak antimarginal striae (also lacking in late ontogeny) and interstitial, widely spaced, prominent commarginal lamellae; shagreen microsculpture absent from post-Eocene species; internal rib carinae lacking; weak dorsal and resilial hinge teeth; byssal notch deep, ctenolium prominent.

**Distribution.** Paleocene–Recent (Beu & Darragh, 2001; del Rio & Martinez, 2015: appendix 1). Eastern Atlantic, Indo-West Pacific, southern Australia and New Zealand, living in the littoral to bathyal zones.

**Discussion.** Hertlein (1969: N355) treated *Talochlamys* as a junior synonym of *Chlamys* Röding, 1798, placed in the suprageneric *Chlamys* group. Waller (1993: 202) considered *Talochlamys* to be a valid genus of Chlamydini (i.e., Pedini).

Beu (1995: 18) for the first time included several fossil and Recent species from New Zealand in *Talochlamys* (see also Beu & Darragh, 2001; Dijkstra & Marshall, 2008).

### *Talochlamys pulleineana* (Tate, 1887)

Figs 82D–E, 83, 84D–E, G

*Pecten pulleineanus* Tate, 1887a: 73, pl. 4, figs 1a–b.

*Chlamys famigerator* Iredale, 1925: 252, pl. 41, figs 1–2; Gatliff & Gabriel, 1931: 232.

*Mimachlamys (Talochlamys) famigerator* (Iredale).—Iredale, 1929: 164.

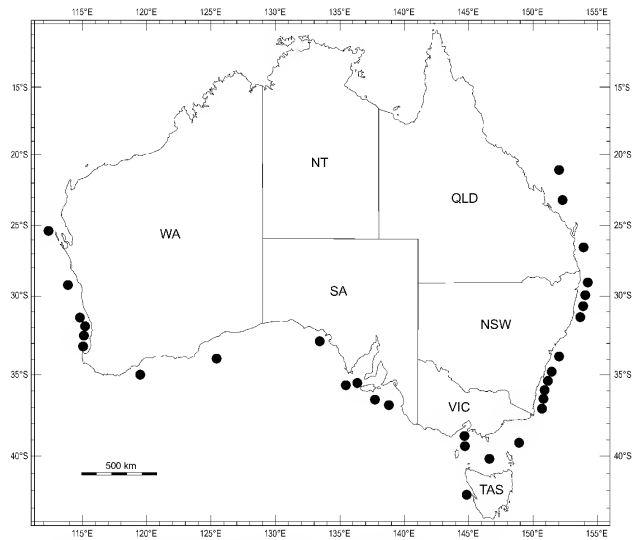


Figure 83. Distribution of *Talochlamys pulleineana* (Tate).

*Mimachlamys famigerator* (Iredale).—Macpherson & Chapple, 1951: 145; Cotton, 1961: 106, fig. 92; Iredale & McMichael, 1962: 11; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 53.

*Chlamys (Camptonectes) famigerator* Iredale.—Gabriel, 1956: 14.

*Camptonectes famigerator* (Iredale).—Macpherson & Gabriel, 1962: 302, fig. 343.

*Chlamys (Talochlamys) famigerator* (Iredale) [sic].—Rombouts, 1991: 34.

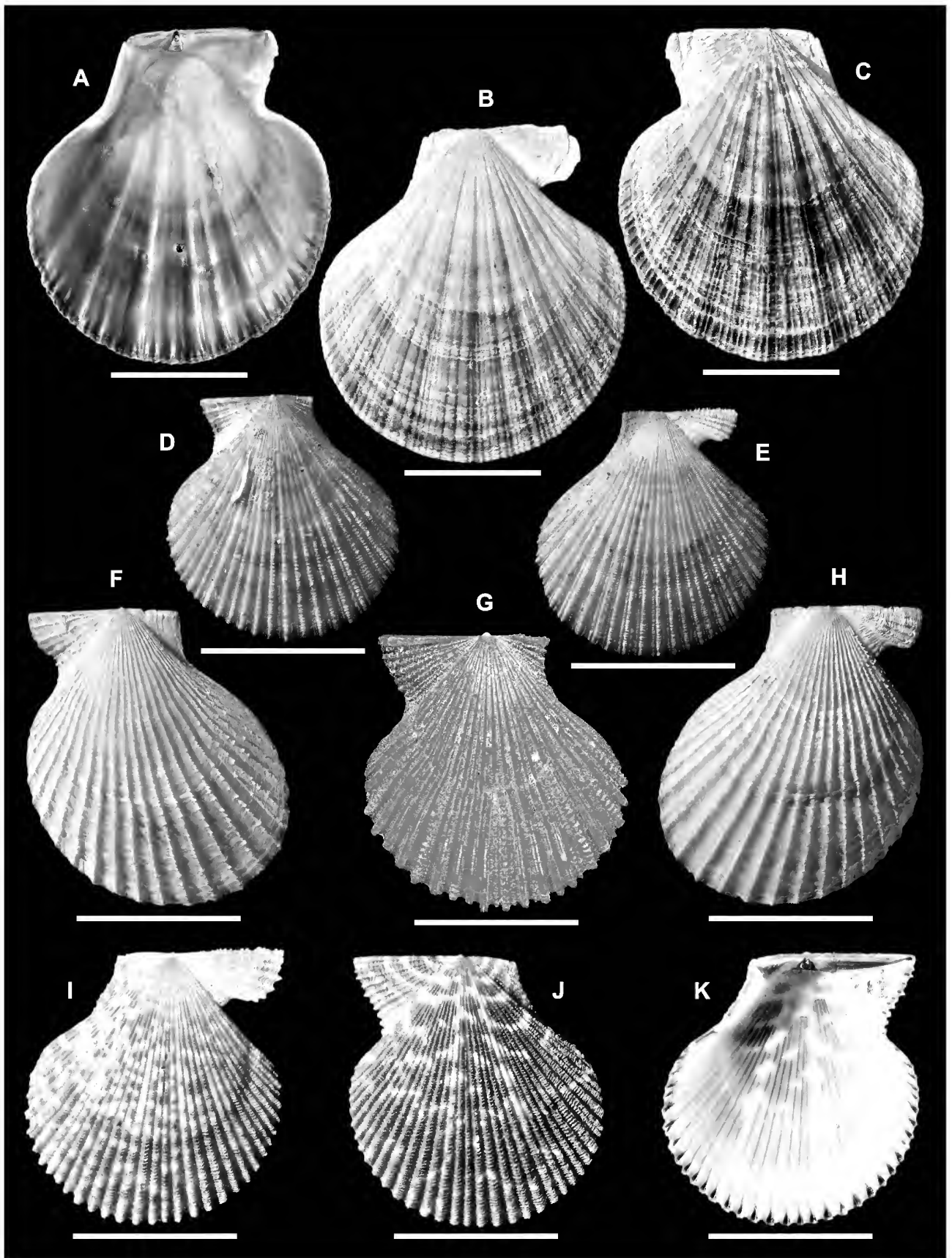
*Talochlamys pulleineana* (Tate).—Beu, 1995: 17–18; Beu & Darragh, 2001: 95, figs 29A–I; Raines & Poppe, 2006: 288–289, lower figs; pl. 239, figs 1–4.

**Type data.** *Pecten pulleineanus* Tate: holotype (rv) SAM D14171. Type locality: south-eastern coast of South Australia.

*Chlamys famigerator* Iredale: lectotype (lv) C.053767 (Fig. 84G), designated by Beu (1995: 17), paralectotype (rv) C.053767. Type locality: southern New South Wales, dead, 90–120 m.

**Comments on type data.** See Beu (1995: 17–18).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Curtis Channel, 24 km SE of Cape Capricorn, 23°61.7'S 151°45'E, alive, 96 m (1 pr, C.097422); NE of Cape Moreton, 26°92.5'S 153°55.8'E, dead, 114–124 m (1 v, C.165607); GBR, Swain Reefs, off Herald Prong No. 1, 21°50'S 151°40'E, alive, 31 m (1 pr, C.097434). NEW SOUTH WALES: off Wattamolla, alive, 95–130 m (1 pr, C.016862); off New South Wales coast, dead, 37–128 m (4 v, C.165597); off Red Head, 32°04'S 152°43'E, dead, 73 m (1 v, C.344576); off Broken Bay, 32°52'S 152°32'E, dead, 145 m (1 v, C.344574); off Newcastle, 32°56'S 151°57'E, dead, 82 m (1 v, C.344579); off Newcastle, 32°58'S 152°41'E, dead, 951–1150 m (many v, C.155842); E of Broken Bay, 33°40'–33°37'S 152°04'–152°06'E, dead, 988–1016 m (9 v, C.155810); 22 mls E of Narrabeen, N of Sydney, 33°42'S 151°43'E, dead, 146 m (6 v, C.026094); off Sydney, 33°46'S 151°43'E, dead, 176 m (1 v, C.155809); E of Broken Bay, 33°46'–33°44'S 151°49'–151°50'E, dead, 410–506 m (1 pr, C.142144); Sydney, 5.6 km E of North Head, 33°49'S 151°21'E, dead, 66 m (1 v, C.344578); off Sydney, 33°50'S 151°20'E, alive, 274–550 m (1 pr, C.310690); off Sydney, 33°58'S 151°29'E, dead, 150 m (5 v, C.344575); 27.5 mls E of Sydney Heads, 33°50'S 151°49'E, dead, 549 m (1 v, C.024342 [in part]; 1 fragm., C.024342 [in part]); 23 ml E of Sydney Heads, dead, 457 m (1 v, C.024343); off Sydney, 34°03'–33°52'S 151°37'–151°22'E, dead, 79–295 m (5 v, C.079056); Sydney, E of Malabar, 33°96.7'S 151°45'E, dead, c. 137 m (3 v, C.165606); c. 30 km E of Little Bay, Malabar, Sydney, 33°58'S 151°34'E, dead, 192–203 m (18 v, C.145001; 8 v, C.165598); Sydney, 28 km E of Little Bay, 33°58'S 151°33'E, dead, 183–192 m (2 v, C.344571); Sydney, 1.74 km E of Malabar Head, 33°58'S 151°17'E, dead, 68 m (2 v, C.344587); Sydney, 2.3 km E of Malabar, 33°59'S 151°16'E, dead, 66 m (1 v, C.344584); Sydney, 2.6 km E of Cape Banks, 33°59'S 151°16'E, dead, 66 m (2 v, C.344585); off Botany Bay, 33°59'S 151°33'E, dead, 194 m (3 v, C.344676); 2.5–4 mls off Botany Heads, 34°0'S 151°17'E, alive, 60–102 m (1 pr, C.048117); off Botany Bay, 34°0'S 151°17'E, alive, 110 m (1 pr, C.344677); Sydney, off Cronulla, 34°03'S 151°12'E, dead, 64 m (3 v, C.344680); Sydney, off Cronulla, 34°03'S 151°12'E, dead, 70–80 m (2 v, C.344568); off Cronulla, 34°03'S 151°12'E, dead, 85 m (3 v, C.344679); Sydney, off Cronulla, 34°04'S 151°14'E, dead (1 v, C.344683); Sydney, off Cronulla, 34°04'S



**Figure 84** A–C, *Sempallium hallae* (Cotton), specimen in Fig. 82G, H, lv interior (A), rv exterior (B), lv exterior (C). D, E, G, *Talochlamys pulleineana* (Tate); (D, E) specimen in Fig. 82D, E; lv exterior (D), rv exterior (E); (G) lv only, AM C.053767, lectotype of *Chlamys famigerator* Iredale, “southern New South Wales”, 90–120 m; lv exterior. F, H, *Veprichlamys perillustris* (Iredale), AM C.154683, S of Gabo Island, VIC, 365 m; lv exterior (F), rv exterior (H). I–K, *Mimachlamys albolineata* (G. B. Sowerby II), ZMA Moll.147088, Rock Island, off Portland Roads, QLD, 12°35'S 143°24'E; rv exterior (I), lv exterior (J), lv interior (K). Scale bars represent 20 mm (A–F, H), 10 mm (G, I–K).

151°14'E, dead, 40–100 m (many v, C.344678); off Jibbon (Hacking) Point, Port Hacking, 34°04'S 151°11'E, dead, 40 m (3 v, C.344682); off Jibbon, Port Hacking, 34°05'S 151°13'E, dead, 75–80 m (2 v, C.344681); off Jibbon, Port Hacking, 34°05'S 151°13'E, dead, 85 m (1 v, C.344689); E of Port Hacking, 34°05'S 151°21'E, dead, 137 m (1 v, C.344684); off Port Kembla, 34°20'S 151°18'E, dead, 161 m (2 v, C.155834); 16 mls E of Wollongong, 34°25'S 151°15'E, dead, 183 m (3 v, C.018286; 2 v, C.018286 [in part]); 5–8 mls off Port Kembla, 34°27'–34°30.4'S 151°04'–151°0.9'E, dead, 115–137 m (10 v, C.016851); Crookhaven, R mouth, 34°52.08'–34°53.75'S 150°46.82'–150°47.27'E, alive, 20–27 m (1 pr, C.016860); 28 km E of Kiama, 35°40'S 151°10'E, dead, 203 m (1 v, C.344665); off Crookhaven, 34°55'S 150°54'E, dead, 64 m (1 v, C.344663); Shoalhaven Bight, 34°57'S 150°48'E, dead, 27–81 m (3 v, C.344567); off Jervis Bay, 35°05'S 151°02'–151°10'E, dead, 400–1000 m (1 v, C.310693; 1 v, C.132061); off Wreck Bay, 35°12'S 150°42'E, alive, 73 m (1 pr, C.344661); E of Ulladulla, 35°33.3'S 150°78.3'E, alive, 135 m (1 pr, C.344659; 1 v, C.165600); off Brush Island, 35°35'–35°37'S 150°40'–150°41'E, alive, 165 m (1 pr, C.155805); Batemans Bay, off Brush Island, 35°36'–35°44'S 150°44'–150°38'E, dead, 549–586 m (1 pr, C.310691); Batemans Bay, off Nobby's, Head, alive, 146 m (1 pr, C.165595); off Batemans Bay, 35°44'–35°29'S 150°46'–150°36'E, dead, 220 m (2 pr, C.344573); Batemans Bay, 22 mls E of Tollgate Islands, 35°45'S 150°31'S alive (2 pr, C.344637); off Batemans Bay, 35°46'S 150°25'E, alive, 137–146 m (3 pr, C.344654); off Batemans Bay, 35°46'S 150°25'E, alive, 110 m (3 pr, C.344656); off Burrewarra Point, S of Batemans Bay, 35°50'S 150°30'E, dead, 161 m (1 pr, C.344652); off Moruya, 35°54'S 150°17'E, alive, 100 m (1 pr, C.344647); 10 mls NE of Montague Island, 36°08'S 150°23'E, alive, 128–146 m (1 pr, C.051455); off Narooma, 36°13'S 150°12'E, alive (4 pr, C.344645); Narooma, off Montague Island, 36°15'S 150°13'E, dead, 9–16 m (1 v, C.344644); 5–10 mls S of Montague Island, 36°23'S 150°13'E, alive, 102–110 m (1 pr, C.344634); E of Bermagui, 36°27'–36°21'S 150°19'–150°21'E, dead, 354–384 m (1 v, C.125832); off Bermagui, 36°30'S 150°16'E, dead, 141 m (1 pr, C.305943); off Lookout Point (Middle Head), Eden, 37°04'S 149°55'E, dead, 27 m (7 v, C.094546); off Eden, 37°04'S 149°55'E, dead (1 v, C.344570); off Eden, 37°05'S 150°10'E, alive, 101 m (3 pr, C.344629; 3 pr + 1 v, C.165428); off Twofold Bay, 37°05'S 149°56'E, dead, 46 m (13 v, C.097446); Twofold Bay, 37°05'S 149°54'E, dead (1 v, C.344615); Twofold Bay, 37°05'S 149°54'E, alive, 18 m (1 pr, C.344620); off Eden, 37°05'S 149°57'E, alive, 55–73 m (1 pr, C.344613); off Twofold Bay, 37°05'S 150°0'E, alive, 73–82 m (3 pr, C.343931); 5–6 km off Eden, 37°05'S 150°0'E, alive, 46–55 m (2 pr, C.344617); Disaster Bay, 37°16'S 149°58'E, alive, 91 m (2 pr, C.344610); off Green Cape, 37°16'S 150°13'E, dead, 91–128 m (2 v, C.053767); off Green Cape, 37°16'S 150°13'E, alive, 71–84 m (3 pr, C.319883); off Green Cape, 37°22'–37°19'S 150°18'–150°19'E, dead, 157 m (1 v, C.165586); 15 mls off Twofold Bay, 37°22'S 150°02'E, dead, 75 m (13 v, C.344622); 20 mls SE of Twofold Bay, 37°26'S 150°15'E, dead, 149 m (1 v, C.344624); 25 mls E of Twofold Bay, 37°27'S 150°17'E, dead, 294–304 m (3 v, C.344625). **VICTORIA:** SSE side Gabo Island, 37°34'S 149°55'E, alive, 21 m (1 pr, C.344528); off Gabo Island, 37°41'S 150°13'E, alive, 274–366 m (1 v, C.047390; 1 pr, C.047395); S of Gabo Island, 38°10'S 149°91.7'E, alive, 165–274 m (pr [cf. *dichroa* form *taiaroa*], C.047386); 15 km S of Gabo Island, 37°43'S 149°57'E, dead, 95 m (1 v, C.344527); E of Gabo Island, 37°45'–37°38'S 150°12'–150°16'E, dead, 400–438 m (1 v, C.310692); 30 km SW of Cape Everard, 38°03'S 149°08'E, dead, 119 m (3 v, C.344526); Cape Everard, 38°08.3'S 149°28.3'E, alive, 128 m (1 pr, C.090467 [in part]); off Cape Everard, 38°05'S 149°17'E, alive, 137 m (1 pr, C.090467); 40 ml S of Cape Everard, 38°50'S 149°25'E, alive, 128 m (1 pr + 1 v, C.165603); Bass Strait, S of Cape Everard, 38°07'S 149°17'E, alive, 128–146 m (1 pr, C.344521); Bass Strait, 36 km S of Cape Conran, 38°08'S 148°43'E, dead, 107 m (4 v, C.344519); off Gabo Island, 38°10'S 149°55'E, alive, 146 m (2 pr, C.047389); Bass Strait, 440 km S of Marlo, 38°12'S 148°35'E, dead, 146 m (2 v, C.165588); Bass Strait, 40 mls SSW of Mt. Cann, 38°13'S 149°0'E, alive, 135 m (2 pr, C.114461); between Cape Howe & Lake Entrance, 38°13'S 149°06'E, dead, 146–158 m (20 v, C.344172); c. 27 mls SE of Cape Everard, 38°15'S 149°12'E, dead, 165–274 m (5 v, C.344523); Bass Canyon, S of Cape Conran, 38°18'S 148°38'E, dead, 220–265 m (11 v, C.344518); Bass Strait, 25 mls off Cape Everard, 38°22'S 149°13'E, dead, 132–146 m (1 v, C.344524); off Port Phillip, 38°30'S 144°30'E, alive (1 pr, C.344517; 1 pr, C.165601); 30 mls S of Cape Everard, 38°30'S 149°30'E, dead, 366 m (1 pr, C.344525). **TASMANIA:** Bass Strait, 32 km E of Babel Island, 39°95'S 148°75'E, dead, 119 m (1 v, C.165589); Bass Strait, 39°0'S 148°30'E, dead, 126 m (3 v, C.165587); Bass Strait, 39°15'S 144°0'E, alive (2 pr, C.047530; 1 pr, C.053768); Bass Strait, E of Babel Island, 39°57'S 148°45'E, alive, 91–146 m (2 pr, C.047387); Bass Strait, 32 km E of Babel Island, 39°57'S 148°45'E, dead, 128 m (1 v, C.344175); Bass Strait, 32 km E of Babel Island, 39°57'S 148°45'E, dead, 119 m (22 v, C.344170; 9 v, C.344182); E of King Island, 40°0'S 144°38'E, dead, 46 m (1 v, C.344156); N of Hummock Island, 40°09'S 145°25'E, dead, 64 m (6 v, C.344152); Bass Strait, King Island, E of Grassy, 40°11'–40°35'S 144°39'–143°28'E, dead, 58–77 m (1 v, C.074090); S of King Island, 40°20'S 144°36'E, dead, 55 m (1 v, C.344138); Bass Strait, S of King Island, 40°36'S 143°37'E, dead, 108 m (2 v, C.344153); S of D'Entrecasteaux Channel, 40°39'S 147°20'E, dead, 95 m (2 v, C.344122); off Cape Naturaliste, 40°48.7'S 148°27'E, dead, 51 m (2 v, C.165590); off Cape Naturaliste, 40°50'S 148°46'E, dead, 399 m (7 v, C.344121); Boat Harbour, 40°57'S 145°38'E, dead (1 v, C.344168); Bass Strait, George Town, N of Port Dalrymple, 40°59'–40°57'S 146°46'E, alive, 48–55 m (1 v, C.344163; 4 pr [typical + atypical] + 3 v, C.165604); W of West Point, 41°0'S 143°55'E, dead, 170 m (1 v, C.344142); W of West Point, 41°01'S 144°21'E, dead, 80 m (1 v, C.344141); Bass Strait, off Devonport, 41°05'S 146°22'E, alive, 26–69 m (2 pr, C.344171); S of West Point, 41°09'S 144°24'E, dead, 88 m (11 v, C.344143); S of West Point, 41°11'S 144°35'E, dead, 80 m (1 v, C.344151); off St. Helens Point, 41°20'S 148°30'E, dead, 110 m (9 v, C.344119); W of Sandy Cape, 41°29'S 144°24'E, dead, 119 m (4 v, C.344145); W of Sandy Cape, 41°29.5'S 144°24.4'E, dead, 119 m (2 v, C.165591); SW of Sandy Cape, 41°39'S 144°37'E, dead, 130 m (2 v, C.344147); off Long Point, N of Bichenno, 41°45'S 148°31'E, dead, 113 m (many v, C.334109); off Cape Forestier, 42°10'S 148°34'E, dead, 205 m (10 v, C.344118); off Maria Island, 42°39.5'S 148°24'E, dead, 130 m (15 v, C.165592); Maria Island, 2.5 mls NE Beaching Bay, 42°27'S 148°12'E, dead, 82.5 m (17 v, C.344164); SW of Macquarie Harbour, 42°30'S 144°52'E, dead (1 v, C.114934); 20 mls E of Maria Island, 42°32'S 148°24'E, dead, 234 m (7 v, C.344181; 1 v, C.165596); E of Maria Island, alive, 91–183 m (2 pr, C.006243); E of Maria Island, 42°39'S 148°24'E,

dead, 130 m (3 v, C.344117); Maria Island, Oyster Bay, 42°40'S 148°03'E, dead, 73 m (3 v, C.344180); S of Maria Island, 42°50'S 148°07'E, dead, 84 m (3 v, C.344116; 11 v, C.165593); NW of Low Rocky Point, 42°51'S 145°0'E, alive, 146 m (1 pr, C.343930); S of Maria Island, 42°51'S 148°20'E, dead, 157 m (3 v, C.344115); off Low Rocky Point, 42°55.2'S 145°26.6'E, dead, 84 m (1 v, C.165594); SW of Low Rocky Point, 42°58'S 145°26'E, dead, 84 m (3 v, C.344136); SW of Low Rocky Point, 42°58'S 145°05'E, dead, 188 m (1 v, C.344137); off Eaglehawk Neck, 43°0'S 148°0'E, dead, 80 m (1 v, C.344114); NE of Cape Pillar, 43°10'S 148°12'E, dead, 172 m (3 v, C.344113); NE of Cape Pillar, 43°11'–43°13'S 148°0'–148°02'E, dead, 91–110 m (2 v, C.344178); off Port Davey, 43°13'S 145°36'E, dead, 132 m (1 v, C.344134); off Cape Pillar, 43°13'S 148°05'E, dead, 183 m (15 v, C.344169; 1 v, C.029103 [in part]); off Cape St. Vincent, 43°15'S 145°30'E, dead, 155 m (1 v, C.344135); 2.5 mls E of Tasman Island, 43°15'S 148°03'E, dead, 183 m (2 v, C.344167); S of Storm Bay, 43°20'S 147°37'E, dead, 97 m (1 v, C.344131); off Port Davey, 43°22'S 145°44'E, dead, 144 m (2 v, C.344132); 11 mls SW of Cape Raoul, 43°25'S 147°45'E, dead, 117 m (1 v, C.344166); 2 mls S Tasman Head, S Bruny Island, 43°33'S 147°19'E, dead, 73 m (2 v, C.344165); S of D'Entrecasteaux Channel, 43°40'S 146°50'E, dead, 104 m (13 v, C.344123); S of South East Cape, 43°42'S 146°18'E, dead, 108 m (2 v, C.344129); S of Storm Bay, 43°47'S 147°48'E, dead, 212 m (4 v, C.344111); S of South East Cape, 43°49'S 146°33'E, dead, 159 m (1 v, C.344128); S of South East Cape, 43°55'S 146°51'E, dead, 168 m (1 v, C.344125); E of D'Entrecasteaux Channel, 44°02'S 146°50'E, dead, 176 m (1 v, C.344126); N of Macquarie Harbour, 44°19'S 144°51'E, dead, 170 m (1 v, C.344150). **SOUTH AUSTRALIA:** 50 mls S of Cape Wiles, 35°29.0'S 150°47.0'E, alive, 137 m (2 pr, C.165600); 50 mls SE of Kangaroo Island, 37°0'S 138°33'E, dead, 77 m (19 v, C.344096); c. 80 ml SW of Cape du Couedic, Kangaroo Island, 36°58'S 137°37'E, alive, 500–600 m (1 pr, SAM D19015); Victor Harbour, The Bluff, dead, 3 m (2 v, SAM D19016); 40 mls S of Cape Wiles, 35°39'S 136°40'–136°50'E, dead, 174–183 m (30 v, C.344093); N of Cape Borda, 35°20'–35°42'S 136°35'E, alive, 73 m (3 pr, C.344094); SW of Cape Carnot, 35°15'S 134°32'E, dead, 150–178 m (3 v, C.344095); 50 mls SW of Cape Adieu, Great Australian Bight, 32°42'S 131°27'E, dead, 79 m (1 v, C.344097). **WESTERN AUSTRALIA:** Great Australian Bight, 33°20'S 128°45'E, dead, 140–147 m (2 v, C.344101); Great Australian Bight, 34°13'S 125°04'E, dead, 75 m (3 v, C.344092); Recherche Archipelago, 34°27'S 122°0'E, dead (1 v, C.344080); Great Australian Bight, E of Hood Point, 34°32'S 121°31'E, dead, 158 m (4 v, C.160995); Great Australian Bight, E of Hood Point, 34°25'S 121°20'E, dead, 158 m (1 v, C.344099); off Albany, 35°14'S 118°30'E, dead, 124 m (1 v, C.344081); S of Cape Leeuwin, 34°32'–34°41'S 114°56'–115°01'E, dead, 73–144 m (2 v [smooth var.], C.160992); between Port Augusta & Cape Leeuwin, 34°40'–34°32'S 114°56'–115°02'E, dead, 66–130 m (1 v, C.165602); NW of Bunbury, 33°15'S 114°37'E, dead, 155 m (1 v, C.344083); W of Bunbury, 33°03'S 114°44'E, dead, 156 m (9 v, C.344098; 2 v, C.160993); NW of Bunbury, 33°05'S 114°37'E, dead, 200–221 m (5 v, C.344072); SW of Mandurah, 32°45'S 114°47'E, dead, 220 m (1 v, C.344084); SW of Mandurah, 32°41'S 114°51'E, dead, 146–150 m (2 v, C.344085); W of Garden Island, 32°19'S 115°07'E, dead, 148–154 m (5 v, C.344073); W of Garden Island, 32°15.7'S 115°06.7'E, dead, 176–182 m (5 v, C.165574); W of Rottnest Island, 32°0'S 115°15'E, dead, 146–150 m (1 v, C.344077; 2 v, C.165577; 2 v, C.165581; 10 v, C.165579); W of Rottnest Island, 31°59'S 115°13'E, dead, 201–214 m (1 v, C.344074); W of Rottnest Island, 31°59'S 115°14'E, dead, 182 m (1 v, C.165576; 10 v [smooth, commarginal lamellae absent], C.165582); Direction Bank, off Rottnest Island, 31°46.6'S 115°11.2'E, dead, 138 m (1 v, C.357994); NW of Rottnest Island, 31°45'S 115°09'E, dead, 144–150 m (1 v, C.344075; 1 v, C.165583); NW of Rottnest Island, 31°45'S 115°02'E, dead, 265–276 m (1 v, C.165580); off Rottnest Island, Direction Bank, 31°44'S 115°15'E, dead, 105 m (1 v, C.344087); off Rottnest Island, Direction Bank, 31°44'S 115°12'E, dead, 138 m (4 v, C.344070); off Rottnest Island, 31°44'S 115°08'E, dead, 165 m (1 v, C.344088); off Rottnest Island, 31°41.3'S 115°08.6'E, dead, 148 m (5 v, C.165578); off Rottnest Island, 31°39'S 115°07'E, dead, 150 m (1 v, C.344089); off Rottnest Island, 31°38'S 115°08'E, dead, 140 m (5 v, C.344091); W of Guilderton, 31°34'S 115°03'E, dead, 135 m (1 v, C.344079); W of Guilderton, 31°30'–31°34'S 114°56'–115°06'E, dead, 146 m (1 v, C.165575); W of Rottnest Island, 31°0'S 114°51'E, dead, 146 m (3 v, C.344086); W of Jurien Bay, 30°45'S 114°51'E, dead, 143 m (2 v, C.165164; 1 v, C.160990); WNW of Lancelin, 30°58'S 114°53'E, dead, 154 m (8 v, C.344069); W of Jurien Bay, 30°45'S 114°51'E, dead, 143 m (2 v, C.160991); NW of Green Head, 30°37'S 114°38'E, dead, 128–140 m (4 v, C.165572); W of Cervantes Island, 30°33'S 114°40'E, dead, 192–196 m (1 v, C.344076); W of Cervantes, 30°33'S 114°32'E, dead, 154 m (2 v, C.165573); NW of Cervantes, 30°30'S 114°38'E, dead, 192–256 m (2 v, C.344071); W of Jurien Bay, 30°21'S 114°38'E, dead, 165 m (1 v, C.344082); NW of Green Head, 29°58'S 114°27'E, dead, 197–219 m (1 v, C.344078); NW of Beagle Island, 29°43'S 114°17'E, dead, 274–283 m (1 v, C.165571); W of Dongara, 29°20.8'S 114°05.7'E, dead, 192–219 m (2 v, WAM 497); Rottnest Shelf, 28°10.2'S 113°23.17'E, dead, 154 m (1 v, WAM 12528); Rottnest Shelf, 25°18.29'S 112°48.36'E, dead, 100 m (1 v, WAM 12525).

**Description.** Shell up to c. 30 mm high, most specimens under 20 mm; thin, weakly inflated, almost equally convex, inequivalve, inequilateral, weakly prosocline, anterior auricles considerable larger and longer than posterior ones, umbonal angle c. 90°; colour pastel, whitish, cream, orange or pink with pale radial or divergent streaks and/or blotches.

Both valves sculptured with 20–24 unevenly spaced, narrow radial plicae (crests weakly convex on left valve, more acuminate on right valve) until central part of the disc; increasing by intercalation of scaly secondary ribs on each side of primary plicae from centre of disc to ventral margin. Widely spaced commarginal lamellae in interspaces, each lamella weakly filled by traces of antimarginal ridgelets.

Pre-radial microsculpture of antimarginal ridgelets crossed by prominent commarginal ridges. Auricles strongly ridged and scaly. Byssal notch moderately deep, byssal fasciole broad. Functional ctenolium well-developed, with c. 4–6 teeth.

**Dimensions.** Illustrated specimen: NSW, E of Broken Bay, 410–506 m (AM C.142144): rv: H 30.0, L 28.7 mm; lv: H 30.1, L 28.4 mm; D 7.9 mm. Iredale (1925: 253) stated the dimensions of the two syntypes (which he evidently thought represented one specimen) of *Chlamys famigerator* as rv: H 15, L 14 m; lv: H 17, L 16 mm.

**Habitat.** Living in the sublittoral to bathyal zones, amongst rubble or shell debris on soft sediment (sand and mud).

**Distribution.** Widespread around southern Australia, ranging from southern Queensland (21°S) southwards and westwards to the Rottneest Shelf (25°S) off Western Australia. Present specimens alive at 18–500 m.

**Remarks.** For comparison with the closest Recent congener *Talochlamys dichroa* (Suter, 1909) from New Zealand see Beu (1995: 18), Beu & Darragh (2001: 95), and Dijkstra & Marshall (2008: 51, figs 42–45).

### *Veprichlamys* Iredale, 1929

*Veprichlamys* Iredale, 1929: 164 (proposed as a subgenus of *Mimachlamys*). Type species (by original designation): *Chlamys perillustris* Iredale, 1925. Recent, off Victoria, Australia.

**Diagnosis.** Small to medium-sized byssate Pedini of strongly prosocline shape, with narrow umbonal angle, auricles highly unequal; pre-radial antimarginal microsculpture; narrow, squamous primary radial costae, secondary costae intercalated near ventral margin (late in ontogeny on most specimens); interstitial antimarginal microsculpture present, with a few long, straight ridgelets in centre of central radial interspaces, shagreen present in a few species; shallow internal radial furrows present, rib carinae lacking; byssal notch deep, ctenolium well-developed. Hinge with moderately prominent resilial and dorsal teeth.

**Distribution.** Miocene–Recent (Beu & Darragh, 2001: 115–118; Balcombian Australian Stage, middle Miocene). Southwestern Pacific, southern Australia, New Zealand, and the Galapagos Islands, living in the sublittoral to bathyal zones.

**Discussion.** Iredale (1929: 164) proposed *Veprichlamys* as a subgenus of *Mimachlamys*. Hertlein (1969: N355) treated *Veprichlamys* as a junior synonym of *Chlamys*, placed in the suprageneric *Chlamys* group. Waller (1993: 236; 2007: 942) considered *Veprichlamys* to be an extant genus of Chlamyidini (i.e., Pedini), based on “its pre-radial microsculpture and lack of internal rib carinae”.

### *Veprichlamys perillustris* (Iredale, 1925)

Figs 84F,H, 85, 86A,C

*Chlamys perillustris* Iredale, 1925: 254, pl. 41, figs 3–4; Gatliff & Gabriel, 1931: 232.

*Mimachlamys (Veprichlamys) perillustris* (Iredale).—Iredale, 1929: 164.

*Mimachlamys perillustris* (Iredale).—Macpherson & Chapple, 1951: 145; Cotton, 1961: 107, fig. 93.

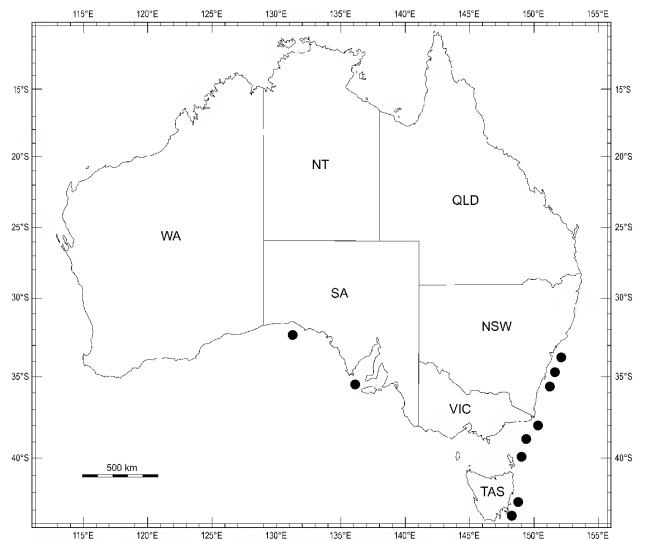


Figure 85. Distribution of *Veprichlamys perillustris* (Iredale).

*Veprichlamys perillustris* (Iredale).—Macpherson & Gabriel, 1962: 300, fig. 342; Garrard, 1969: 5; Beu, 1995: 19; Beu & Darragh, 2001: 115, figs 39A–C, G–I; Raines & Poppe, 2006: 252–253, lower figs; 254, upper figs; pl. 197, fig. 2. *Chlamys (Veprichlamys) perillustris* (Iredale).—Rombouts, 1991: 34, pl. 28, fig. 2. *Chlamys (Chlamys) perillustris* Iredale [sic].—Lamprell & Whitehead, 1992: [20], pl. 8, fig. 45.

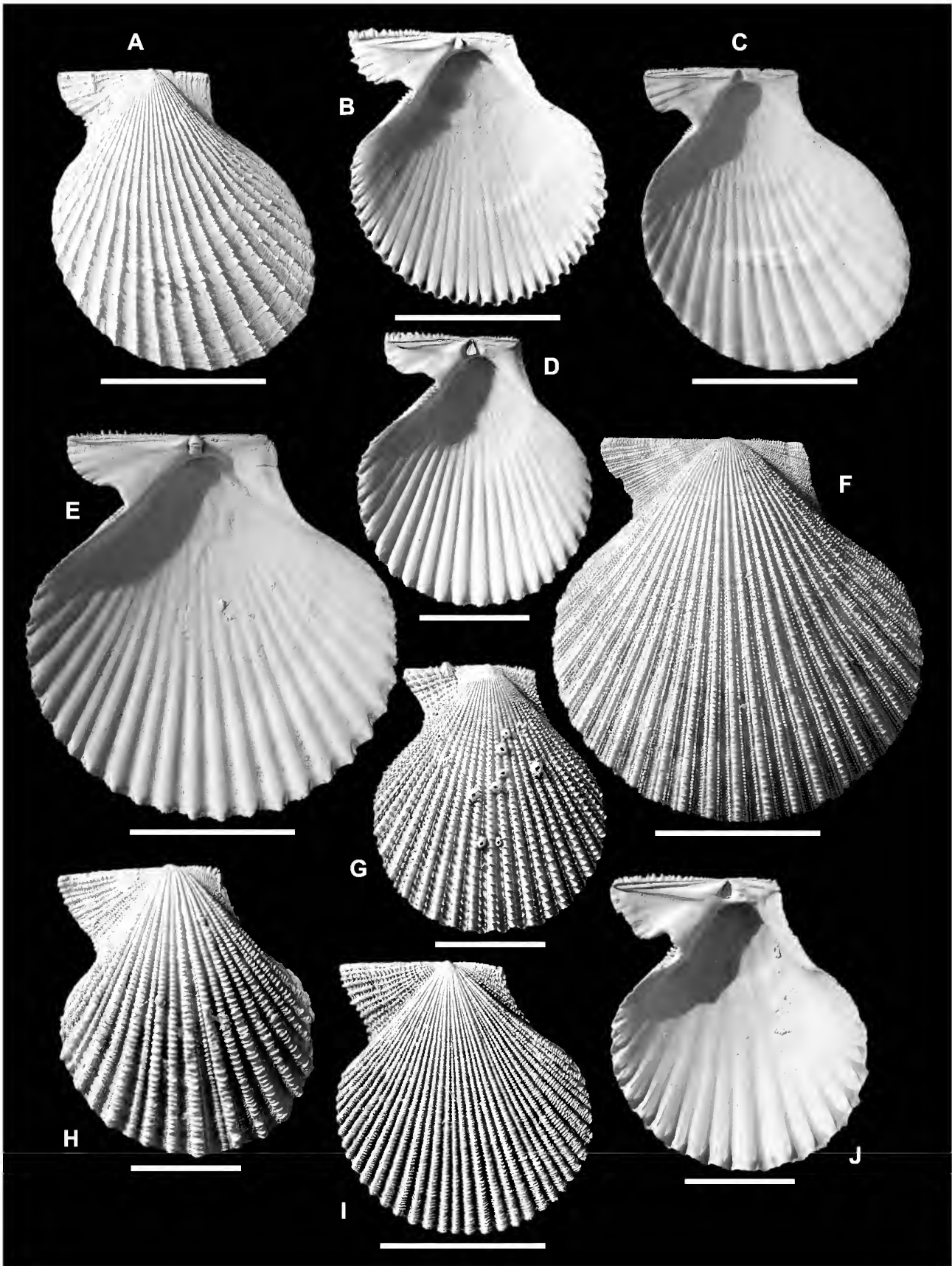
**Type data.** Holotype (pr) AM C.047394. Type locality: Victoria, off Gabo Island, alive, 150–250 fathoms [274–457 m].

**Additional material examined.**—AUSTRALIA: NEW SOUTH WALES: NNE of Sydney, 33°42'S 151°53'–152°0'E, alive, 406 m (3 pr, C.343937); off Sydney, 33°44'–33°50'S 151°50'–151°46'E, dead, 329–439 m (1 v, C.339094); off Sydney, 33°45'S 151°49'–151°50'E, dead, 439 m (1 v, C.339155); E of Sydney, 33°48'–33°43'S 151°48'–151°51'E, dead, 421 m (1 v, C.339156); off Botany Bay, 34°18'–34°20'S 151°26'–151°23'E, dead, 457 m (1 pr, C.122960); NE of Wollongong, 34°18'–34°24'S 151°26'–151°21'E, dead, 457–466 m (2 v, C.339154); off Wollongong, 34°21'–34°19'S 151°23'–151°25'E, alive, 439 m (1 v, C.117902; 2 pr, C.120412); off Jervis Bay, 35°05'S 151°02'–151°10'E, dead, 400–1000 m (2 v, C.131983); Batemans Bay, off Brush Island, 35°28'–35°34'S 150°48'–150°45'E, alive, 448–467 m (1 pr, C.343935); SE of Ulladulla, 35°29'–35°25'S 150°47'–150°50'E, dead, 440 m (1 v, C.102897); off Batemans Bay, 35°29'–35°34'S 150°48'–150°45'E, dead, 457 m (2 v, C.123378); ENE of Batemans Bay, 35°32'–35°42'S 150°45'–150°39'E, alive, 384 m (1 pr, C.343936); E of Eden, 36°57'–36°58'S 150°22'–150°22.14'E, dead, 960–1050 m (1 v, C.310695). VICTORIA: off Gabo Island, 37°41'S 150°13'E, alive, 274–366 m (1 pr, C.047394; 1 pr, C.170816); between Cape Howe & Lakes Entrance, 37°55'S 149°0'E, dead, 75–78 m (21 v, C.339093); off Gabo Island, 38°06'–38°0'S 149°58'–150°02'E, dead, 329 m (1 v, C.339153); S of Gabo Island, 38°10'S 149°55'E, dead, 365 m (3 pr, C.154683); SE of Gabo Island, 38°12'–38°11'S 149°49'–149°53'E, alive, 439 m (1 pr, C.108614); c. 27 mls SE of Cape Everard, 38°15'S 149°12'E, dead, 165–274 m (1 v, C.094543); 33 mls S of Cape Conran, Bass Canyon, 38°18'S 148°39'E, dead, 750 m (1 v, C.339092); 30 mls S of Cape Everard, 38°30'S 149°30'E, dead, 366 m (6 v, C.339091). TASMANIA: off Cape Naturaliste, 40°50'S 148°46'E, dead, 399 m (7 v, C.339090); off NE coast, 41°03'S 148°42'E, dead, 125 m (1 v, C.339089); off Cape Forestier, 42°10'S 148°34'E, dead, 205 m (1 v, C.339086); 20 mls E of Maria Island, 42°32'S 148°24'E, dead, 234 m (1 v, C.336935); ENE of Maria Island, 42°34'S 148°30'E, dead, 229–329 m (3 v, C.339085); 9.5 mls NE of Tasman Island, 43°12'S 148°13'E, dead, 570.5 m (1 v, C.339088); E of D'Entrecasteaux Channel, 44°02'S 146°50'E, dead, 176 m (2 v, C.339087). SOUTH AUSTRALIA: 40 mls S of Cape Wiles, 35°39'S 136°40'–136°50'E, dead, 174–183 m (10 v, C.305945; 10 v [more close-set lamellae on costae], C.032057); Great Australian Bight, 50 mls SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (1 v, C.339084).

**Description.** Shell up to c. 37 mm high, thin, weakly inflated, strongly prosocline, almost equivalve, strongly inequilateral, anterior auricles markedly larger and longer than posterior ones, umbonal angle c. 85–90°; whitish or pale orange to orange-brown, a few specimens yellowish.

Both valves sculptured with c. 20 regular, narrow, widely spaced scaly costae and intercostal antimarginal microsculpture, forming evenly concave intercostal spaces. Pre-radial stage with short antimarginal ridgelets (Beu &





**Figure 86.** *A, C*, *Veprichlamys perillustris* (Iredale), specimen in Fig. 84F, H, lv exterior (A), rv interior (C). *B, I*, *Mimachlamys albolineata* (G. B. Sowerby II), specimen in Fig. 84I–K; rv interior (B), lv exterior (I). *D, G*, *Mimachlamys funebris* (Reeve), WAM S55490, Entrance Point, Broome, WA, rv interior (D), lv exterior (G). *E, F*, *Mimachlamys asperima* (Lamarek), AM C.097543, D'Entrecasteaux Channel, TAS, 18 m; rv interior (E), lv exterior (F). *H, J*, *Mimachlamys cloacata* (Reeve), AM C.103803, off Picnic Point, Hervey Bay, QLD, 9–12 m; lv exterior (H), rv interior (J). Scale bars represent 20 mm (A, C, D, G), 10 mm (B, H–J), 30 mm (E, F).

Darragh, 2001: fig. 39G, I), continuing intercostally over disc; antimarginal ridgelets long and straight near centre of disc. Anterior auricles with 3–4 narrow, weakly scaly radial riblets; posterior auricle of left valve smooth, of right valve with 4–5 prominent squamous radial riblets. Byssal notch relatively deep, byssal fasciole broad. Functional ctenolium well-developed, with 5–6 teeth.

**Dimensions.** Illustrated specimen: VIC, S of Gabo I., 365 m (AM C.154683): rv: H 37.0, L 33.0 mm; lv: H 37.3, L 32.6 mm; D 11.0 mm. Iredale (1925: 254) stated the dimensions of the holotype as H 29, L 25 mm.

**Habitat.** Living on the continental shelf and in the upper bathyal zone, probably byssally attached to hard substrates on soft bottoms.

**Distribution.** Australian temperate waters, from New South Wales (c. 33°S) southwards to the Great Australian Bight. Present specimens alive at 274–467 m.

**Remarks.** This species closely resembles its New Zealand congener *Veprichlamys kiwaensis* (Powell, 1933) (Dijkstra & Marshall, 2008: 61, figs 51–52), differing mainly in shape (*V. perillustris* is much more strongly prosocline than *V. kiwaensis*) and sculpture (*V. perillustris* has about 20 costae, *V. kiwaensis* about 25, with secondary interstitial riblets near the ventral margin in some specimens that are absent from *V. perillustris*). *Veprichlamys kiwaensis* also consistently has pink radial costae on a paler ground, whereas the costae are not distinctively coloured in *V. perillustris*.

### *Zygochlamys* Ihering, 1907

*Zygochlamys* Ihering, 1907: 250 (proposed as a subgenus of *Chlamys*). Type species (by original designation): *Pecten geminatus* G. B. Sowerby I, 1846. San Julian Formation (late Oligocene or early Miocene), near Puerto Madryn, Argentina.

*Psychrochlamys* Jonkers, 2003: 43. Type species (by original designation): *Pecten patagonicus* King, 1832. (Pliocene?) Pleistocene & Recent, southern South America and the Falkland Islands.

**Diagnosis.** Medium to large Pedini with antimarginal microsculpture throughout ontogeny, some (Argentinian Eocene–early Miocene) species with shagreen microsculpture throughout or early in ontogeny; weak interstitial commarginal sculpture in early radial stage; scaly primary, secondary and tertiary radial macrosculpture in a characteristic fasciculate pattern, forming wide, triangular-section primary plicae on lv; dorso-ventrally elongate, with byssal notch and ctenolium prominent when young, becoming subcircular or length exceeding height when adult; byssal notch shallow and ctenolium weak in adults. Internal radial furrows present, representing internal expressions of external plicae. Hinge with moderately weak to prominent resilial and dorsal teeth.

**Distribution.** Eocene–Recent. Southern Hemisphere (southern Australia, New Zealand, southern Chile and southern Argentina; fossil in the subantarctic islands; Jonkers, 2003), living in the littoral to bathyal zones in colonies on soft sediment, free-lying as adults.

**Discussion.** Hertlein (1969: N355) treated *Zygochlamys* as a junior synonym of *Chlamys* Röding, 1798, placed in the *Chlamys* group.

Waller (1991: 28) considered *Zygochlamys* to be an extant genus from the Southern Hemisphere, including the following species: *Z. patagonica* (King, 1832), *Z. delicatula* (Hutton, 1873) and the “closely related” New Zealand species *Pecten dichrous* Suter, 1909 [sic], and *Chlamys* (*Mimachlamys*) *taiaroa* Powell, 1952, and placed it in the suprageneric *Chlamys* group.

Iredale (1925: 253) and Beu (1995: 18) pointed out that the type material of *Talochlamys pulleineana* is closely similar to *Pecten* (*Chlamys*) *dichrous* and that *Chlamys* (*Mimachlamys*) *taiaroa* is a subjective junior synonym of the former. According to Beu (1995) and Beu & Darragh (2001), *Zygochlamys* and *Talochlamys* have different origins, and *C. dichroa* should be placed in *Talochlamys*. According to Jonkers (2003) circum-subantarctic Recent species, formerly placed in *Zygochlamys*, belong in a distinct genus *Psychrochlamys*, lacking the shagreen microsculpture present on some early species of *Zygochlamys*. However, in our opinion middle Eocene specimens observed (AGB, with M. Griffin, Museo de La Plata, Argentina) in the Rio Turbio Formation, southern Argentina, are typical of *Zygochlamys* as well as very similar to Recent specimens of *Z. patagonica* and *Z. delicatula* in all characters. This group merely lost shagreen microsculpture during its evolution, and these taxa all form one clade. We follow the opinion of Beu & Darragh (2001: 118) and Dijkstra & Marshall (2008: 63) and treat *Psychrochlamys* as a synonym of *Zygochlamys*.

### *Zygochlamys delicatula* (Hutton, 1873)

Figs 82F, 87

*Pecten delicatula* [sic] Hutton, 1873: 30.

*Chlamys asperrimus* (Lamarck).—Hedley & May, 1908: 113 (misidentification).

*Chlamys antiaustralis* (Tate).—Hedley, 1911: 96 (Cape Pillar record only); May, 1912: 44; May, 1923: pl. 3, fig. 8 (misidentification).

*Pecten* (*Patinopecten*) *delicatus* Hutton.—Suter, 1914: 42, pl. 9, fig. 4.

*Chlamys subantarctica* Hedley, 1916b: 23, pl. 2, figs 14–15; Tomlin, 1948: 230.

*Pecten delicatus* Hutton.—Thomson, 1919: 282.

*Chlamys campbellicus* [sic] Odhner, 1924: 61, pl. 2, fig. 36.

*Chlamys instar* Iredale, 1925: 251, pl. 41, figs 5–7.

*Chlamys delicatula* (Hutton).—Marwick, 1928: 453; King, 1933: 353; Fleming, 1944: 210; Boreham, 1963: 3–25; Beu, 1977: 199–203; Fleming, 1979: 72, figs 72a–d; Fleming, 1980: 20, fig. 5.

*Chlamys titirangiensis* Marwick, 1928: 458, fig. 28.

*Chlamys campbellicus* [sic] Odhner.—Powell, 1939: 222, pl. 50, figs 10–14.

*Mimachlamys campbellica* Odhner.—Fleming, 1944: 209.

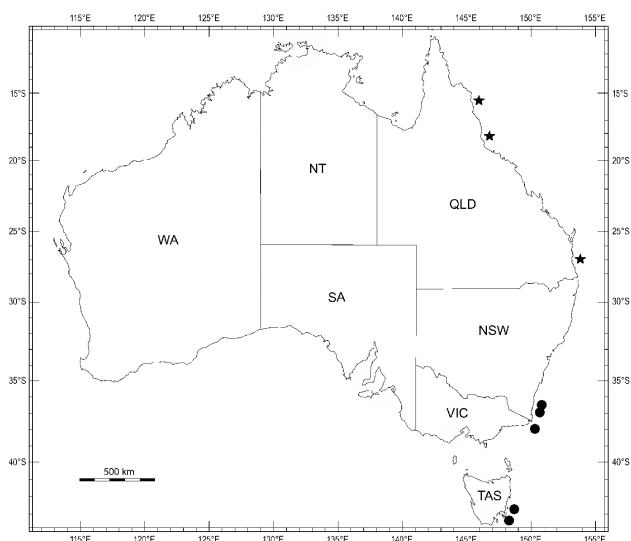
*Chlamys* (*Zygochlamys*) *delicatula* (Hutton).—Powell, 1950: 76; Powell, 1955: 25; Dell, 1956: 19; Fleming, 1957: fig. 1E; Fleming & Boreham *in* Pantin, 1957: 788, figs 1–2; Powell, 1960: 175; Pantin, 1963: 507, figs 1, 3–4; Dell, 1964: 180; Boreham, 1965: 22, pl. 5, figs 8–10; Beu *et al.*, 1977: 217–234, figs 3–6; Powell, 1979: 379, pl. 68, fig. 3; Beu *et al.*, 1981: 127–132.

*Mimachlamys instar* (Iredale).—Kershaw, 1955: 294.

*Chlamys* (*Zygochlamys*) *instar* Iredale.—Dell, 1964: 180.

*Chlamys patagonica delicatula* (Hutton).—Beu, 1985: 4, pl. 1, figs 5–9; pl. 2, figs 1–5; Beu & Maxwell, 1990: 308, pl. 38j.

*Zygochlamys delicatula* (Hutton).—Waller, 1991: 28, pl. 2, figs 15–16, pl. 3, fig. 4; Beu, 1995: 15, figs 3a–d, 23b–c, e; Beu, 1999: 534, figs 4–7; Beu & Darragh, 2001: 118,



**Figure 87.** Distribution of *Zygochlamys delicatula* (Hutton) (circles) and *Haumea rehderi* (Grau) (stars).

figs 41A–G; Dijkstra & Marshall, 2008: 63, figs 53A–F, 54A–F, 55A–B, D–E, 56; Spencer *et al.*, 2009: 198; Huber, 2010: 205.

*Psychrochlamys delicatula subantarctica* (Hedley).—Jonkers, 2003: 48, pl. 1, fig. b; pl. 9, figs a–d; pl. 11, figs d–g.

*Psychrochlamys delicatula delicatula* (Hutton).—Jonkers, 2003: 49, pl. 10, figs e–g.

*Psychrochlamys delicatula instar* (Iredale).—Jonkers, 2003: 51, pl. 11, figs a–c.

*Psychrochlamys delicatula* (Hutton).—Raines & Poppe, 2006: 224, 227, upper figs; pl. 172, figs 1–4.

**Type data.** *Pecten delicatula* Hutton: lectotype GNS TM2835, designated by Boreham (1965: 22, pl. 5, fig. 9). Type locality: Castlepoint, eastern Wairarapa, Castlepoint Formation (early Nukumaruan) (early Pleistocene, 2.4 Ma).

*Chlamys subantarctica* Hedley: holotype AM C.047411 (Hedley 1916b: pl. 2, fig. 14). Type locality: Macquarie Island, Lusitania Bay, 25 m.

*Chlamys campbellicus* Odhner: lectotype ZMUC, designated by Beu (1995: 17), 9 paralectotypes ZMUC (Odhner 1924: pl. 2, figs 36–39). Type locality: Campbell Island, Perseverance Harbour, 20 fathoms [37 m].

*Chlamys instar* Iredale: holotype AM C.029103, 9 paratypes C.029103 (holotype: Iredale, 1925: pl. 41, figs 5–6). Type locality: SE Tasmania, 11 km east of Cape Pillar, c. 180 m (late Pleistocene fossils).

*Chlamys titirangiensis* Marwick: holotype GNS TM4207, 2 paratypes GNS GS1178, CH/f04 (Marwick 1928: fig. 28). Type locality: Chatham Island, Titirangi Point, Titirangi Sand (early Nukumaruan) (early Pleistocene, 2.4 Ma).

**Comments on type data.** For additional information see Beu (1995: 17).

**Additional material examined.**—AUSTRALIA: NEW SOUTH WALES: E of Eden, 36°56′–36°58′S 150°20′E, dead, 274 m (1 v, C.122923); SE of Eden, 37°04′–37°13′S 150°21′–150°20′E, dead, 269–282 m (1 v, C.346882); off Green Cape, 37°22′–37°14′S 150°18′–150°19′E, dead, 154–157 m (1 v, C.346879). VICTORIA: E of Gabo Island, 37°35′–37°41′S 150°11′–150°14′E, dead, 220 m (4 v, C.110804); E of Gabo Island, 37°38′–37°46′S 150°13′–150°08′E, dead, 208–223 m (11 v, C.346889); SE of Gabo Island, 37°43′–37°46′S 150°08′–150°10′E, dead, 220 m (1 v, C.108843). TASMANIA: NE of Cape Pillar, 43°10′S 148°12′E, dead, 172 m (3 v, C.115202); off Cape Pillar, 43°13′S 148°05′E, dead, 183 m (7 v, C.029103; 1 v, C.053769; 1 v, C.105646; 4 v, C.346892); 2.5 ml E of Tasman Island, 43°15′S 148°03′E, dead, 183 m (1 v, C.098623); off Cape Raoul, 43°31′S 147°48′E, dead, 140 m (1 v, C.097427). MAQUARIE ISLAND: The Nuggets, 54°31′S 158°57′E, alive, 22 m (1 pr, C.155794); Lusitania Bay, 54°41′S 158°54′E, dead, 26 m (1 v, C.047411).

**Description.** Shell up to 110 mm high, most specimens smaller, to c. 70 mm; thin to more solid (Macquarie Island morph), adults almost circular, moderately inflated, left valve of most specimens a little more convex than right, equivalve, equilateral, anterior auricles larger and longer than posterior ones, umbonal angle of juveniles c. 85–90°, of adults c. 115–120°; most specimens white or yellowish, others orange, red or cream.

Both valves sculptured with c. 20 moderately prominent radial plicae; with narrow plicae with broader, evenly concave interspaces on left valve, wider plicae with narrower interspaces on right valve, subdivided and flanked by lamellose secondary and tertiary radial riblets. Antimarginal microsculpture in pre-radial stage and intercostally (Beu & Darragh, 2001: figs 41C, E; Dijkstra & Marshall, 2008: figs 53C, 54C). Auricles with 10–16 squamous radial riblets, except 4–5 riblets on anterior auricle of right valve. Byssal notch moderately deep, byssal fasciole broad, both decreasing in prominence with age. Functional ctenolium well-developed in juveniles, with 4–5 teeth, decreasing in number with age. Internal radial furrows present, edges not carinate. Hinge with moderately weak resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: VIC, E of Gabo I, 208–223 m (AM C.346889), large single lv: H 89.6, L 90.5 mm.

**Habitat.** Living in the sublittoral to bathyal zones, many specimens encrusted with sponges. However, not known living around Australia.

**Distribution.** Cook Strait to the southern region of the South Island, New Zealand, southwards to the Bounty, Antipodes, Auckland, Campbell and Macquarie Islands; dead specimens on the Chatham Rise, off W Auckland and N of the Three Kings Islands, New Zealand (Beu, 1999; Dijkstra & Marshall, 2008: fig. 56), westwards to southernmost New South Wales, eastern Victoria and eastern Tasmania. Present specimens dead at 140–282 m.

**Remarks.** The present specimens from Australia are Last Glacial Maximum fossils and no living records are known from Australia (see also Beu & Darragh, 2001: 121). Specimens from southeastern Australia have been incorrectly identified in the past as “*Mimachlamys asperrima*” or “*Mimachlamys antiaustralis*” by Hedley & May (1908), Hedley (1911) and May (1921) (Beu, 1985).

For information on biostratigraphy see Beu (1995: 16).

## Mimachlamyidini Waller, 1993

**Diagnosis.** Pedinae with chlamydoid, aequipectinoid or pectinoid shape, simple primary radial sculpture of solid plicae with (in some taxa) secondary and tertiary flanking costellae; microsculpture of simple, smooth, oval pits in pre-radial stage, antimarginal or divaricated (herringbone-like) interstitial microsculpture on remainder of shell; true shagreen microsculpture never present, although some taxa have “pseudo-shagreen” sculpture in which cells are not united across dorsal surface; internal rib carinae near ventral margin of most taxa; hinge with prominent resilial and dorsal teeth; deep byssal notch and prominent functional ctenolium in late ontogeny of almost all taxa.

### Key to genera of *Mimachlamydingi* occurring in Australia

- 1 Shell medium to large, chlamydoid, auricles highly unequal, primary and secondary spinous radial macrosculpture, intercalated herringbone microsculpture, byssal notch deep ..... *Mimachlamys*
- Shell medium, circular, lv slightly concave, rv convex, auricles equal, solid plicae ..... 2
- 2 Shell medium, pectinoid, auricles equal, simple radial plicae, lv with commarginal lamellae, lacking on rv ..... *Minnivola*
- Shell medium, oblong to (sub)circular, solid, almost equally convex, auricles unequal, simple radial plicae ..... 3
- 3 Shell medium, chlamydoid, auricles highly unequal, simple radial macrosculpture, intercalated imbricate (early ontogeny) and radial (late ontogeny) microsculpture, byssal notch deep ..... *Volachlamys*

**Remarks.** Genera included previously in *Mimachlamydingi* are *Mimachlamys* Iredale, 1929, *Dimarzipecten* Ward, 1992, *Spathochlamys* Waller, 1993, *Interchlamys* Waller, 2011, and an unnamed genus for the Puerto Rican Oligocene species *Pecten sansebastianus* Maury, 1920 (Waller, 1993, 2011). Following the advice of T. R. Waller (USNM, pers. comm. 1 July 2017) we now include *Minnivola* Iredale, 1939 and *Volachlamys* Iredale, 1939 in *Mimachlamydingi*.

primitive hinge type with prominent resilial and dorsal teeth; macrosculpture of evenly spaced, undivided, solid radial plicae in most species, bearing spines, flanked with secondary costellae; antimarginal and/or divaricated interstitial microsculpture; byssal notch deep, ctenolium well-developed.

**Distribution.** Eocene–Recent (Waller, 1991: 32). Indo-West Pacific and eastern Atlantic, living in the intertidal to sublittoral zones, byssally attached to rocks or coral and amongst rubble.

### *Mimachlamys* Iredale, 1929

*Mimachlamys* Iredale, 1929: 162. Type species (by original designation): *Pecten asperrimus* Lamarck, 1819. Recent, southwestern, southern and southeastern Australia.

**Discussion.** Hertlein (1969: N355) placed *Mimachlamys* in the synonymy of *Chlamys* Röding, 1798, as did Vaught (1989: 118). Waller (1991: 31; 1993: 200) established the morphological differences between *Mimachlamys* and *Chlamys*, and placed the former genus in *Mimachlamydingi*.

**Diagnosis.** Medium-sized to large, byssate *Mimachlamydingi* with chlamydoid shape, auricles highly unequal; a

### Key to species of *Mimachlamys* from Australia

- 1 Shell c. 30 mm high, elongate, weakly inflated, almost equally convex, valves with c. 30 evenly spaced, narrow, raised, serrated radial plicae, byssal notch deep, byssal fasciole broad ..... *M. albolineata*
- Shell with 24–30 prominent squamous radial plicae ..... 2
- 2 Shell c. 100 mm high, subcircular, rather thin to solid, almost equally convex, valves with 24–30 evenly spaced, prominent squamous radial plicae, flanked by subdivided secondary riblets, tertiary riblets in interspaces, byssal notch deep, byssal fasciole broad ..... *M. asperrima*
- Shell with 16–18 narrowly rounded lamellate primary radial plicae ..... 3
- 3 Shell c. 35 mm high, solid, triangularly ovate, almost equally convex, valves with 16–18 evenly spaced, narrowly rounded, lamellate, radial plicae, byssal notch deep, byssal fasciole broad ..... *M. cloacata*
- Shell with 20–25 squamous radial plicae, flanked by riblet ..... 4
- 4 Shell c. 70 mm high, elongate, weakly inflated, almost equally convex, valves with 20–25 evenly spaced, squamous radial plicae, flanked by a riblet on each side of each plica, byssal notch deep, byssal fasciole broad ..... *M. funebris*
- Shell with 22–23 primary radial plicae with widely set scales ..... 5

- 5 Shell c. 120 mm high, subcircular, weakly inflated, lv slightly more convex than rv, valves with 22–23 evenly spaced radial plicae bearing widely set scales, byssal notch deep, byssal fasciole broad ..... *M. gloriosa*  
 — Shell with 24–30 primary narrow riblets and many riblets in interspaces ..... 6
- 6 Shell c. 110 mm high, thin, moderately to strong prosocline, lv much more inflated than rv, strongly inequivalve and inequilateral, valves with c. 24–30 evenly and widely spaced, narrowly squamous radial plicae, many closely spaced radial riblets in interspaces, byssal notch deep, byssal fasciole narrow ..... *M. heterophyseta*  
 — Shell with 20–24 squamous radial plicae ..... 7
- 7 Shell c. 70 mm high, elongate, weakly inflated, almost equally convex, valves with 20–24 evenly spaced, squamous radial plicae, flanked by secondary riblet on each side in late growth stage or lacking, byssal notch deep, byssal fasciole broad ..... *M. punctata*  
 — Shell with 20–24 radial plicae with tripartite scales ..... 8
- 8 Shell c. 70 mm high, solid, circular to elongate, moderately inflated, lv slightly more convex than rv, valves with 20–24 evenly spaced, radial plicae with small tripartite scales, flanked by a spinous radial riblet, byssal notch deep, byssal fasciole broad ..... *M. sanguinea*  
 — Shell with c. 20 strongly squamous radial plicae, variable in prominence ..... 9
- 9 Shell c. 80 mm high, solid, moderately inflated, lv slightly more convex than rv, valves with c. 20 almost evenly spaced, strongly squamous radial plicae (5–7 with spatulate lamellae), byssal notch deep, byssal fasciole broad ..... *M. scabricostata*  
 — Shell with c. 20 delicately squamous, rounded primary radial plicae ..... 10
- 10 Shell c. 120 mm high, solid, moderately inflated, almost equally convex, valves with c. 20 evenly spaced, fine squamous radial plicae, almost equal in prominence, flanked by a spinous radial riblet, secondary spinous radial riblets in interspaces, byssal notch deep, byssal fasciole broad ..... *M. spinicostata*

***Mimachlamys albolineata***  
**(G. B. Sowerby II, 1842)**

Figs 84I–K, 86B,I, 89

- Ostrea pusio* Linnaeus, 1758: 698, no. 169 (in part, not including lectotype).  
*Pecten albolineatus* G. B. Sowerby II, 1842: 73, pl. 14, figs 69–70; Reeve, 1853: sp. 95, pl. 24, fig. 94b; Küster & Kobelt, 1888: 75, pl. 19, fig. 3.  
*Pecten (Chlamys) albolineatus* Sowerby.—Dautzenberg & Bavay, 1912: 10.  
*Chlamys albolineata* (Sowerby).—Abbott & Dance, 1982: 314, fig; Dharma, 1992: 84, pl. 20, figs 6–6a; Bernard *et al.*, 1993: 48; Dharma, 2005: 248, pl. 99, figs 5a–b.  
*Chlamys (Mimachlamys) albolineata* (Sowerby).—Wang, 1983c: 51, pl. 1, fig. 4; Higo & Goto, 1993: 574; Higo *et al.*, 1999: 443.  
*Chlamys (Chlamys) albolineata* (Sowerby).—Dijkstra, 1990a: 9; Rombouts, 1991: 9, pl. 6, fig. 4.  
*Mimachlamys albolineata* (Sowerby).—Dijkstra, 1991: 33; Dijkstra, 1997: 324; Dijkstra, 1998a: 39, pl. 8, figs 1–3; Hayami, 2000: 901, pl. 448, fig. 23; Wang, 2002: 191, pl.

5, fig. 13; Raines & Poppe, 2006: 266, 269, upper figs; pl. 211, figs 1–7; Xu & Zhang, 2008: 83, fig. 232; Huber, 2010: 210; Raines, 2010: 638, pl. 1010, figs 1–4; Dijkstra, 2013: 88, pl. 19, figs 4a–b, pl. 23, figs 1a–d, pl. 31, figs 3a–b.

**Type data.** Lectotype (pr) (H 27.0 mm, W 23.8 mm, D 8.6 mm) NHMUK1994163/1, 4 paralectotypes (pr) NHMUK1994163/2–5, herein designated. Type locality: Philippine Islands, Guimaras Island; 3 possible syntypes (pr) ZMB Moll.114.614, labelled “*Pecten albolineatus*, Sw./Philippinen/H. Cuming” and “*P. albolineatus*, Sow. Thes. Conch. p. 73. pl. 14 f. 69” (Dijkstra & Köhler 2008: 32, fig. 2a).

**Comments on type data.** The designated lectotype is probably the specimen illustrated by Sowerby (1842: fig. 70) and Reeve (1853: pl. 24, fig. 94b) (pers. comm. Ms K. Way and Mrs J. Pickering, 2000).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: off Portland Roads, Rock Island, 12°35'S 143°24'E, alive (1 pr, ZMA Moll.147088). —JAPAN: Okinawa, off Bolo Point, alive, 12 m (4 pr, ZMA Moll.140881). —CHINA: Hainan, alive, intertidal (2 pr, ZMA Moll.141992). —VIETNAM: Nha Trang, SW of Hon Mun Island, alive, 20 m (6 pr, ZMA Moll.145835). —PHILIPPINE ISLANDS: Zamboanga, Recodo, alive, 12 m (1 pr, ZMA Moll.144245). —INDONESIA: Java, Rambut Island, alive, intertidal (2 pr, ZMA Moll.141999); Timor, alive, intertidal (1



pr, ZMA Moll.141987). ANDAMAN ISLANDS: Between South Point and Corbyn's Cove, alive, intertidal (1 pr, ZMA Moll.141988). —THAILAND: Phuket Island, alive, 6–12 m (2 pr, ZMA Moll.141989). —PAPUA NEW GUINEA: Port Moresby, Quayles Reef, dead, 20 m (2 v, ZMA Moll.141986). —SOLOMON ISLANDS: Ngela Island, Mbolu Passage, dead, 1 m (2 pr, ZMA Moll.141983); Guadalcanal, Honiara, off Mandana Hotel, alive, 1 m (1 pr, ZMA Moll.141982). —FIJI ISLANDS: Viti Levu, Vuda Point, alive, at low tide on shore reef (8 pr, ZMA Moll.141993).

**Description.** Shell up to 39 mm high (Huber, 2010), weakly inflated, almost equally convex, elongate, equivalve, slightly inequilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 85–90°; right valve whitish with black and white streaks on plicae; four plicae paler, forming widely spaced pale rays; left valve darker than right.

Both valves sculptured with c. 30 evenly spaced, narrow, raised, serrated radial plicae, subdivided in late ontogeny in a few specimens. Interplical spaces with narrow commarginal lamellae near ventral margin. Antimarginal microsculpture very weak or even lacking. Anterior auricles with 6–7 prominent squamous radial riblets, posterior ones with 5 narrow squamous radial riblets. Byssal notch moderately deep, byssal fasciole rather broad. Functional cntenulum well-developed, with 5–6 teeth. Weak internal rib carinae around ventral margin. Moderate resilial and dorsal teeth.

**Dimensions.** Illustrated specimen: QLD, off Portland Roads, Rock Island, 12°35'S 143°24'E, alive (ZMA Moll.147088): H 16.8, L 15.7, D 5.0 mm.

**Habitat.** Living in the upper littoral zone, byssally attached to rocks or coral or amongst coral rubble, most specimens on sandy bottoms.

**Distribution.** Tropical Indo-West Pacific, from southern Japan southwards to northern Australia, westwards into the Bay of Bengal, and eastwards to the Fiji Islands (Raines & Poppe, 2006: 268); Amami (southern Japan) to the Andaman Islands, 1–55 (Huber, 2010: 210); Philippines, intertidal zone to 6 m (Raines, 2010: 638; Dijkstra, 2013: 89); Indonesia (Dijkstra, 1991: 33); Papua New Guinea, intertidal zone (Dijkstra, 1998a: 39). Maximum depth range of live-taken specimens is from the intertidal zone to 55 m. Present specimens from Australia alive (depth not recorded).

**Remarks.** The specimen from Queensland is indistinguishable from the type material. It is remarkable that this rather common species from the southwest Pacific is rare in Queensland and not yet recorded from northern and Western Australia. The present species is a **new record** for Australia.

### *Mimachlamys asperrima* (Lamarck, 1819)

Figs 86E–F, 88A,H, 89

*Pecten asperrimus* Lamarck, 1819: 174; Deshayes, 1836: 145; Delessert, 1841: pl. 15, figs 1a–b; G. B. Sowerby II, 1842: 75, pl. 17, fig. 156; Chenu, 1844: pl. 33, figs 4–6; Menke, 1844: 90; Reeve, 1853: sp. 75, pl. 20, fig. 75; Angas, 1877: 293; Tenison Woods, 1878a: 33, 56; E.A. Smith, 1885: 294; Harris, 1897: 315; Tate & May, 1901: 440; Hedley, 1916a: 157; Odhner, 1917: 14; Thiele, 1930: 591; Dijkstra, 1994: 487, pl. 24, figs 101–104 (lectotype).

*Ostrea matonii* Donovan, 1825: pl. 91.

*Pecten australis* G. B. Sowerby II, 1842: 76, pl. 19, figs 219–220; Reeve, 1853: sp. 103, pl. 25, figs 103a–b.

*Pecten rubidus* “Martyn”.—Menke, 1843: 36 (misidentification).

*Pecten asperrimus* Lamarck var.—Tate, 1882: 45.

*Pecten antiaustralis* Tate, 1886: 106, pl. 9, figs 7a–c; Harris, 1897: 315; Tate, 1899: 269.

*Pecten asperrimus* [sic] Lamarck.—Tate & May, 1901: 440.

*Chlamys asperrimus* [sic] (Lamarck).—Pritchard & Gatliff, 1898: 264; Hedley, 1902: 307; Hedley, 1918a: M9; May, 1921: 10; May, 1923: pl. 3, fig. 7; Macpherson & Gabriel, 1962: 303, fig. 344; Macpherson, 1966: 232; Wells & Bryce, 1985: 158, fig. 581; Richmond, [1990]: 46, figs 125.

*Mimachlamys asperrimus* [sic] (Lamarck).—Iredale, 1929: 162; Cotton & Godfrey, 1938: 100, fig. 86; Allan, 1950: 280, pl. 37, fig. 3; Macpherson & Chapple, 1951: 145; Cotton, 1961: 105, fig. 90.

*Chlamys asperrimus* [sic] *antiaustralis* (Tate).—Gatliff & Singleton, 1930: 71, pl. 2, fig. 3; pl. 3, figs 6–7; pl. 4, figs 10a–b.

*Chlamys asperrimus asperrimus* [sic] (Lamarck).—Gatliff & Singleton, 1930: 73, pl. 2, figs 1, 2, 4; pl. 3, fig. 5; pl. 4, figs 11a–12.

*Chlamys asperrimus* [sic] *dennanti* Gatliff & Singleton, 1930: 73, pl. 3, figs 8–9; pl. 4, figs 13a–b.

*Chlamys* (*Chlamys*) *antiaustralis* (Tate).—Ludbrook, 1955: 30, pl. 5, fig. 11; Ludbrook, 1959: 223.

*Chlamys* (*Aequipecten*) *asperrimus* [sic] Lamarck.—Gabriel, 1956: 14.

*Mimachlamys asperrima* (Lamarck).—Garrard, 1961: 5; Iredale & McMichael, 1962: 11; Waller, 1991: 32, pl. 4, figs 4–5; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 50; Beu & Darragh, 2001: 133, figs 46A–C, 47A–D, F, 52C; Raines & Poppe, 2006: 268, 269, lower figs; pl. 212, figs 1–3; pl. 213, figs 1–4; Huber, 2010: 210.

*Chlamys* (*Chlamys*) *asperrimus asperrimus* [sic] (Lamarck).—Ludbrook, 1983: 39.

*Chlamys* (*Chlamys*) *asperrimus* [sic] *dennanti* Gatliff & Singleton.—Ludbrook, 1983: 39.

*Chlamys* (*Chlamys*) *asperrima* (Lamarck).—Ludbrook, 1984: 160, 238, fig. 41a, pl. 4f–i; Ludbrook & Gowlett-Holmes, 1989: 642, fig. 11.40a, pl. 42, fig. 4.

*Chlamys* (*Chlamys*) *asperrima dennanti* Gatliff & Singleton.—Ludbrook, 1984: 238.

*Chlamys* (*Mimachlamys*) *asperrima* (Lamarck); Rombouts, 1991: 27, pl. 10, figs 3–3b.

**Type data.** *Pecten asperrimus* Lamarck: lectotype (pr) MNHN Moll21197, designated by Dijkstra (1994: 488), 10 paralectotypes (8 pr + 2 v) (3 MNHN Moll21198, 7 MHNG1088/66/1–6). Type locality: “Habite les mers australes, à la Nouvelle Hollande [Australia], les côtes de Diémen” [Tasmania].

*Ostrea matonii* Donovan: repository of type material not known. Neotype (lectotype of *Pecten asperrimus* Lamarck) designated by Beu & Darragh (2001). Type locality: “Van Diemen’s Land” [Tasmania].

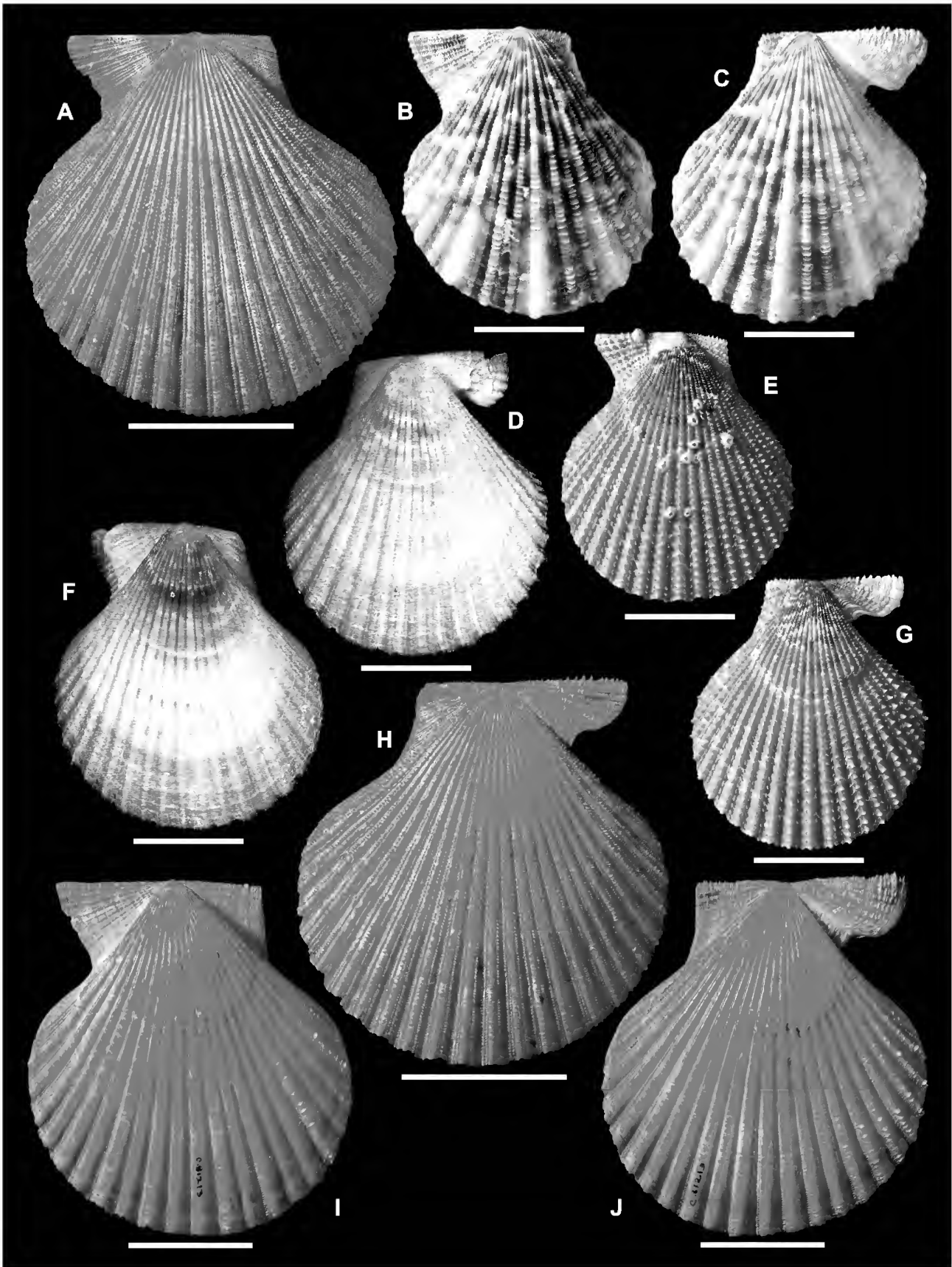
*Pecten australis* Sowerby: three possible syntypes (pr) NHMUK [not registered]. Type locality: “Swan River”, Western Australia.

*Pecten antiaustralis* Tate: lectotype (pr) SAM T.928A, designated by Beu & Darragh (2001: 135). Type locality: “Oyster beds, Aldinga Bay”, i.e. Hallett Cove Sandstone, Late Pliocene, near Adelaide (Beu & Darragh, 2001).

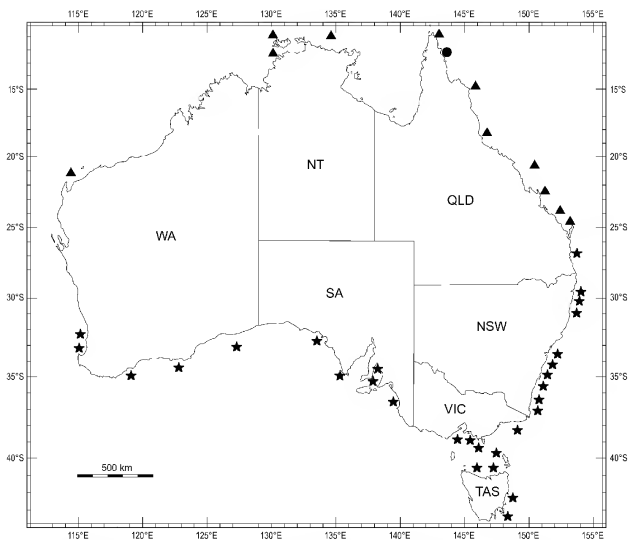
*Chlamys asperrimus* [sic] *dennanti* Gatliff & Singleton: holotype NMV P13503, paratype NMV P13504. Type locality: Werriook Limestone, above Limestone Creek, Glenelg River, western Victoria; early Pleistocene?

**Comments on type data.** For more information on type material of the synonyms of *Mimachlamys asperrima* see Beu & Darragh (2001: 135).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Caloundra, 26°49'S 153°10'E, dead (5 v, C.375798). NEW SOUTH WALES: Smiths Lake Bar, 32°24'S 152°31'E, dead, beach (1 v, C.350406); Port Stephens, Nelson Bay, 32°43'S 152°08'E, dead, 15 m (1 v, C.347403); 5.5 mls E of The Entrance, 33°20'S 151°35'E, dead, 40–49 m (1 v, C.347401); off Tuggerah Lake, 33°20'S 151°39'E, dead,



**Figure 88.** *A, H*, *Mimachlamys asperima* (Lamarck), specimen in Fig. 86E, F; lv exterior (A), rv exterior (H). *B–D, F*, *Mimachlamys cloacata* (Reeve); (B, C) specimen in Fig. 86H, J; lv exterior (B), rv exterior (C); (D, F) AM C.089670, holotype of *Mimachlamys curtisiana* Iredale, Port Curtis, Gladstone, QLD; rv exterior (D), lv exterior (F). *E, G*, *Mimachlamys funebris* (Reeve), specimen in Fig. 86D, G; lv exterior (E), rv exterior (G). *I, J*, *Mimachlamys gloriosa* (Reeve), smooth form, AM C.081213, trawled off Moreton Island, QLD; lv exterior (I), rv exterior (J). Scale bars represent 30 mm (A, H–J), 10 mm (B–D, F), 20 mm (E, G).



**Figure 89.** Distribution of *Mimachlamys albolineata* (G. B. Sowerby II) (circle), *M. asperima* (Lamarck) (stars) and *M. cloacata* (Reeve) (triangles).

60 m (1 v, C.347409); off Norah Head, 33°20'S 151°56'E, dead, 73–91 m (2 v, C.130120); Sydney N, Collaroy, Long Reef, 33°44.6'S 151°18.6'E, alive (1 pr + 1 v, C.375925); Sydney Harbour, Nielson Park, Bottle & Glass Rocks, 33°50'S 151°16'E, alive, 15 m (3 v, C.007500); Sydney, Port Jackson, Watsons Bay, Green Point, 33°50'S 151°16'E, alive, 15 m (1 pr, C.047344); Sydney, Port Jackson, 33°51'S 151°14'E, alive (1 pr, C.015689; 5 v, C.132923); Sydney Harbour, 33°51'S 151°14'E, alive (22 v, C.094550; 10 v, C.346926); Sydney, Botany Bay, Yarra Bay, 33°58'S 151°13'E, dead (3 v, C.122377); Sydney, off Malabar, 33°58'S 151°17'E, dead, 67 m (4 v, C.347377); Sydney, 3 km E of Long Bay, 33°58'S 151°16'E, dead, 47 m (4 v, C.347381); Sydney, Long Bay, 33°58.3'S 151°15.4'E, dead (1 v, C.375942); Sydney, Botany Bay, Barton St, Monterey to Ramsgate, 33°58.53–33°59.2'S 151°08.95–151°08.85'E, dead (1 v, C.375933); Sydney, Botany Bay, Yarra Bay, 33°59'S 151°13.3'E, dead, beach (4 v, C.375780); Sydney, 2.3 km E of Malabar, 33°59'S 151°16'E, dead, 64–66 m (2 v, C.347368; 3 v, C.347374); Sydney, 2.2 km E of Cape Banks, 34°0'S 151°15'E, dead, 49 m (1 v, C.347370); Sydney, Botany Bay, Kurnell, 34°00.58'S 151°12.38'E, dead (1 v, C.375926; 1 v, C.375941); Sydney S, Cronulla, 34°03'S 151°09'E, dead (2 v, C.347367); Sydney, off Cronulla, 34°03'S 151°12.5'E, dead, 70–80 m (1 v, C.375949); Sydney S, Cronulla, 34°03.5'S 151°09.2'E, dead (18 v, C.375943); off Cronulla, 34°04'S 151°14'E, dead, 40–100 m (6 v, C.347366); off Botany to Wattamolla, 34°05'S 151°14'E, alive, 64 m (1 pr, C.111391); Port Hacking, off Jibbon, 34°05'S 151°13'E, dead, 75–85 m (1 v, C.347369; 6 v, C.375947); Shellharbour, 34°35'S 150°52'E, dead (1 v, C.375935); Gerringong, 34°45'S 150°50'E, dead (many v, C.375930); NE of Nowra, S of Gerringong, Seven Mile Beach, 34°48.8'S 150°46'E, dead (4 v, C.375944); off Shoalhaven Bight, 34°51'S 150°52.5'E, dead, 46–55 m (1 v, C.346946); Shoalhaven Bight, 34°57'S 150°48'E, alive, 27–82 m (1 pr, C.347359); Jervis Bay, Callala Point, 35°0'S 150°43'E, dead (7 v, C.129696); Jervis Bay, 35°02'S 150°44'E, dead (1 pr, C.012062; 1 pr, C.117385); Jervis Bay, 35°02'S 150°40'E, dead (3 v, C.346946); Jervis Bay, Huskisson, 35°02'S 150°40'E, dead (5 v, C.346971; 5 v, C.375919); Jervis Bay, 35°03'S 150°45'E, dead, 27.5 m (3 v, C.346969); Jervis Bay, Honeymoon Bay, 35°03.5'S 150°46.7'E, dead (4 v, C.375917); Jervis Bay, Honeymoon Bay, 35°03.5'S 150°46.50'E, alive, 7.5 m (2 pr, C.375939); Jervis Bay, off Huskisson, 35°05'S 151°0'E, dead, 55 m (1 v, C.375927); off Jervis Bay, 35°05'S 151°0'E, alive, 64–73 m (1 pr, C.375946); Darling Point, S side Jervis Bay, 35°07'S 150°44'E, alive, 18 m (9 pr, C.346945; 4 pr, C.375940); Bendalong, N of Lake Conjola, 35°15'S 150°32'E, dead, beach (3 v, C.346970); off Ulladulla, 35°21'S 150°31.5'E, alive (1 pr, C.375920; 1 pr, C.375928); Burrill Lake, S of Ulladulla, 35°22.5'S 150°26'E, dead (20 v, C.375945); Batemans Bay, 35°44'S 150°13'E, dead (1 v, C.346928); Montague Island, Narooma, 36°10'S 150°14'E, alive (7 pr, C.094863); Narooma, 36°13.24'S 150°08.37'E, dead (1 v, C.375937); Narooma, 36°13.4'S 150°08'E, dead (1 v, C.375938); off Montague Island, 36°14.2'S 150°15'E, alive, 82–110 m (2 pr, C.375923); Narooma, off Montague Island, 36°15'S 150°13'E, alive, 9–18 m (11 v, C.040698; 31 v, C.347365); Merimbula Lake, Spencer Park, 36°53.55'S 149°55.4'E, dead, 0–0.25 m (1 v, C.375995); off Merimbula, 36°54'S 150°07'E, dead, 91 m (1 pr, C.094549); 10 mls N of Eden, 36°55'S 149°55'E, dead, 18–46 m (27 v, C.094544); off Merimbula, 36°55'S 150°0'E, alive, 46 m (4 pr, C.375931); 10 mls N of Eden, 36°57'S 150°0'E, dead, 36.5 m (2 v, C.346930); Eden, Twofold Bay, 37°04'S 149°54'E, dead (9 v, C.346972); Eden, off Lookout Point (Middle Head), 37°04'S 149°55'E, dead, 27 m (32 v, C.346956); 5–6 km off Eden, 37°05'S 150°0'E, alive, 46–55 m (1 v, C.346916; 6 v, C.346961; 1 pr, C.375921); Twofold Bay, 37°05'S 149°55'E, dead, beach (8 v, C.007670); Twofold Bay, 37°05'S 149°55'E, dead (2 v, C.047342); Twofold Bay, 37°05'S 149°54'E, alive, 9–46 m (1 pr, C.346910; 5 v, C.346909; 10 v, C.375934); Twofold Bay, 37°05'S 149°57'E, dead, 37 m (many v, C.375924); off Twofold Bay, 37°05'S 150°10'E, alive, 54–91 m (8 pr, C.064360; 1 pr, C.097545; 2 pr, C.375918); off Eden, 37°05'S 150°10'E, alive, 73–91 m (2 pr, C.375932); Twofold Bay, SSE of Eden, Boydtown, 37°06.24'S 149°52.73'E, dead (1 v, C.375922); 2–3 mls N of Green Cape, 37°14'S 150°03'E, alive, 55–73 m (3 pr, C.051441); Green Cape, 37°16'S 150°03'E, dead, 2–4 m (1 v, C.346904); off Green Cape, 37°17'S 150°12'E, alive, 110 m (1 pr, C.094544); Disaster Bay, 37°16'S 149°59'E, alive (6 v, C.094545); Newtons Beach, Nadgee Fauna Reserve, 37°22'S 149°57'E, dead (3 v, C.346905); Nadgee Fauna Reserve, Black Head, 37°26.5'S 149°58.5'E, dead (4 v, C.375948).

**VICTORIA:** Mallacoota, 37°34'S 149°56'E, dead (2 v, C.050287; 4 v, C.050441); Gabo Island, 37°34'S 149°55'E, alive, 18 m (1 pr, C.347505); between Cape Howe & Lakes Entrance, 37°55'S 149°0'E, dead, 75–78 m (1 v, C.347502); off Lakes Entrance, 38°03'S 148°03.5'E, alive (many, C.375787); off Lakes Entrance, 38°03'S 148°03'E, alive, 35–46 m (1 pr, C.347504; 6 v, C.347506); Lakes Entrance, 37°53'S 147°59'E, dead (5 v, C.050296); off Lakes Entrance, 37°53'S 147°59'E, alive (2 pr, C.103820); off Waterloo Bay, Wilsons Promontory, 39°05'S 146°27'E, alive, 46 m (5 pr, C.094313); Western Port, 38°22'S 145°32'E, alive, 15–18 m (2 pr, C.130121); Sandy Point, Western Port, just N of North Arm, 38°24'S 145°14'E, dead, 7.5 m (2 v, C.347460); Bass Strait, off Western Port, 38°34'S 145°10'E, dead (2 pr, C.097542); Port Phillip, 38°19'S 144°42'E, alive, 4.5–6 m (3 pr, C.092004; 1 pr, C.112573; 1 pr, C.347461); Port Phillip, Portsea Pier, 38°19'S 144°42'E, alive, 3–4.5 m (1 pr, C.112790). **TASMANIA:** Bass Strait, Flinders Island, Warrens Farm, 39°58'S 148°07'E, dead (1 v, C.300317); Bass Strait, Flinders Island, Arthur Bay, 40°03'S 147°56'E, dead (1 v, C.356712); off Cape Naturaliste, 40°49'S 148°32'E, dead, 62 m (1 v, C.124189); Bass Strait, off Devonport, 41°10'S 146°21'E, dead (1 pr, C.375783); 20 mls E of Maria Island, 42°32'S 148°24'E, dead, 234 m (3 v, C.356705); Freycinet Peninsula, W side, Promise Bay, Hazards Beach, 42°10'S 148°16'E, dead (3 v, C.342443); Hobart, Derwent River, 42°53'S 147°19'E, alive (2 pr, C.375782); off Eaglehawk Neck, 43°0'S 148°0'E, dead, 80 m (6 v, C.356710); S of Hobart, 43°43'–43°42.4'S 147°46'–147°48.2'E, dead, 160 m (2 v, C.356702); Bass Strait, W of Banks Strait, 40°32'S 147°42'E, alive (13 pr, C.356788); Bass Strait, Deal Island, East Cove, 39°30'S 147°20'E, alive, 6–15 m (2 pr, C.357098); 2 mls S of Tasman Head, S Bruny Island, 43°33'S 147°19'E, dead, 73 m (1 v, C.356707); D'Entrecasteaux Channel, SE side Partridge Island, 43°23.9'S 147°06.6'E, alive, 16.5–20 m (8 pr, C.356787); NW of Low Rocky Point, 42°51'S 145°0'E, dead, 146 m (1 v, C.124237); Seven Mile Beach, W side of Frederick Henry Bay, 42°51'S 147°30'E, dead (3 v, C.073930); Cremorne Bay, 42°58'S 147°32'E, dead (6 v, C.356706); Frederick Henry Bay, 42°53'S 147°34'E, dead (1 v, C.094536); Hobart, 42°53'S 147°19'E, dead (1 v, C.094537); D'Entrecasteaux Channel, Pierson's, Point, 43°02'S 147°20'E, dead, 14.5–16.5 m (6 v, C.120944); D'Entrecasteaux Channel, 43°03'S 147°20'E, alive, 9–18 m (18 v, C.058572; 14 v, C.097543; 1 pr, C.110176); D'Entrecasteaux Channel, Killora Bay, 43°05'S 147°19'E, dead, 7.5 m (4 v, C.080639; 1 v, C.107275; 9 v, C.300338); D'Entrecasteaux Channel, 0.25 ml W of Roberts Point, 43°08'S 147°15'E, dead, 18–25.5 m (many v, C.096110); 1 ml W of Simpsons Point, 43°14'S 147°15'E, dead, 9–13 m (1 v, C.356598); Sheepwash Bay, W side of Bruny Island, 43°15'S 147°15'E, alive, 10–12 m (5 pr, C.147520); Simpsons Bay, D'Entrecasteaux Channel, South Bruny Island, 43°17'S 147°18'E, alive (1 pr, C.054112); Cox Bight, 43°30'S 146°15'E, dead (1 v, C.356594); Rocky Cape, 40°51'S 145°30'E, alive, 3 m (1 pr, C.357094); The Pinnacle, 1 ml off Cape Woolamai, 38°35'S 145°22'E, alive, 33 m (2 pr, C.37068); Stanley, 40°46'S 145°18'E, dead (1 v, C.356683); N of Three Hummock Island, 40°09'S 145°11'E, dead, 51 m (3 v, C.356708); Bass Strait, King Island, E of Grassy, 40°11'–40°33'S 144°39'–143°28'E, dead, 58–77 m (8 v, C.356595); E of King Island, 40°0'S 144°38'E, dead, 46 m (1 v, C.356711); W of Hunter Island, 40°30'S 144°37'E, dead, 44 m (4 v, C.356709); S of King Island, 40°20'S 144°36'E, dead, 55 m (3 v, C.356713). **SOUTH AUSTRALIA:** Lacedpede Bay, Kingston Sea, 36°50'S 139°51'E, alive (6 pr, C.375971); Nuys Archipelago, West Island, 35°37'S 138°36'E, alive, 53 m (1 pr, C.357085); 50 mls SE of Kangaroo Island, 37°0'S 138°33'E, dead, 77 m (19 v, C.082928); Adelaide, 34°58'S 138°32'E, alive (2 pr, C.047341); Adelaide, Glenelg Beach, 34°58'S 138°32'E, dead (1 v, C.356364); Port Adelaide, 34°52'S 138°30'E, dead (2 pr, C.375796; 1 pr, C.375797); Adelaide, West Beach, 34°56'S 138°30'E, dead (8 v, C.097544); SE of Kangaroo Island, 37°10'S 138°30'E, dead, 155 m (11 v, C.356484); Adelaide, Outer Harbour, 34°49'S 138°29'E, dead (2 pr, C.073486); Adelaide, Outer Harbour Beach, 34°49'S 138°29'E, dead (1 v, C.356491); Adelaide, Semaphore Beach, 34°50'S 138°29'E, dead (1 pr, C.375794); Gulf of St. Vincent, Largs Bay, 34°49'S 138°29'E, dead (3 v, C.094508); Adelaide, 2 mls off Glenelg, 34°59'S 138°28.5'E, alive, 3.5–11 m (1 pr, C.357052; 1 pr, C.375792); Seaford, 35°11'S 138°28'E, dead (1 v, C.091011); Port Noarlunga, 35°09.1'S 138°27.8'E, dead (7 v, C.375793); Port Noarlunga, 35°09'S 138°27'E, alive, 5–7 m (1 pr, C.114869); Port Noarlunga, Onkaparinga Point, 35°10'S 138°27'E, alive, 14 m (many, C.117081); NE Kangaroo Island, Penneshaw, 35°43'S 137°56'E, alive, 5 m (1 pr, C.356487); Port Vincent, 34°47'S 137°52'E, dead (2 v, C.068384); Kangaroo Island, Eastern Point, Rocky Point, 35°48'S 137°50'E, dead (7 v, C.096068); Yorke Peninsula, off Edithburgh, 35°05'S 137°45.5'E, alive, 9 m (1 pr, C.357071); Edithburgh, 35°05'S 137°45'E, alive (1 pr, C.357072); Kangaroo Island, Kingscote, 35°39'S 137°38'E, dead (11 v, C.049180); off Pt Hughes, Tiparra Reef, 34°03'S 137°24'E, dead, 6–7.5 m (1 pr, C.356486); N coast Kangaroo Island, Knob Bluff, 35°37'S 137°14'E, alive, 18 m (1 pr, C.356493; 1 pr, C.357087; 8 pr, C.357089); Kangaroo Island, S coast, 36°0'S 137°11'E, dead (5 v, C.356479); N coast Kangaroo Island, Stokes Bay, 35°37'S 137°12'E, alive, 7 m (1 pr, C.356492); Kangaroo Island, 35°50'S 137°06'E, alive (2 pr, C.130119; many, C.303774); Spencers Gulf, 34°0'S 137°0'E, alive (2 pr, C.004561); N coast Kangaroo Island, Western River Cove, 35°41'S 136°58'E, dead, 0–5 m (1 v, C.356488); 40 ml S of Cape Wiles, 35°39'S 136°40'–136°50'E, dead, 174–183 m (many v, C.032056); Spencer Gulf, Tumbly Bay, 34°22'S 136°08'E, dead (16 v, C.356464); Eyre Peninsula, Point Warra, 34°32'S 135°56'E, alive, 1–2 m (1 pr, C.357060); Port Lincoln, Boston Bay, opposite Boston House, 34°51'S 135°56'E, alive, 2 m (1 pr, C.357056; 2 pr, C.357091); Port Lincoln, 34°44'S 135°54'E, alive, 15 m (1 pr, C.357079); Port Lincoln, 34°47'S 135°51'E, alive (1 pr, C.012061; 1 pr, C.130118); W side of Thevenard, near Ceduna, 32°09'S 133°39'E, semi-sheltered rock platform, dead (3 v, C.092140); Petrel Bay, N of St Francis Island, 32°29'S 133°18'E, dead, 20–30 m (many v, C.100513); Nuys Archipelago, St Francis Island, 32°29'S 133°18'E, alive, 15–37 m (1 pr, C.357100); St Francis Islands, Masillon Island, 32°33'S 133°17'E, alive, 15–30 m (1 pr, C.356481); S of St. Francis Island, 33°0'–33°05'S 133°05'–133°10'E, dead, 64 m (19 v, C.356471); Great Australian Bight, 50 mls SW of Cape Adieu, 32°42'S 131°27'E, dead, 79 m (2 v, C.120186; many v, C.356670). **WESTERN AUSTRALIA:** Great Australian Bight, 33°15'S 126°0'–129°0'E, alive, 146–220 m (1 pr, C.356238); Great Australian Bight, 33°05'–33°20'S 128°40'–128°45'E, dead, 75–147 m (many v, C.079057); Great Australian Bight, 33°05'S 128°40'E, dead, 75 m (many v, C.094507; 2 v, C.356483); 32 mls E of Madura, off Nullarbor Plain Road, 32°0'S 126°30'E, dead (2 v, C.356355); Great Australian Bight, 75 mls E of Rocky Point,

33°43'S 125°04'E, dead, 77–80 m (many v, C.100512); Duke of Orleans Bay, Esperance, 33°55'S 122°35'E, dead (2 v, C.069319); Recherche Archipelago, E of Sandy Hook Island, 34°02'S 122°03'E, dead (1 v, C.069373; 1 v, C.356245); Recherche Archipelago, off Woody Island, 33°58'S 122°01'E, dead, 29–40 m (1 v, C.069368); Recherche Archipelago, off Remark Island, 34°04'S 122°0'E, alive, 37 m (5 v, C.356250); Great Australian Bight, E of Hood Point, 34°21'S 121°16'E, dead, 82 m (23 v, C.356354); Esperance area, 33°52'S 121°54'E, dead (1 pr, C.086085; 7 v, C.147408); E of Cheyne Bay, 34°55'S 119°0'E, dead, 71–76 m (13 v, C.094506; 1 v, C.356239); off Albany, 35°06'S 118°39'E, dead, 76 m (1 v, C.356254); King George Sound, 35°03'S 117°58'E, alive (2 pr, C.043569; 12 pr, C.048277; 4 pr, C.356288); Albany, 35°03'S 117°58'E, alive (3 v, C.010538); Albany, Emu Point, 35°0'S 117°57'E, dead, beach (8 v, C.090933); Albany, off Emu Point, 35°0'S 117°57'E, dead (12 v, C.356351); Albany, 1.5 ml N of Green Island, Oyster Harbour, 34°58'S 117°57'E, dead, 9 m (2 v, C.356252); Albany, Oyster Harbour side of Emu Point, 35°0'S 117°57'E, alive (2 v, C.356255; 1 v, C.356353; 2 pr, C.357092); Albany, King George Sound, Middleton Beach, 35°01'S 117°56'E, alive (3 v, C.094504; 2 v, C.095280; 2 pr, C.375789); Albany, 35°02'S 117°53'E, dead (2 v, C.056936); Princess Royal Harbour, Hanover Bay, beach near Albany railway station, 35°02'S 117°53'E, dead (2 v, C.356352); S of Cape Leeuwin, 34°25'–34°45'S 114°40'–115°0'E, dead, 73–144 m (1 v, C.356233); W of Dunsborough, Eagle Bay, 33°33'S 115°04'E, dead (5 v, C.356236); off Dunsborough, 33°36'S 115°06'E, alive, 16.5 m (2 pr, C.356251); Geographe Bay, 33°37'S 115°18'E, alive (many, C.018015); Geographe Bay, 5 mls W of Busselton, 33°39'S 115°15'E, dead (1 v, C.083709); Geographe Bay, Busselton, 33°39'S 115°20'E, dead (2 v, C.375786); Geographe Bay, Busselton Jetty, 33°39'S 115°20'E, alive, 7.5 m (1 pr, C.108903); off Dunsborough, 33°36'S 115°06'E, dead, 16.5 m (10 v, C.356231); 3.5 km off Dunsborough, 33°36'S 115°04'E, dead, 16.5 m (4 v, C.086928); Bunbury, 33°0'S 114°41'E, dead (1 v, C.069293; 1 pr, C.093611); Cockburn Sound, Sulphur Rock, 32°11'S 115°40'E, alive, 17 m (3 pr, C.356229); Cockburn Sound, Woodman's Point, 32°09'S 115°46'E, alive (1 pr, C.357097); Fremantle, 32°03'S 115°44'E, alive (5 pr, C.107392); Perth, Mosman Park, S of Cottesloe, 32°01'S 115°45'E, dead (2 v, C.356256); Cockburn Sound, off Fremantle, 32°09'S 115°43'E, alive, 18 m (3 pr, C.357082); Rottnest Island, Thomson Bay, 32°0'S 115°32'E, dead (5 v, C.118741; 3 v, C.132423); Rottnest Island, NE side, Thomson Bay, 32°0'S 115°33'E, dead (5 v, C.356227); Perth, Cottesloe Beach, 31°59'S 115°45'E, dead (2 v, C.094503; 6 v, C.356253); Perth, Cottesloe Beach & nearby beaches, 31°59'S 115°45'E, dead (many v, C.094505); Perth, City Beach, 31°56'S 115°45'E, dead (2 v, C.356247); Triggs, near Perth, 31°52'S 115°45'E, on open coast platform, dead (1 pr, C.356228); Carnarvon, 24°53'S 113°40'E, dead (5 v, C.375785); off Carnarvon, 24°52'S 113°36'E, alive (5 v, C.375784); 3 km off Carnarvon, 24°52'S 113°36'E, alive, 7.6 m (1 pr, C.357083).

**Description.** Shell up to c. 100 mm high, most specimens smaller, to c. 60 mm; rather thin to more solid, moderately to strongly inflated, almost equally convex; juveniles elongate, some acline; adults more nearly semi-circular and weakly prosocline; equivalve, slightly inequilateral, anterior auricles much larger and longer than posterior, umbonal angle c. 95° in juveniles, increasing to c. 110° in adults; colour polychromatic, many specimens reddish brown with a range of maculations.

Both valves sculptured with 24–30 evenly spaced, prominent, squamous radial plicae, flanked by subdivided squamous secondary and narrow spinous tertiary riblets in interplical spaces. Herringbone-like (complex of comm- and antimarginal) microsculpture in interstices. Auricles delicately radially sculptured as on disc, anterior auricle of right valve more coarsely sculptured with c. 5 prominent and 4 fine secondary riblets. Byssal notch deep, byssal fasciole moderately broad. Functional ctenolium well-developed, with 4–7 teeth. Internal rib carinae weakly developed on most specimens, short, present around ventral margin of thick shells. Resilial and dorsal teeth moderately prominent.

**Dimensions.** Illustrated specimen: TAS, D'Entrecasteaux Channel, 18 m (AM C.097543): rv: H 69.6, L 66.6 mm; lv: H 69.8, L 67.6 mm; D 25.5 mm.

**Habitat.** *Mimachlamys asperrima* is the most abundant and widespread scallop in southern Australia, living in the littoral zone to the upper bathyal zone in eastern and south-eastern Australia from southern Queensland to Carnarvon, Western Australia, byssally attached to jetty piles, *Pinna* shells and rubble, always covered in sponges (*Hymedesmia* species, det. R. W. M. van Soest, ZMA). The significance of epizoid sponges on scallop shells for the avoidance of starfish predators was described by Pitcher & Butler (1987); the sponge helps prevent recognition of the scallop by the predator. Consequently, apparently to help sponge adhesion,

many species of chlamydoid scallops secrete more spinous sculpture on their plicae and costae when overgrown with sponge. In New Zealand and southern Australia, this includes most *Talochlamys* and *Mimachlamys* species and *Zygochlamys delicatula* (Dijkstra & Marshall, 2008: 56, 68, figs 53A, E). Adults of *Mimachlamys asperrima* become detached and live amongst weed and rubble in the littoral zone on soft sediment (sand/mud). In Tasmania, *Mimachlamys asperrima* grows to a much larger size than elsewhere and is found in similar surroundings to *Equichlamys bifrons*, in sand, mud and shell rubble (pers. comm. H. Morrison, 2002). Studies of its abundance and distribution in Tasmania have been carried out by (among others) Zacharin (1994) and Mendo *et al.* (2014).

**Distribution.** Southern Queensland (c. 26°S) southwards all around southern Australia to Western Australia (c. 24°S). Present specimens alive in the intertidal zone to 110 m (generally in 5–45 m); specimens from the Great Australian Bight live in exceptional depths (146–220 m).

**Remarks.** *Mimachlamys asperrima* is variable in size and thickness. The largest and thinnest specimens are found around Tasmania. Smaller and more solid shells occur along the mainland coast. It is also variable in convexity (from weakly to strongly inflated), radial sculpture (primary plicae and secondary costae with variable tertiary sculpture), and colour (polychromatic or uniformly brownish coloured).

This “doughboy scallop” is a locally common and occasionally commercially harvested species in Tasmanian waters.

For biostratigraphy see Beu & Darragh (2001: 136).

### *Mimachlamys cloacata* (Reeve, 1853)

Figs 86H,J, 88B–D,F, 89

*Pecten rugosus* G. B. Sowerby II, 1842: 66, pl. 19, fig. 226 (junior primary homonym of *Pecten rugosus* Lamarck, 1819).

*Pecten cloacatus* Reeve, 1853: sp. 166, pl. 34, fig. 166.

*Pecten valdecostatus* Melville, 1888: 281, pl. 2, fig. 10.

*Pecten (Chlamys) pelseeneeri* Dautzenberg & Bavay, 1912: 8 (replacement name for *P. rugosus* Sowerby, 1842).

*Mimachlamys curtisiana* Iredale, 1939: 351, pl. 5, figs 19–19a.

*Chlamys asperulata pelseeneeri* (Dautzenberg & Bavay).—Kira, 1962: 137, pl. 49, fig. 11.

*Chlamys asperulata* (A. Adams & Reeve).—Abbott & Dance, 1982: 313, fig. (misidentification).

*Chlamys (Mimachlamys) valdecostatus* [sic] (Melville).—Wang, 1983c: 50, pl. 1, fig. 7.

*Chlamys (Mimachlamys) asperulata* (A. Adams & Reeve).—Wang, 1983c: 51, pl. 1, fig. 3.

*Chlamys (Chlamys) cloacata* (Reeve).—Dijkstra, 1990a: 10; Rombouts, 1991: 10, pl. 4, fig. 4; Higo *et al.*, 1999: 442.

*Chlamys cloacata* (Reeve).—Dijkstra, 1991: 29; Wang, 2002: 179, pl. 5, fig. 6; Dharma, 2005: 248, pl. 99, figs 6a–m.

*Chlamys (Chlamys) curtisiana* (Iredale).—Lamprell & Whitehead, 1992: [20], pl. 8, fig. 42.

*Chlamys pelseeneeri* (Dautzenberg & Bavay).—Bernard *et al.*, 1993: 49.

*Chlamys valdecostata* (Melville).—Bernard *et al.*, 1993: 49.

*Mimachlamys cloacata* (Reeve).—Dijkstra, 1998a: 41, pl. 8, figs 4–5; Dijkstra, 1998b: 254; Raines & Poppe, 2006: 268–269, upper figs; pl. 214, figs 3, 5–6, 8–9; Huber, 2010: 210; Raines, 2010: 638, pl. 1010, figs 5–8; Dijkstra, 2013: 89, pl. 23, figs 2a–d, pl. 31, figs 4a–b.

*Mimachlamys asperulata* (A. Adams & Reeve).—Hayami, 2000: 901, pl. 448, fig. 22.



*Mimachlamys gloriosa* (Reeve).—Xu & Zhang, 2008: 83, fig. 233 (misidentification).

**Type data.** *Pecten rugosus* Sowerby: two possible syntypes NHMUK 1996438. Type locality: Philippine Islands, Bureas Island.

*Pecten cloacatus* Reeve: lectotype (pr) NHMUK 1995.158.1, paralectotype (pr) NHMUK 1995158.2, designated by Dijkstra (1998a: 41). Type locality: Philippine Islands.

*Pecten valdecostatus* Melvill: holotype (pr) NMW 1955.158.5. Type locality: Hong Kong.

*Mimachlamys curtisiana* Iredale: holotype (pr) AM C.089670 (Fig. 88D, F). Type locality: Australia, QLD, Gladstone, Port Curtis.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Gulf of Carpentaria, 28 ml S of Sweers Island, 17°06'S 139°37'E, dead (1 v, C.375622); Cape York, Peak Point, 10°43'S 142°26'E, alive, 5–11 m (1 pr, C.375625; 2 pr, C.375745); Cape York, Somerset, Stover Bay, 10°44.1'S 141°35'E, alive (1 pr, C.376074); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (many v, C.375623; 19 v, C.375746); Cooktown, 15°28'S 145°15'E, alive (1 pr, C.375624); GBR, Low Isles, 16°23'S 145°34'E, dead (1 v, C.375740); Cairns Harbour, 16°53'S 145°48'E, dead (2 v, C.107992; 1 v, C.375744); Kurraming Beach, S of Innisfail, 17°47'S 146°06'E, dead (1 v, C.375626); Cardwell, 18°16'S 146°01'E, dead (8 v, C.375627); off Great Palm Island, 18°43'S 146°37'E, alive (2 pr, C.303769); Dingo Beach, Cape Gloucester, 20°05'S 148°30.5'E, dead (1 v, C.375759); Whitsunday Passage, 20°13.5'S 148°47.5'E, dead, 24 m (4 v, C.375629); Whitsunday Group, Hamilton Island, 20°22'S 148°57'E, dead (1 pr, C.375758); Whitsunday Group, Lindeman Island, dead (1 v, C.380453); Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, dead (many v, C.375631; 1 v, C.375756; 1 v, C.375757); Whitsunday Group, off Shaw Island, dead, 37 m (3 v, C.132023); Repulse Bay, Conway Beach, 20°28.5'S 148°45'E, dead (2 v, C.103808); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (many v, C.375628); Seaforth, N of Mackay, 20°54'S 148°58'E, dead (1 v, C.132020; 7 v, C.375630); E of Sarina, 21°27.5'S 150°08'E, dead, 42 m (3 v, C.375741); E of Sarina, 21°28'S 150°08.5'E, dead, 40 m (2 v, C.375742); off Broad Sound, 22°06'S 150°49'E, dead, 53 m (1 v, C.375743); Broad Sound, Clairview, 22°11'S 149°34'E, alive (1 pr, C.074842); Pearl Bay, E of Shoalwater Bay, 22°25'S 150°44'E, alive (2 v, C.070504); SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (1 v, C.375760); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, dead (1 v, C.375632); Keppel Bay, Yeppoon, 23°08'S 150°45'E, alive (1 pr, C.132019); Keppel Bay, Emu Park, 23°15'S 150°49'E, dead (3 v, C.132018); Keppel Bay, 23°25'S 150°55'E, alive (13 v, C.103819); Capricorn Group, Mashead Island, 23°32'S 151°45'E, dead, 31–37 m (2 v, C.021215); Port Curtis, off Gatcombe Head, 23°54'S 151°22'E, alive, 13–18 m (9 v, C.018678); Port Curtis, 23°55'S 151°23'E, alive, 16–22 m (3 v, C.012051; 1 pr [holotype *Mimachlamys curtisiana*], C.089670; 3 pr, C.097539; 1 pr, C.132017; 5 v, C.375633); Port Curtis, Gladstone, 23°54'S 151°22'E, alive, 13–18 m (many, C.375734); Port Curtis, Quoin Island, 23°49'S 151°17'E, dead, 2–5.5 m (13 v, C.375736); Port Curtis, Facing Island, 23°49'S 151°22'E, alive (many v, C.375735; 1 pr + 1 v, C.375737); Port Curtis, South Channel, Jenny Lind Buoy, 23°56.5'S 151°30.5'E, alive (2 pr + 1 v, C.036984); Tannum Sands, S of Gladstone, 23°57'S 151°22'E, dead (5 v, C.375739); Hervey Bay, off Picnic Point, 25°06'S 152°49'E, alive, 9–12 m (2 pr, C.103803); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (2 pr, C.097433); Hervey Bay, Mary River mouth, North Head, 25°25.6'S 152°55'E, alive (1 pr + 1 v, C.375738); Moreton Bay, Redcliffe Peninsula, Clontarf, Woody Point, 27°16'S 153°06'E, dead (1 v, C.103823). WESTERN AUSTRALIA: Exmouth, Bundegi Reef, 21°51'S 114°11'E, alive, 6 m (1 pr, C.160987). NORTHERN TERRITORY: Darwin, 32 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (19 v, C.375761); Melville Island, near Garden Point, 11°24.5'S 130°24.7'E, dead (1 v, C.375621); Darwin, Sandbar No. 2, 12°24'S 130°44'E, dead (9 v, C.375599); Darwin, West Point, 12°26.5'S 130°46'E, alive (1 pr, C.376075); Port Darwin entrance, 12°25'S 130°46.5'E, dead, 36 m (1 pr, C.375768); Darwin, Sandbar, 12°26'S 130°48'E, dead (1 pr, C.375769); Darwin Harbour, Weed Point, alive (1 pr, WAM448); Darwin, 36 km off Point Charles, 12°16.7'S 130°36.7'E, dead, 27–37 m (many v, C.165427); Darwin, off Point Charles, 12°16.7'S 130°36.7'E, dead, 27–37 m (17 v, C.165429); Darwin, Fannie Bay, W of East Point, 11°24.5'S 130°48.5'E, alive, 8–10 m (1 pr, C.376073); Darwin, 12°27'S 130°50'E, dead (1 v, C.131216; 1 v, C.375619; 3 v, C.375764); Darwin, Dudley Point, 12°25'S 130°49'E, alive (1 pr, C.375762); Port Darwin, 12°28'S 130°50'E, alive, 15 m (3 pr, C.057357; 1 v, C.375620; 1 pr, C.375751); Darwin, Waigait, 11°28'S 130°50'E, alive (1 pr, C.165225); Darwin, Waigait, 11°28'S 130°50'E (1 pr, alive, C.072324; 6 v, dead, C.375765); Darwin, Casuarina Beach, 12°21'S 130°52'E, dead (1 v, C.375766); Arafura Sea, c. 110 ml N of Melville Island, 9°34'S 131°22'E, dead, 135 m (2 v, C.160976); 100 km NE of Melville Island, 10°22.5'S 131°37'E, dead, 71 m (1 v, C.160975); Arafura Sea, c. 95 ml N of Cobourg Peninsula, 9°45'S 132°04'E, dead, 108 m (1 v, C.160978); Arafura Sea, c. 100 ml N of Croker Island, 9°30'S 132°34'E, dead, 124 m (2 v, C.160971); Arafura Sea, c. 45 ml N of Croker Island, 10°17'S 132°38'E, dead, 65 m (7 v, C.160977); 180 km N of Croker Island, 9°24'S 133°02'E, dead, 125 m (2 v, C.160972); 68 km NE of Croker Island, 10°39'S 133°05'E, dead, 62 m (1 v, C.160973); 91 km N of Goulburn Island, 10°42'S 133°36'E, alive, 58 m (2 pr + 1 v, C.160974); Arafura Sea, c. 210 ml NE of Croker Island, 8°18'S 133°58'E, dead, 132 m (2 v, C.160970); Arafura Sea, c. 250 ml NE of Croker Island, 8°09'S 134°50'E, dead, 115 m (4 v, C.375750). —JAPAN: Shikoku Island, Iyo, 33°43'N 132°42'E, alive (2 pr, C.045722). —CHINA: off Hong Kong, 21°17.4'–21°20.4'N 114°48.1'–114°52.8'E, dead, 87–97 m (1 v, C.143458); Hong Kong, Mirs Bay (Tai Pang Wang), SE of Ping Chau Island, 22°33'N 114°24'E, dead, 0–8 m (5 v, C.375603). TAIWAN: NE of Taiwan, alive, 40–50 m (3 pr, ZMA Moll.143127). —PHILIPPINE

ISLANDS: Bohol, Balicasag Island, alive, 130–140 m (1 pr, ZMA Moll.144227); Davao, Talikud, alive, 80–200 m (3 pr, ZMA Moll.144236); Sulu Archipelago, Jolo Island, alive, 45 m (2 pr, ZMA Moll.143724). SINGAPORE: Pulau Sudong, Selat Sulong & vicinity, 1°12'N 103°44'E, dead (6 v, C.127293); Sentosa Island, W end of Silosa Beach, 1°15'S 103°48'E, dead, beach (1 v, C.375601). —VIETNAM: Nha Trang, Hon Mieu, alive, 4–5 m (1 pr, ZMA Moll.139639). —THAILAND: Gulf of Siam, Samui Island, alive, 5–20 m (20 pr, ZMA Moll.145792); Andaman Sea, Phuket Island, alive, 10–35 m (2 pr, ZMA Moll.142130). —INDONESIA: E Sumatra, near Singkep Island, alive, 50–60 m (4 pr, ZMA Moll.143709); Java Sea, alive, 30–34 m (3 pr, ZMA Moll.142186); Kei Islands, alive, 18 m (1 pr, ZMA Moll.142184). —PAPUA NEW GUINEA: New Britain, Rabaul, 4°12'S 152°11'E, dead (2 v, C.375602); Gulf of Papua, off Yule Island, 8°50'S 146°32'E, alive, 37 m (1 pr, C.375747); Gulf of Papua, 1.5 ml SW of Yule Island, 8°51'S 146°30'E, dead, 22–23 m (3 v, C.375749); off Port Moresby, Manubada Island, off W end, 9°31'S 147°10'E, dead, 18–22 m (1 v, C.375600). CORAL SEA: Marion Reef, 19°07'S 152°23'E, dead (1 pr, C.357993). —NEW CALEDONIA: Bay of Prony, Ouen Island, alive, 44–55 m (1 pr, ZMA Moll.142270).

**Description.** Shell up to 44 mm high (Raines, 2010), rather solid, moderately well inflated, almost equally convex, triangularly ovate, equivalve, slightly inequilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 75–85°; colour polychromatic.

Both valves sculptured with c. 16–18 evenly spaced, narrowly rounded, lamellate, primary radial plicae, in some specimens flanked by secondary riblets in late growth stage. Commarginal lamellae on plicae of most specimens, widely to more closely spaced, present in radial interspaces of some specimens. Intercostal “herringbone” microsculpture on disc, in late growth stage transformed into antimarginal microsculpture. Anterior auricle of left valve with 6–7 prominent radial costae with closely spaced intercostal commarginal lamellae; posterior auricle with c. 5 weak, squamous radial riblets and intercostal granular or antimarginal microsculpture, or with closely spaced irregular commarginal lamellae. Anterior auricle of right valve with c. 5 prominent squamous radial costae, weaker and narrower on posterior auricle. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium well developed, with c. 5–7 teeth. Internal rib carinae prominent, short, in narrow zone around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: QLD, Hervey Bay, off Picnic Point, 9–12 m (AM C.103803): rv and lv both H 26.8, L 23.7 mm; D 11.4 mm. Iredale (1939: 351) stated the dimensions of the holotype of *Mimachlamys curtisiana* as H 28, L 25 mm.

**Habitat.** Living in the littoral zone to on the continental shelf, most specimens byssally attached to undersides of rocks or coral boulders, or amongst coral rubble on sandy bottoms; often encrusted with sponge.

**Distribution.** Tropical Indo-West Pacific, from southern Japan, southwards to northern Australia, westwards into the Indian Ocean to the Gulf of Bengal, and eastwards to New Caledonia (Raines & Poppe, 2006: 270); Japan to the Andaman Islands, 1–58 m (Huber, 2010: 210); Philippines, 20–111 m (Raines, 2010: 638; Dijkstra, 2013: 92); Indonesia, 58 m (Dijkstra, 1991: 29); Papua New Guinea, 20–30 m, dead (Dijkstra, 1998a: 41). Maximum depth range of live-taken specimens is 1–140 m. Present specimens from Australia alive at 5–58 m.

**Remarks.** The present specimens (*curtisiana* morph) from Australia resemble the type material of *Mimachlamys cloacata*, but differ somewhat in the number of radial plicae (c. 20, typically 16–18) and secondary radial sculpture (present in the late growth stage of most specimens, typically almost lacking). Other characters are identical, and small specimens are indistinguishable from the equal-sized specimens of *Mimachlamys cloacata* from the Philippine Islands.



*Mimachlamys cloacata* has a polymorphic microsculpture (see description) and also varies in convexity (moderately to rather strongly inflated) and macrosculpture (prominence of the radial sculpture and development of the lamellae).

### *Mimachlamys funebris* (Reeve, 1853)

Figs 86D,G, 88E,G, 92

*Pecten funebris* Reeve, 1853: sp. 85, pl. 22, fig. 85 (not a junior homonym of *Chlamys funebris* Lacordaire, 1848, Insecta; ICZN, 1999: 60, Article 57.8); E. A. Smith, 1884: 116; Küster & Kobelt, 1888: 171, pl. 47, fig. 6.

*Chlamys funebris* (Reeve).—Wells & Bryce, 1988: 160, fig. 588; Wells, Slack-Smith & Bryce, 2000: 42.

*Chlamys (Mimachlamys) funebris* (Reeve).—Rombouts, 1991: 28, pl. 11, figs 2–2a; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 54.

*Mimachlamys funebris* (Reeve).—Beu & Darragh, 2001: 181, fig. 47E; Slack-Smith & Bryce, 2004: 237; Raines & Poppe, 2006: 270, 273, upper figs; pl. 217, figs 1–5; Huber, 2010: 210.

**Type data.** Type material not traced in NHMUK. Type locality: Bathurst Island, Western Australia. The illustrated articulated specimen, from WA, Broome, Entrance Point (WAM S55490; Figs 86D, G, 88E, G) is here designated the neotype of *Pecten funebris* Reeve, 1853.

**Additional material examined.**—AUSTRALIA: WESTERN AUSTRALIA: Cardabia, S of Point Cloates, 23°06'S 113°48'E, dead (1 v, C.375604); Point Cloates, 22°43'S 113°40'E, dead (1 v, C.375605); Exmouth Gulf, 17 ml S of Exmouth townside, 22°13'S 114°06'E, dead (1 v, C.093621; 1 v, C.375607); North West Cape, Lighthouse Beach, 21°49'S 114°11'E, dead (2 v, C.100740); Turtle Beach, W side of North West Cape, 21°48'S 114°10'E, dead (4 v, C.375606); S Muiron Island, off SW coast, 21°41.55'S 114°18.17'E, dead, 19–20 m (1 v, WAM S12834); S Muiron Island, off NE coast, 21°40.46'S 114°20.91'E, dead, 3–5 m (1 v, WAM S12785; 1 v, WAM S12836); S Muiron Island, off North West Point, 21°39.45'S 114°20.22'E, dead, 11–13 m (1 v, WAM S12835); Onslow Beach, 21°38'S 115°07'E, dead (1 v, C.119519); Onslow area, 21°38'S 115°07'E, dead (2 v, C.375608); Onslow, W side of Peak Island, 21°36'S 114°30'E, alive, 18 m (4 pr + 2 v, WAM); Bundegi Reef, 21°51'S 114°10'E, dead (1 v, WAM); Exmouth, Bundegi Reef, 21°15'E 114°11'E, alive (3 pr, C.344047); Exmouth, Bundegi Reef, 21°51'S 114°11'E, alive, 0–3 m (1 pr, C.344046); 40 ml S of Dampier, 21°0'S 116°06'E, dead (1 v, C.375609); Passage Island, Sholl Island, NE side, 20°57'S 113°53'E, dead, intertidal (1 pr, WAM); between Cape Dupuy and Cape Malouet, Barrow Island, 20°40'–42'S 115°25'E, dead (1 v, WAM); Montebello Islands, Buttercup Island, 20°29.16'S 115°32.04'E, dead, intertidal (1 pr, WAM); Montebello Islands, Stephenson Channel near S end of Hermite Island, 20°28'21"S 115°32'27"E, dead, 4 m (2 v, WAM S12838); Montebello Islands, E side of Trimouille Island, dead (3 v, WAM); Montebello Islands, S of Gannet Island to E of Delta Island, stn MB#12, 20°27'S 115°33.59'E, dead, 4–6 m (1 v, WAM S12974); Montebello Islands, 20°26'S 115°32'E, alive (1 pr, C.049666; 1 pr, C.132070); Montebello Islands, near rock islands, SW end of Bluebell Island, 20°23'30"S 115°31'04"E, dead, 0–9 m (1 v, WAM S12839); Montebello Islands, 20°21'16"S 115°30'53"E, inside reef of North-West Island, dead, 3–4 m (1 v, WAM S12837); Dampier Archipelago, Rosemary Island, 20°29'S 116°35'E, alive (2 pr, WAM); Dampier Archipelago, NE corner of Delambre Island, approx. 20°26'S 117°10'E, alive (1 pr, WAM); Dampier Archipelago, N end of Flying Foam Passage, 20°28'S 116°50'E, alive (1 pr, WAM); Port Hedland, 20°18'S 118°35'E, alive (1 pr, WAM); Port Hedland, 20°18'S 118°35'E, alive (1 pr, C.097536; 1 pr, C.119518); Lagrange, 18°37'S 121°43'E, alive (1 pr, WAM); Lagrange Bay, 18°38'S 121°42'E, alive (2 pr, C.103817); c. 230 ml W of Roebuck Bay, 18°30'S 118°03'E, dead, 238 m (1 v, C.165163); Broome, 17°58'S 122°14'E, alive (3 pr, WAM); Broome, Entrance Point, 18°01'S 122°12'E, alive, intertidal (4 pr, WAM); Broome, Entrance Point, 18°01'S 122°12'E, dead (3 v, C.119521; 2 pr, C.121369); Broome, Roebuck Bay, 18°0'S 122°15'E, alive (1 pr, C.097537; 1 pr, C.132071; 3 pr, C.344037); Gantheaume Point, W of Broome, 17°59'S 122°11'E, dead (1 pr, C.057197); Black Ledge, Roebuck Bay, S of Broome, 17°59'S 122°17'E, dead (4 pr, C.303776); Broome, 17°58'S 122°14'E, alive 0–16 m (1 v, C.075235; 3 v, C.375613; 1 pr, C.375612); Broome, Cable Beach, 17°56'S 122°12'E, dead (5 v, C.375610); Rowley Shoals, Imperieuse Reef, 17°31'S 118°56'E, dead (2 v, WAM); Kimberley, Beagle Bay, 16°56'S 122°32'E, dead (many v, C.119520; 10 v, C.119522); Kimberley, Beagle Bay, 16°52'S 122°32'E, dead, 9 m (1 pr, WAM); King Sound, 16°50'S 123°30'E, alive (2 pr, C.097538); Kimberley, Sunday Island, Derby, 16°25'S 123°11'E, dead (1 pr + 1 v, WAM); Kimberley, Sunday Island, S side, 16°26'S 123°09'E, dead, 23 m (1 v, WAM); Cape Leveque, 16°24'S 122°55'E, alive (2 v, C.160997; 1 pr, C.061584; 1 v, C.375614; 1 pr, C.095818; 1 v, C.375615).

**Description.** Shell up to c. 70 mm high, most specimens smaller, to c. 50 mm; dorsoventrally elongate, weakly

inflated, almost equally convex, equivalve, almost equilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 85–90°; most specimens brownish, a few orange, red or yellow; mottled in juvenile stage, more uniform in adults.

Both valves sculptured with c. 20–25 evenly spaced, squamose radial plicae; a narrow secondary riblet present on each side of each plica, commencing on central part of disc of mature shells. Anterior auricle of left valve with c. 10 squamose radial riblets, weaker and fewer (c. 6) on posterior auricle; anterior auricle of right valve with 4–5 prominent radial riblets, much weaker on posterior. Dorsal margin somewhat declined on posterior auricle. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 4–6 teeth. Interior radially furrowed, internal rib carinae prominent in narrow zone around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: WA, Broome, Entrance Point (WAM S55490): H 48.4, L 42.4 mm.

**Habitat.** Living in the upper littoral zone, byssally attached to undersides of rock slabs on hard reef at minus tide levels only. Usually slabs are in shallow pools or in almost dried out gutters (pers. comm. H. Morrison, 2000).

**Distribution.** Mainly along the shores of northern Western Australia, from Shark Bay to the Kimberley. Present specimens alive in the intertidal zone to 18 m.

**Remarks.** This species easily could be confused in the juvenile stage with *Mimachlamys punctata* (Gmelin, 1791), a common species from the tropical Southwest Pacific, also occurring in the tropical region of Australia, although more offshore than *M. funebris* in Western Australia. The two species can be distinguished by size, sculpture and colour (Table 7).

### *Mimachlamys gloriosa* (Reeve, 1853)

Figs 88I–J, 90A,C–E, 91, 93A–C,E

*Pecten ustulatus* Reeve, 1853: sp. 87, pl. 22, fig. 87.

*Pecten gloriosus* Reeve, 1853: sp. 134, pl. 30, figs 134a–b (see Reeve, 1853, errata).

*Pecten testudineus* Reeve, 1853: sp. 160, pl. 34, fig. 160.

*Pecten similis* Baird in Brenchley, 1874: 453, pl. 42, fig. 7.

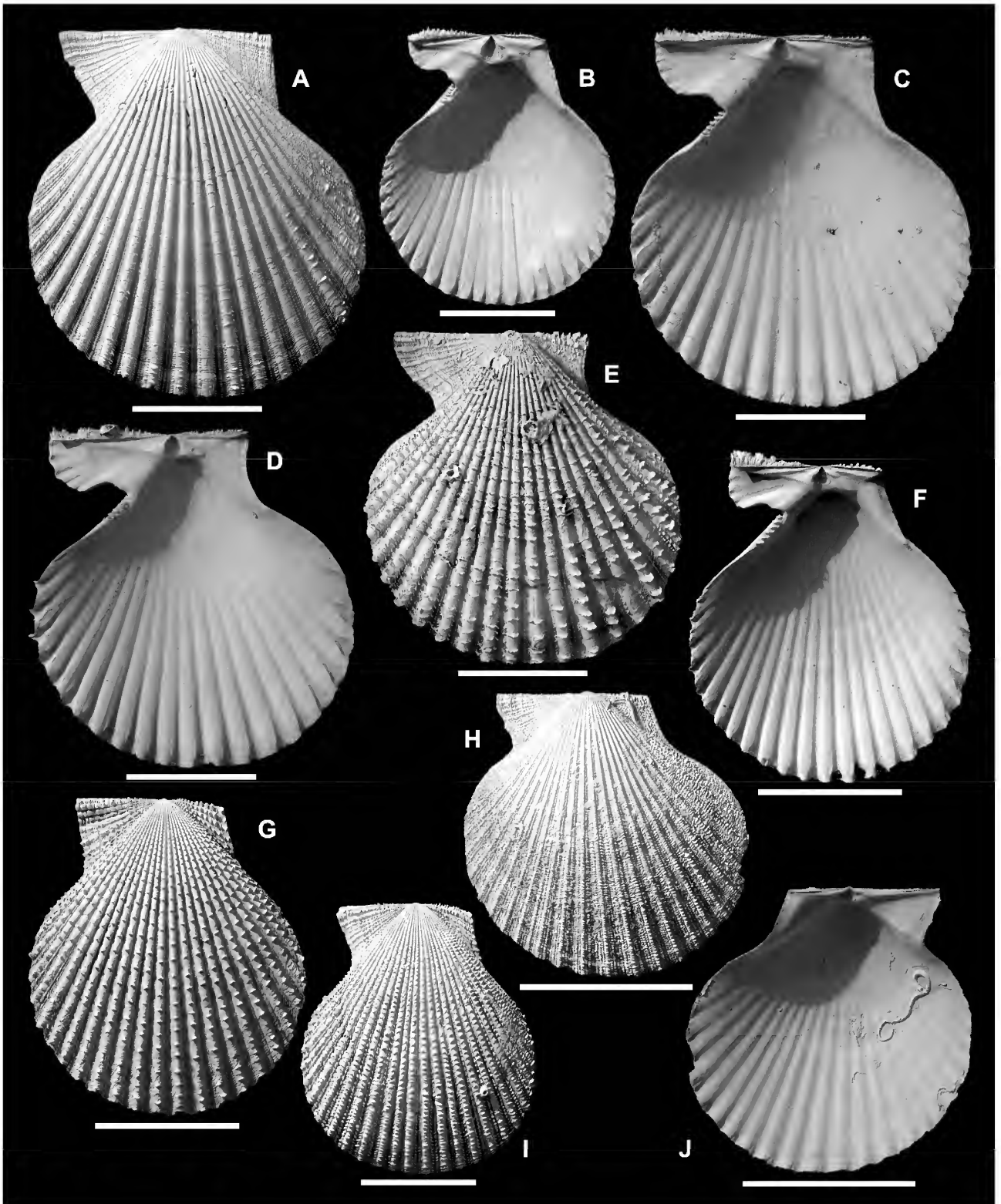
*Mimachlamys subgloriosa* Iredale, 1939: 350, pl. 5, figs 21–21a.

*Mimachlamys gloriosa* (Reeve).—Allan, 1950: 280, fig. 7; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 52; Slack-Smith & Bryce, 2004: 237; Raines & Poppe, 2006: 272–273, lower figs; pl. 218, figs 1–3; pl. 219, figs 1–6; Huber, 2010: 211; Dijkstra, 2013: 92, pl. 23, figs 3a–d, pl. 32, figs 1a–b.

*Chlamys gloriosa* (Reeve).—Coleman, 1982: 280, fig. 771; Dijkstra, (1983–1994) 1983: 19, figs; Dharma, 1992: 84, pl. 20, figs 2–2d.

*Chlamys (Mimachlamys) gloriosa* (Reeve).—Rombouts, 1991: 29, pl. 11, figs 4–4c; Dharma, 2005: 248, pl. 99, figs 1a–m.

**Comments on synonymy.** Although Reeve introduced *Pecten ustulatus* (May 1853) a few months earlier than *Pecten gloriosus* (Aug 1853), we prefer to use the latter name because of its wide general acceptance. This is further complicated by Reeve (1853: caption to pl. 30, sp. 134, Jun 1853) initially applying the name *Pecten nobilis* to this species, but later (Reeve, 1853: errata; evidently issued after



**Figure 90.** *A, C–E*, *Mimachlamys gloriosa* (Reeve), 2 pairs, (*A, C*) smooth form, specimen in Fig. 88I, J, lv exterior (*A*), rv interior (*C*), (*D, E*) scaly form, AM C.069989, Rodds Harbour, Port Curtis, QLD; rv interior (*D*), lv exterior (*E*). *B, F, G, I*, *Mimachlamys punctata* (Gmelin), 2 pairs, (*B, I*) AM C.097537, Roebuck Bay, Broome, WA; rv interior (*B*), lv exterior (*I*); (*F, G*) AM C.303777, Langford Reef, Whitsunday Group, GBR, QLD; rv interior (*F*), lv exterior (*G*). *H, J*, *Mimachlamys heterophyseta* Beu & Darragh, lv only, AM C.079057, Great Australian Bight, WA, 33°12.00'S 128°43.00'E, 75–147 m; lv exterior (*H*), lv interior (*J*). Scale bars represent 30 mm (*A, C–E, H, J*), 20 mm (*B, F, G, I*).

the last plate, dated Aug 1853) apparently realising that he had previously (Reeve, Nov 1852) applied the same name to pl. 1, fig. 3, now universally known as *Mimachlamys nobilis* (Reeve, 1852), and providing the new name *Pecten gloriosus*

for pl. 30, fig. 134a–b in the errata. As first revisers, we select the name *Pecten gloriosus* to be used as the valid name for the species named *Pecten gloriosus*, *Pecten testudineus* and *Pecten ustulatus* by Reeve (1853).

**Table 7.** Characters distinguishing *Mimachlamys funebris* (Reeve) from *M. punctata* (Gmelin).

characters	<i>Mimachlamys funebris</i>	<i>Mimachlamys punctata</i>
size	c. 70 mm high	c. 45 mm high
shape	weakly inflated, nearly equally convex	weakly inflated, nearly equally convex
auricles	delicately sculptured	more coarsely sculptured
sculpture	20–25 primary squamose ribs, rounded and narrow	20–24 primary squamose ribs, rounded and broader
secondary radial riblets	prominent	weak or lacking
colour	uniform brown, orange or red	mottled brown, black and white

**Type data.** *Pecten ustulatus* Reeve: figured holotype (pr) (H 65.1 mm, L 61.0 mm, D 23.9 mm) (Reeve 1853: pl. 22, fig. 87) NHMUK [not registered]. Type locality: Australia. Herein restricted to Moreton Bay, QLD.

*Pecten gloriosus* Reeve: figured syntype (pr) (H 87 mm, L 84 mm) (Reeve 1853: pl. 30, fig. 134a) NHMUK 1950.11.14.35; 3 syntypes NHMUK 1950.11.14.36–38. Type locality: Australia, QLD, Moreton Bay.

*Pecten testudineus* Reeve: three syntypes (pr) NHMUK 20010210. Type locality: “Amboyna” [Indonesia, Maluku, Ambon].

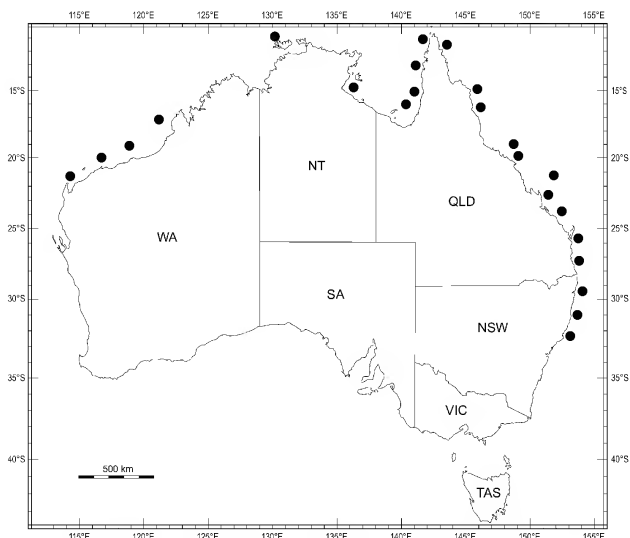
*Pecten similis* Baird: possible holotype (pr) (H 42 mm, L 38 mm) NHMUK [not registered]. Type locality: “Tongatabu, Friendly group” [Tongatapu, Tongatapu Group, Tonga].

*Mimachlamys subgloriosa* Iredale: holotype (pr) (H 43 mm, L 40 mm) AM C.089668 (Fig. 93B, E). Type locality: Australia, QLD, GBR, Low Isles, 9–12 fathoms [16–22 m].

**Comments on type data.** The auricles of the holotype of *Pecten ustulatus* are damaged, although the auricles have been “restored” on Reeve’s figure (1853: pl. 22, fig. 87).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Murray Island, 9°56’S 144°04’E, dead, beach (1 v, C.357620); N Gulf of Carpentaria, 11°34’S 138°36’E, dead, 59 m (1 v, C.346931); Gulf of Carpentaria, Mapoon, 11°58’S 141°53’E, dead (1 pr, C.348434); Gulf of Carpentaria, 10 ml SW of Mapoon, 12°05’S 141°40’E, dead, 18 m (6 v, C.014079); Gulf of Carpentaria, Albatross Bay, Weipa, 12°38’S 141°43’E, alive, 7 m (1 pr, C.094501); NE Gulf of Carpentaria, W of Weipa, 12°42’S 141°31’E, dead, 18 m (1 v, C.346944); Mid Gulf of Carpentaria, 14°09’S 139°40’E, dead, 61 m (2 v, C.346925); Gulf of Carpentaria, W of Edward River, 14°44’S 141°18’E, dead, 22 m (1 pr, C.114866); Gulf of Carpentaria, W of Edward River, 14°46’S 141°20’E, dead, 18 m (2 v, C.346941); Gulf of Carpentaria, W of Mitchell River, 15°09’S 141°22’E, dead, 14.5 m (1 v, C.346933); E Gulf of Carpentaria, W of Nassau River, 15°51’S 140°54’E, alive, 22 m (4 pr + 7 v, C.111500); E Gulf of Carpentaria, W of Nassau River, 15°53’S 140°42’E, alive, 25.6 m (5 pr, C.114871); Gulf of Carpentaria, W of

Nassau River, 15°53’S 141°02’E, dead, 20 m (1 pr, C.109332); E Gulf of Carpentaria, W of Nassau River, 15°53’S 141°13’E, dead, 11 m (1 v, C.346932); E Gulf of Carpentaria, SW of Nassau River, 16°06’S 140°44’E, alive, 22 m (4 pr, C.110630); SE Gulf of Carpentaria, W of Gilbert River, 16°41’S 140°09’E, dead, 18.3 m (1 v, C.110624); Gulf of Carpentaria, Forsyth Island, 16°50’S 139°06’E, dead, beach (2 v, C.014849); SE Gulf of Carpentaria, W of Point Burrowes, 16°57’S 140°16’E, alive, 18 m (2 v, C.346921; 1 pr, C.348457); SE Gulf of Carpentaria, W of Point Burrowes, 16°57’S 140°35’E, alive, 14.5 m (2 pr, C.346923); SE Gulf of Carpentaria, W of Point Burrowes, 16°58’S 140°0’E, dead, 18 m (1 v, C.111259); Gulf of Carpentaria, S of Sweets Island, 17°06’S 139°37’E, dead, 9–22 m (1 v, C.346939); Gulf of Carpentaria, 28 ml S of Sweets Island, 17°06’S 139°37’E, dead (9 v, C.346943); Torres Strait, Murray Island, 9°56’S 144°04’E, dead (1 pr, C.348278); Torres Strait, 10°11’S 141°48’E, dead, 13 m (2 pr, C.164906); Torres Strait, 10°22’S 141°42’E, alive, 16 m (2 pr, C.164911); Torres Strait, Thursday Island, 10°35’S 142°13’E, alive (12 v, C.097439; 3 pr, C.346960); Torres Strait, Friday Island, 10°36’S 142°10’E, dead (9 v, C.094502); Cape York Peninsula, 10°41’S 142°31’E, alive (2 pr, C.097435); Cape York, Telegraph Station, 10°42’S 142°28’E, dead, beach (3 v, C.036313); Cape York, near Telegraph Station, 10°42’S 142°28’E, dead (1 pr, C.103811); Cape York Peninsula, Somerset Bay, 10°44’S 142°35’E, alive (1 pr, C.348484); Cape York Peninsula, Albany Passage, 10°45’S 142°37’E, dead, 7–26 m (many v, C.036128); Cape York Peninsula, Albany Passage, 10°45’S 142°37’E, alive (3 pr, C.131991); Cape York Peninsula, Albany Passage, 10°45’S 142°37’E, alive, 16–22 m (pr, C.055697); Cape York, Red Island Point, near Bamaga, 10°51’S 142°21’E, alive (1 pr, C.131997); Cairncross Island, 11°14’S 142°55’E, alive (6 pr, C.097441); 2 ml NE of Hannibal Island, 11°33’S 142°57’E, dead, 22–23 m (1 pr, C.347792); GBR, Lizard Island, 14°40’S 145°28’E, dead (1 v, C.347793); off Bow Reef, near Cape Sidmouth, 13°20’S 143°40’E, dead, 19 m (1 v, C.002576); 5 ml WNW of Lizard Island, 14°30’S 145°22’E, dead, 20 m (1 pr, C.130385); 0.5 ml SE of Lizard Island, 14°41’S 145°29’E, dead, 35 m (1 v, C.153561); Turtle Island, 14°44’S 145°12’E, dead, 14.5 m (1 v, C.347795); 0.25 ml N of North Direction Isle, 14°44’S 145°31’E, dead, 34.5 m (1 v, C.089667; 1 v, C.094500); off Cape Flattery, Decapolis Reef, 14°50’S 145°17’E, dead, 12–14 m (1 v, C.347796); off Two Isles, 15°01’S 145°26’E, dead (2 v, C.161021); 0.5 ml W of Two Isles, 15°01’S 145°26’E, dead, 30 m (5 v, C.347794); Cooktown, 15°28’S 145°15’E, dead (1 v, C.106987); off Cooktown, 15°28’S 145°23’E, alive (8 pr, C.097440); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42’S 145°30’E, dead, 9–18 m (12 v, C.027531); Penguin Channel, 16°15’S 145°31’E, alive, 18–28.5 m (1 pr, C.093400); Penguin Channel, 16°15’S 145°31’E, dead, 22–25 m (8 v, C.094499); Low Isles, 16°23’S 145°34’E, dead, 16–22 m (1 pr, C.075258; 6 v, C.093403); Low Isles, 16°23’S 145°34’E, alive (1 pr, C.089668; 24 v, C.119460); off Cairns, 16°51’S 146°01’–146°04’E, dead, 33–35 m (many v, C.347804; 12 v, C.348267); off Cairns, GBR, 16°52’–16°53’S 146°06’E, dead, 37–38 m (5 v, C.348263); Cairns Harbour, 16°53’S 145°48’E, dead (1 v, C.094498); off Cairns, GBR, 16°55’S 146°07’E, dead, 37–40 m (5 v, C.348265); Magnetic Island, Horseshoe Bay, 17°07’S 146°51’E, dead, 6–9 m (1 v, C.348261); Family Islands, Dunk Island, 17°57’S 146°10’E, dead (1 v, C.009983; 1 pr, C.047367); off Townsville, 18°40’S 146°55’E, dead, 40–41 m (2 v, C.348266); off Townsville, 6–7 ml E of Keeper Reef, 18°45’S 147°23’E, dead, 43 m (6 v, C.347812); off Ingham, 18°53’S 147°35’E, alive, 58 m (1 pr, C.337113); off Townsville, 19°0’S 147°0’E, alive, 45 m (1 pr, C.348268); Magnetic Island, 19°08’S 146°50’E, dead (6 v, C.094496); Bohle River mouth, N of Townsville, 19°11’S 146°45’E, dead (1 v, C.068508); Townsville, Rows Bay, 19°14’S 146°48’E, dead (1 v, C.107188); Townsville, Rows Bay, 19°14’S 146°48’E, dead, intertidal (1 pr, C.131996); Townsville, 19°16’S 146°49’E, dead (3 v, C.094497; 2 pr, C.347809; 17 v, C.348428); S of Townsville, 19°17’S 147°32’E, dead, 24 m (7 v, C.348264); off Cape Upstart, 19°42’S 147°45’E, alive, 36 m (4 pr, C.097517); off Bowen, 19°44’S 148°14’E, dead, 40 m (1 v, C.119545); E of Bowen, 19°45’S 148°19’E, dead, 46 m (3 v, C.348269); W of Hayman Island, 20°03’S 148°50’E, dead, 33 m (22 v, C.348274); Bowen, 20°04’S 148°22’E, dead (1 pr, C.348432); Sinclair Bay, Cape Gloucester, 20°07’S 148°27’E, alive (2 pr, C.097438); Edgecumbe Bay, Sinclair Bay, 20°07’S 148°27’E, dead (3 pr, C.348426); Edgecumbe Bay, Bowen, 20°08’S 148°23’E, dead (1 v, C.131993); Whitsunday Islands, Lindeman Island, 20°27’S 149°02’E, dead (many v, C.348270); off Shaw Island, N of Mackay, 20°29’S 149°05’E, dead, 37 m (1 v, C.348273); E of Mackay, 20°52’S 149°29’E, dead, 35 m (8 v, C.116558); Seaforth, N of Mackay, 20°54’S 148°58’E, dead (1 v, C.059194); E of Sarina, 21°27’S 150°08’E, dead, 42 m (many v, C.119596); E of Sarina, 21°28’S 150°08’E, dead, 40 m (26 v, C.348275); GBR, Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42’S 152°26’E, dead, 64–73 m (many v, C.153560); SE of Sarina, 21°47’S 150°34’E, dead, 59 m (many v, C.116486); E of Broad Sound, 21°58’S 150°45’E, dead, 57 m (many v, C.347637); off Broad Sound, 22°06’S 150°49’E, dead, 53 m (many v, C.116496); SE of Swain Reefs, 22°31’S 152°32’E, dead, 100 m (many v, C.151489); off Yeppoon, 22°40’S 151°16’E, dead, 58 m (6 v, C.348280); off Yeppoon, 22°42’S 151°37’E, dead, 68 m (3 v, C.348281); 30 ml NE of Yeppoon, 22°50’S 151°11’E, alive, 46–55 m (12 pr, C.073249); NE of Rockhampton, 22°50’S 151°39’E, dead, 64 m (2 v, C.348279); off Yeppoon, off North Keppel Island, 23°02’S 151°10’E, alive, 51 m (5 pr, C.348491); Keppel Bay, North

**Figure 91.** Distribution of *Mimachlamys gloriosa* (Reeve).

Keppel Island, 23°04'S 150°54'E, dead (4 v, C.348430); North Keppel Island, close inshore to NW end, alive, 7 m (1 pr, C.348488); Keppel Bay, Yeppoon, 23°08'S 150°45'E, alive (3 pr, C.131995; 1 pr, C.348282); 1.5 ml NW of South Keppel Island, 23°08'S 150°56'E, alive, 13–20 m (7 pr + 1 v, C.077056); Keppel Bay, NE of South Keppel Island, between Outer Rock & Man & Wife, 23°08'S 150°56'E, dead, 24–26 m (2 v, C.348271); Capricorn Channel, 23°08'S 152°16'E, dead, 155 m (2 v, C.348272); Keppel Bay, 1.5 ml NW of South Keppel Island, 23°09'S 150°57'E, dead, 13–20 m (2 v, C.070801); Capricorn Channel, 4 ml E of North Reef, 23°09'S 151°58'E, alive, 64 m (2 pr + 3 v, C.348277); Capricorn Channel, off North Reef, 23°09'S 151°59'E, dead, 54 m (1 pr, C.348284); Keppel Bay, off Humpy Island, 23°13'S 150°58'E, dead, 4 m (1 v, C.124011); Capricorn Group, North West Island, 23°18'S 151°42'E, alive (7 v, C.057647; many v, C.131992; 2 v, C.161006); Capricorn Group, off North West Island, 23°18'S 151°42'E, alive, 36 m (4 v, C.348283); Keppel Bay, 23°25'S 150°55'E, dead (1 v, C.131994); Capricorn Group, One Tree Island, 23°30'S 152°05'E, dead, 55 m (23 v, C.348276); Gladstone Harbour, 23°51'S 151°16'E, dead (9 v, C.089474); S of Gladstone, Tannum Sands, 23°57'S 151°22'E, dead, beach (1 v, C.347625); Port Curtis, Rodds Harbour, 24°0'S 151°34'E, alive (1 pr, C.069989; 1 pr, C.080062); Port Curtis, Hummock Hill Island, 24°01'S 151°28'E, alive (2 pr, C.062604); off Burnett Heads, 24°46'S 152°24'E, alive, 27 m (12 pr, C.097437); Bargara, 24°49'S 152°28'E, dead (2 v, C.348429); S of Fraser Island, 25°28'S 153°0'E, alive (1 pr, C.070291); off S end Frazer Island, 25°48'S 153°46'E, dead, 73 m (1 v, C.347624); off Tin Can Bay, 25°50'S 153°27'E, alive (1 pr, C.062503); E of Caloundra, 26°48'S 153°35'E, dead, 91–119 m (4 pr, C.097445); near Moreton Bay, 27°13'S 153°20'E, alive (1 pr, C.081213); Moreton Bay, Redcliffe Beach, 27°14'S 153°07'E, alive (1 v, C.089483; 3 pr, C.147401); Moreton Bay, off Redcliffe Beach, 27°14'S 153°07'E, alive (1 pr, C.094494); Moreton Bay, 27°15'S 153°15'E, alive (3 pr, C.047362; 2 pr, C.064544; 1 pr + 1 v, C.077041); Moreton Bay, 27°15'S 153°15'E, alive, 3.5–11 m (7 v, C.094493); Moreton Bay, Bramble Bay, Humpybong, 27°17'S 153°04'E, alive (1 pr, C.019174); Moreton Bay, Sandgate, Cabbage Tree Creek, 27°20'S 153°06'E, alive (2 pr, C.102906); Moreton Bay, Green Island, 27°26'S 153°14'E, dead (1 v, C.347635); Moreton Bay, off Peel Island, 27°30'S 153°21'E, alive, 9 m (many, C.097443; 5 pr, C.097444); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, alive, 5–7 m (7 v, C.075250; 3 v, C.347633); Moreton Bay, Dunwich, Stradbroke Island, 27°30'S 153°24'E, alive (1 pr, C.348478); Moreton Bay, Peel Island, 27°30'S 153°21'E, alive (3 pr, C.094495). **NEW SOUTH WALES:** Brunswick Heads, 28°32'S 153°33'E, dead, beach (1 v, C.098628); off Coffs Harbour, 30°36'–30°39'S 153°19'–153°18'E, dead, 165 m (1 v, C.123478); Port Stephens, 32°42'S 152°05'E, alive (2 pr, C.012155). **WESTERN AUSTRALIA:** Shark Bay, South Passage, 26°10'S 113°13'E, dead (1 v, C.069374); Exmouth Gulf, SE of Exmouth Homestead, 22°24'S 114°08'E, alive (1 pr, C.348477); North West Shelf, 26 n.ml NNE of Dampier, 20°14'S 116°50'–116°50.6'E, alive, 40–41 m (2 pr + 4 v, C.346912); North West Shelf, 50 n.ml NNE of Port Hedland, 19°30'19°31'S 118°52'–118°49'E, dead, 38–40 m (4 v, C.149900); North West Shelf, 52 n.ml NNE of Port Hedland, 19°30'–19°28.2'S 118°49'–118°55.4'E, dead, 36–37 m (5 pr + 5 v, C.149172; 14 v, C.149202); North West Shelf, 74 n.ml NNE of Port Hedland, 19°05'–19°05.3'S 118°53'–118°54'E, dead, 80 m (1 v, C.149987); North West Shelf, 77 n.ml NNE of Port Hedland, 19°05'–19°04.9'S 118°58'–118°58.2'E, dead, 82 m (3 v, C.149916); North West Shelf, 76 n.ml NNE of Port Hedland, 19°04'–19°04.7'S 118°50'–118°50.8'E, dead, 81 m (4 v, C.148635; 2 v, C.148636); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04'–19°04.3'S 118°47'–118°47.6'E, dead, 82 m (11 v, C.149222); North West Shelf, 78 n.ml NNE of Port Hedland, 19°04'–19°04.2'S 119°04'–119°0.7'E, dead, 82 m (34 v, C.149316); North West Shelf, 80 n.ml NNE of Port Hedland, 19°03'–19°03.4'S 119°03'–119°03.5'E, dead, 82 m (4 v, C.346913); North West Shelf, 94 n.ml NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m (2 v, C.346911); c. 80 ml NW of Broome, 17°20'S 121°11'E, dead, 95 m (1 v, C.160981). **NORTHERN TERRITORY:** Arafura Sea, c. 110 ml N of Melville Island, 9°34'S 131°22'E, dead, 135 m (1 v, C.123870); Arafura Sea, 10°13'S 133°58'E, alive, 72 m (3 pr, C.348486); Arafura Sea, c. 45 ml N of Croker Island, 10°17'S 132°38'E, dead, 65 m (3 v, C.346918); Arafura Sea, 91 km N of Goulburn Island, 10°42'S 133°36'E, dead, 58 m (4 v, C.346937); Darwin, Waigait, 11°28'S 130°50'E, alive (7 pr, C.348472); Darwin, Stokes Hill Powerhouse, 11°28'S 130°50'E, alive (15 pr, C.348475); off Darwin, 12°04'S 123°50'E, dead, 132 m (3 v, C.070519); Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (1 v, C.346919); Port Darwin, 12°28'S 130°50'E, dead (2 v, C.013918); Daly River mouth, 13°19'S 130°15'E, dead (1 pr, C.019478); Anson Bay, 13°20'S 130°10'E, dead (4 v, C.40801); Gulf of Carpentaria, Grootte Eylandt, 14°0'S 136°25'E, dead (1 v, C.346920). —**PAPUA NEW GUINEA:** New Britain, Rabaul, 4°12'S 152°11'E, dead (1 v, C.348447); Gulf of Papua, off Cape Possession, 8°37'S 146°20'E, dead, 27 m (2 v, C.088004); SW Port Moresby, Lolorua Island, 9°30'S 147°06'E, dead, 13–18 m (5 v, C.348443); Port Moresby, Manubada Island, 9°31'S 147°10'E, off W end, just inside of outer reef, alive, 18–22 m (many, C.348442); Louisiade Archipelago, Nimoa Island, Calvados Chain & Rossel Island, 11°18'S 153°15'–154°0'E, dead (1 v, C.348444; 3 v, C.348446). —**NEW CALEDONIA:** Baaba Island, 20°03'S 163°58'E, W coast, alive, 0–0.5 m (1 pr, C.348466); Poum Bay, Daomboui Island, 20°09'S 163°59'E, alive, 0–3 m (1 pr, C.348468); Poum, 20°13'S 164°03'E, dead (1 pr, C.348438); Poum, Recif Bay, 20°13'S 164°03'E, alive, 1–4 m (1 pr, C.348469); Nouméa, North Dumbea, Baie Papaya, 22°11'S 166°19'E, alive, 0–3 m (1 pr, C.348465); Nouméa, Baie des Isoles, Magenta, Ouemo, 22°16'S 166°29'E, alive (2 pr, C.348691); Nouméa, Baie des Citrons, 22°18'S 166°26'E, dead (1 v, C.106418); Nouméa, Ile Ste. Marie, 22°18'S 166°29'E, alive, 0–2 m (3 v, C.348439; 10 pr + 3 v, C.348440; 1 pr, C.348461); Anse Vata, Aquarium de Nouméa, 22°19'S 166°27'E, alive (many, C.348435; many, C.348436); Nouméa, Anse Vata, 22°31.7'S 166°45'E, alive, 1–3 m (1 pr, C.348458). **TASMAN SEA:** off Newcastle, Taupo Guyot, 33°06'S 156°09'E, dead, 154–164 m (5 v, C.139602).

**Description.** Shell rather compressed, up to c. 120 mm high, juvenile elongate, adult subcircular, equivalve, equilateral, left valve slightly more convex than right, auricles highly unequal, umbonal angle c. 80–85°; most specimens dark brick red with paler maculations.

Both valves sculptured with 22–23 evenly spaced primary radial plicae bearing variably prominent, widely set scales, with secondary squamose interstitial riblets near ventral margin (absent in juveniles). Interstitial microsculpture of irregular antimarginal scratches, weakly developed on central part of disc, more prominent near posterior margin. Anterior auricle of left valve with c. 8 scaly radial riblets; of right valve with 5–6 more prominent riblets. Posterior auricle of left valve with similar sculpture to anterior, although weaker and with fewer riblets. Dorsal margin straight. Resilifer narrowly triangular. Byssal notch deep, byssal fasciole rather broad. Functional ctenuium well-developed, with c. 5 teeth. Interior furrowed; internal rib carinae short, prominent around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimens: N QLD, Port Curtis, Rodds Harbour (AM C.069989; scaly, coarsely sculptured specimen): rv: H 77.4, L 74.4 mm; lv: H 76.3, L 73.4 mm; D 26.0 mm; S QLD, trawled off Moreton Island (AM C.081213; weakly sculptured specimen): rv: H 86.6, L 79.3 mm; lv: H 85.7, L 78.7 mm; D 27.9 mm; holotype of *Mimachlamys subgloriosa* Iredale, AM C.089668 (Fig. 93B, E), QLD, GBR, Low Isles, 16–22 m: H 43 mm, L 40 mm.

**Habitat.** Living in the littoral zone, byssally attached to rocks or coral, or amongst coral rubble on soft sediment (sand and/or mud). In Western Australia often attached to pipes or ropes in deeper water, occasionally found attached to ropes hanging under floats washed as far south as Perth (H. Morrison, pers. comm.).

**Distribution.** Tropical western Pacific, from the Philippines southwards to Indonesia and northwestern, northern and northeastern Australia, eastwards to Tonga (Raines & Poppe, 2006: 272); Philippines to Australia, 17–110 m (Huber, 2010: 211); Philippines, 10–30 m (Raines, 2010: 640; Dijkstra, 2013: 92); Vanuatu, 91–110 m (Dijkstra & Maestrati, 2012: 401). Maximum depth range of live-taken specimens is in the intertidal zone to 110 m. Present specimens from Australia alive at 3.5–72 m.

**Remarks.** *Mimachlamys gloriosa* closely resembles *Mimachlamys crassicosata* (G. B. Sowerby II, 1842) from northern Chinese and Japanese waters. *Mimachlamys gloriosa* can be distinguished from *M. crassicosata* by its smaller size (*M. gloriosa* up to c. 120 mm in height, *M. crassicosata* up to c. 140 mm), its different sculpture (*M. gloriosa* c. 22 plicae with secondary riblets in late growth stage; *M. crassicosata* c. 24 plicae lacking interplacal secondary sculpture), and its colour (*M. crassicosata* is more brightly coloured, resembling the colour of *M. spinicostata*). The eggs and larval development of New Caledonian specimens of *M. gloriosa* were described by Lefort (1992).

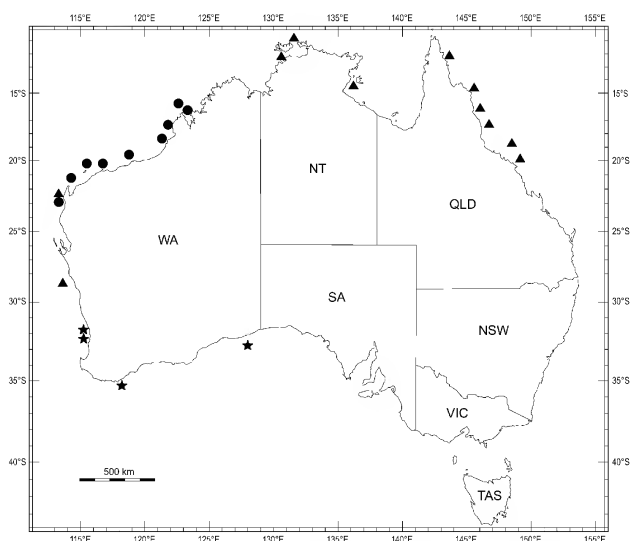
### *Mimachlamys heterophyseta*

Beu & Darragh, 2001

Figs 90H, J, 92, 93I

*Mimachlamys heterophyseta* Beu & Darragh, 2001: 141, figs 44A, G, 50A–E, 51A–G, 52B, D.

**Type data.** Holotype (pr) NMV P302152, from NMV fossil locality PL1206, Memana Formation (early Pleistocene), Bass Strait, Flinders Island, Backline Road, 2.3 miles NE of junction with Wingaroo Road, dam C on “Brunah” Station,



**Figure 92.** Distribution of *Mimachlamys funebris* (Reeve) (circles), *M. heterophyseta* Beu & Darragh (stars) and *M. punctata* (Gmelin) (triangles).

grid ref. Flinders Island 915809; 18 paratypes in NMV listed by Beu & Darragh (2001: 143), all from Memana Formation on Flinders Island.

**Additional material examined.** **Fossils:** Early Pleistocene: Specimens in a further 12 lots from Memana Formation on Flinders Island were listed by Beu & Darragh (2001: 143), in NMV and WAM. Specimens were also listed from nine localities in “younger” Ascot Formation (early Pleistocene) of the Perth Basin, Western Australia, in WAM (Beu & Darragh, 2001: 143–144). Middle Pleistocene: Specimens were also listed by Beu & Darragh (2001: 144) from five lots in middle Pleistocene rocks from excavations near Busselton, Geographe Bay, southern Western Australia, in WAM. **Recent:** Beu & Darragh (2001: 144) listed the following present-day material examined by them: WA, S of Fremantle, Cockburn Sound (1 pr, WAM S12615); WA, Cockburn Sound, dredged (2 pr, WAM S12616); S coast of WA, Albany, Middleton Beach (21 v, WAM S12376); WA, N of Fremantle, W of City Beach, FRV *Flinders* sta. 13, dredged 12 Dec. 1974 (2 v, WAM S12377). One additional lot has been examined: WA, Great Australian Bight, 33°12.00'S 128°43.00'E, 75–147 m, HMAS *Gascogne*, 5 July 1962 (2 lv, AM C.079057).

**Description.** Shell large, to 112 mm high, most specimens to c. 50–70 mm; unusually thin and fragile for a *Mimachlamys* species; moderately to strongly prosocline; strongly inequivalve and inequilateral, right valve weakly inflated, left valve much more strongly inflated; anterior auricles much larger and longer than posterior ones, posterior ones short, with concave posterior outline; umbonal angle c. 90° in juveniles, c. 110–115° in adults; most specimens uniform cream or pale purplish pink, some variable, purple or brick-red to yellow, some with primary radial plicae darker than remainder of surface, forming radial bands.

Both valves sculptured with c. 24–30 evenly and widely spaced, narrow-crested, squamose radial plicae; many narrow, closely spaced, squamose secondary, tertiary and quaternary riblets fill each wide, shallowly concave interspace. Pre-radial area of left valve bearing large, smooth pits, grading downwards into mixed commarginal and antimarginal “herringbone” pattern between plicae. Anterior auricle of left valve with c. 20–25 narrow, closely spaced, squamose radial riblets, similar but fewer (c. 10–12) on posterior auricle; anterior auricle of right valve with 6–7 prominent, wide, flattened radial riblets; posterior auricle sculptured as on left valve. Byssal notch deep, narrow, byssal fasciole strongly depressed, rather narrow. Functional ctenolium well-developed, with 4 stout, hooked teeth. Short internal rib carinae prominent inside ventral margin on a few unusually large, thick-shelled specimens, otherwise lacking.

Hinge with weak teeth; 1 low, wide resilial tooth present on each side of resilifer in a few specimens.

**Dimensions.** Illustrated specimen: WA, Great Australian Bight, 33°12.00'S 128°43.00'E, 75–147 m (AM C.079057), lv only: H 49.9, L 49.9 mm; unfigured specimen, lv: H 47.1, L 47.0 mm.

**Habitat.** The few Recent specimens recognized up until now have been either picked up on beaches or dredged from shallow water (c. 5–20 m; one lot from 75–147 m) living free on a soft substrate. Unlike *Mimachlamys asperrima*, they do not seem to have lived byssally attached or to have been heavily encrusted with sponge when collected, although this needs confirmation; the illustrated specimen bears a very thin layer of yellow sponge. The densely scaly exterior appears to be an ideal medium for sponge attachment, and the ctenolium and byssal notch remain functional in all but a few of the largest specimens.

**Distribution.** *Mimachlamys heterophyseta* appears to be limited to early Pleistocene rocks on Flinders Island, Bass Strait, Tasmania, and in the “younger” Ascot Formation in boreholes in the Perth Basin, Western Australia; to late middle Pleistocene rocks near Geographe Bay in southwestern Western Australia; and to the Recent fauna of southern Western Australia, from Fremantle to the Great Australian Bight. As it has been recognized relatively recently, its distribution is poorly known.

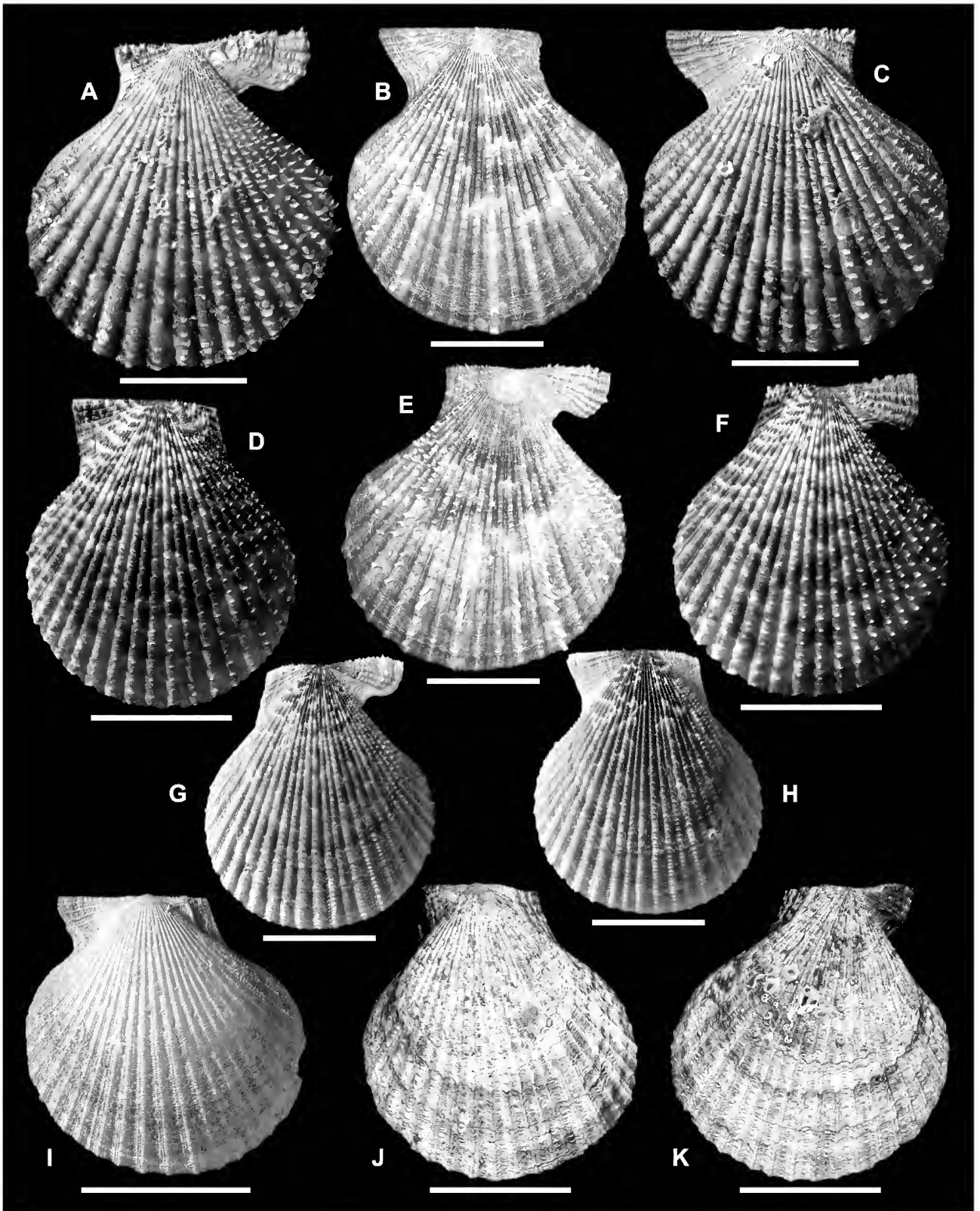
**Remarks.** *Mimachlamys heterophyseta* and *M. asperrima* are similar enough that all malacologists confused them until 2001. The main, obvious distinguishing character of *Mimachlamys heterophyseta* is the great discrepancy between the inflation of the two valves (Beu & Darragh, 2001: figs 48–49). The right valve is very weakly inflated, much less so than in *Mimachlamys asperrima*, whereas the left valve is strongly inflated, a little more so than in *M. asperrima*; the right valve tends to be slightly more inflated than the left valve in *M. asperrima* (Beu & Darragh, 2001: fig. 49). However, there are also a number of other consistent differences: the primary plicae are much narrower and there are much more numerous secondary, tertiary and quaternary riblets filling the primary radial interspaces in *Mimachlamys heterophyseta* than in *M. asperrima*; the disc shape is more strongly prosocline in *M. heterophyseta* than in *M. asperrima*; most specimens of *M. heterophyseta* have a much thinner shell and (apparently as a consequence) much weaker internal rib carinae than in *M. asperrima*; the much more numerous scales on the many orders of radial costae give the exterior surface of *M. heterophyseta* a much more uniformly even, scaly appearance, without the clearly differentiated primary plicae of *M. asperrima*; and the hinge teeth of *M. heterophyseta* are much less obviously developed than those of *M. asperrima*. Most specimens also are much paler than *M. asperrima*.

***Mimachlamys punctata* (Gmelin, 1791)  
comb. nov.**

Figs 90B,F–G,I, 92, 93D,F–H,J–K

*Ostrea punctata* Gmelin, 1791: 3320, no. 29; refers to Gualtieri, 1742, pl. 74, fig. G; Dijkstra, 2016: 120, fig. 17.  
*Pecten punctatus* (Gmelin).—Bosc, 1802: 265; Bosc, 1824: 260; Defrance, 1825: 248.  
*Pecten lentiginosus* Reeve, 1853: sp. 76, pl. 20, fig. 76 [syn. nov.].





**Figure 93** A–C, E, *Mimachlamys gloriosa* (Reeve), 2 pairs, (A, C) specimen in Fig. 90D, E, rv exterior (A), lv exterior (C), (B, E) AM C 089668, holotype of *Mimachlamys subgloriosa* Iredale, Low Isles, GBR, QLD, 9–12 fathoms [16–22 m], lv exterior (B), rv exterior (E). D, F–H, J, K, *Mimachlamys punctata* (Gmelin), 3 pairs, (D, F) specimen in Fig. 90F, G, lv exterior (D), rv exterior (F); (G, H) specimen in Fig. 90B, I, rv exterior (G), lv exterior (H); (J, K) AM C 089666, holotype of *Mimachlamys gavena* Iredale, Low Isles, GBR, QLD, 9–12 fathoms [16–22 m], lv exterior (J), rv exterior (K). I, *Mimachlamys heterophyseta* Beu & Darragh, specimen in Fig. 92H, J, lv exterior. Scale bars represent 30 mm (A, C, I), 20 mm (B, D–H, J, K).

*Pecten sanguinolentus* Reeve, 1853: sp. 159, pl. 34, fig. 159 (junior secondary homonym of *Ostrea sanguinolenta* Gmelin, 1791).

*Pecten saniosus* Reeve, 1853, errata (replacement name for *Pecten sanguinolentus* Reeve, 1853).

*Pecten* (*Chlamys*) *cruentatus* var. *lentiginosa* [sic] Reeve.—Dautzenberg & Bavay, 1912: 9.

*Mimachlamys gavena* Iredale, 1939: 351, pl. 5, fig. 28 [syn. nov.].

*Chlamys* (*Mimachlamys*) *lentiginosa* (Reeve).—Habe, 1964b: 174, pl. 53, fig. 13; Springsteen & Leobrera, 1986: 326, pl. 93, fig. 5; Rombouts, 1991: 29, pl. 11, figs 1, 1a.

*Chlamys lentiginosa* (Reeve).—Abbott & Dance, 1982: 314, fig.; Wells, Slack-Smith & Bryce, 2000: 42.

*Chlamys* (*Chlamys*) *lentiginosa* (Reeve).—Dijkstra, 1990a: 9, 11.

*Chlamys* (*Mimachlamys*) *gavena* (Iredale).—Rombouts, 1991: 28.

*Mimachlamys lentiginosa* (Reeve).—Dijkstra, 1991: 33; Lamprell & Whitehead, 1992: [24], pl. 10, fig. 58; Dijkstra, 1998a: 41, pl. 8, figs 6–7; Hayami, 2000: 903, pl. 449, fig. 26; Wang, 2002: 190; Slack-Smith & Bryce, 2004: 237; Raines & Poppe, 2006: 272, 275, upper figs; pl. 220, figs 1–7; pl. 297, fig. 1; Xu & Zhang, 2008: 83, fig. 231; Huber, 2010: 211; Raines, 2010: 644, pl. 1013, figs 2–5; Dijkstra, 2013: 93, pl. 19, figs 5a–b, pl. 24, figs 1a–d.

**Type data.** *Ostrea punctata* Gmelin: lectotype (rv: H 49 mm, L 42.9 mm), not figured by Gualtieri (1742), in Museo di Storia Naturale et del Territorio, Università di Pisa, in the Certosa di Calci (MSNP G. 2260), herein designated. Paralectotype (lv) figured by Gualtieri (1742: pl. 74, fig. G) not traced. Type locality: Unknown.

*Pecten lentiginosus* Reeve: lectotype (pr) NHMUK 1950.11.14.40, figured by Reeve (1853: pl. 20, fig. 76), herein designated, 2 paralectotypes (pr) NHMUK 1950.11.14.41–42. Type locality: Philippine Islands, Ticao Island, under stones at low water.

*Pecten saniosus* Reeve: syntype (pr) NHMUK 2009001. Type locality: Unknown.

*Mimachlamys gavena* Iredale: holotype (pr) AM C.089666 (Fig. 93J–K). Type locality: Australia, N QLD, GBR, Low Isles, 9–12 fathoms [16–22 m].

**Comments on type data.** During a visit to Gualtieri's collection in the Museo di Storia Naturale at Calci, near Pisa, Italy, the first author (Dijkstra, 2016) traced only the right valve, with an ink number “72.G” on the inside, referring to the figure by Gualtieri (1742: pl. 74, fig. G) of an articulated specimen of *Ostrea punctata* Gmelin, 1791 in the Gualtieri collection, similar to the type material of *Pecten lentiginosus* Reeve, 1853. *Mimachlamys gavena* from Queensland is indistinguishable from the type material of *Ostrea punctata* and *Pecten lentiginosus*.

We are not aware of the 25 published usages of the name *Chlamys* (or *Mimachlamys*) *lentiginosa* that would be needed to allow this name to be declared a *nomen protectum*, and so are obliged to adopt Gmelin's earlier name *Mimachlamys punctata*.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Darnley Island, 9°35'S 143°46'E, alive (1 pr, C.097535); Torres Strait, Murray Island, 9°56'S 144°04'E, dead (8 v, C.029788; 6 v, C.029789; 5 v, C.343646; 2 v, C.343650); Cape York, Portland Roads, Rocky Island, 12°35'S 143°24'E, alive (1 pr, C.097448); GBR, S end No. 5 Sandbank reef (13–120), 13°45'S 144°16'E, dead, 9–15 m (1 v, C.343652); GBR, 0.5 ml NW of Howick Isle, 14°29'S 144°57'E, dead, 18 m (1 pr, C.132073); Lizard Island, Kapok Cove, North Point, 14°39'S 145°27'E, dead, 3 m (1 pr, C.343661); Lizard Island, North Point, 14°39'S 145°27'E, alive, 3.5 m (2 pr, C.344040); Lizard Island, Macgillivray Cay, NW side, 14°39'S 145°29'E, dead, 6–17 m (1 pr, C.343657); Lizard Island, Watsons Bay, 14°40'S 145°27'E, alive, 10.5 m (1 pr, C.343656); Lizard Island, Watsons Bay, N side, 14°40'S 145°27'E, alive, 2–3 m (1 pr, C.343660); Lizard Island, Watsons Bay, N end, 14°40'S 145°27'E, alive, 0–2 m (1 pr, C.344034); Lizard Island, 14°40'S 145°28'E, alive (1 pr, C.008626; 3 v, C.041561); Lizard Island, off Casuarina Beach, 14°41'S 145°27'E, dead, 3–6 m (1 v, C.105844); Lizard Island, Casuarina Beach, 14°41'S 145°27'E, dead (1 v, C.121463); Lizard Island,

SE side of Casuarina Beach, 14°41'S 145°27'E, alive (1 pr, C.344042; 1 pr, C.344044); Lizard Island, No. 1 Bommie, 14°41'S 145°28'E, alive, 0–15 m (1 pr, C.344043); Lizard Island, Eagle Island, N side, 14°42'S 145°23'E, alive, 3 m (1 pr, C.344038); Lizard Island, South Island, 14°42'S 145°27'E, alive, 3–18 m (1 pr + 4 v, C.343654); Lizard Island, South Island, S end, 14°42'S 145°27'E, dead, 15 m (1 v, C.343658); Lizard Island, South Island, 14°42'S 145°27'E, dead, 0.5–12 m (1 v, C.343659); Turtle Island, 14°44'S 145°12'E, dead, 14.5 m (1 v, C.089688); Reef 14–151, 14°55'S 145°41'E, dead, 8–13 m (1 v, C.343662); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (7 v, C.028011); Mackay Reef, 16°03'S 145°37'E, alive, intertidal (1 pr, C.132074); N of Cairns, Opal Reef, 16°15'S 145°50'E, dead, 27 m (1 v, C.343665); Low Isles, 16°23'S 145°34'E, alive, 0–22 m (1 pr, C.089666; 1 pr, C.119525; 1 pr, C.343663); Michaelmas Cay, 16°36'S 145°59'E, dead (15 v, C.119526); NE of Cairns, Big Upolu Cay, 16°40'S 145°56'E, alive (2 pr, C.132075); N of Cairns, Buchans Point, 16°44'S 145°40'E, dead (1 v, C.343664); off Cairns, Green Island, 16°46'S 145°58'E, dead (1 v, C.096636; 3 v, C.343666); Ellison Reef, near Kurramine, 17°42'S 146°25'E, alive, 15 m (1 pr, C.050783); Palm Islands, 18°40'S 146°33'E, dead (5 v, C.009986); off Palm Islands, 18°44'S 146°31'E, alive (1 pr, C.097540); E of Townsville, Broadhurst Reef, 18°57'S 147°44'E, dead, subtidal (1 pr, C.132076); off Townsville, Broadhurst Reef, 18°57'S 147°44'E, alive, sublittoral (1 pr, C.344041); Bowden Reef, 19°02'S 147°56'E, dead, sublittoral (1 pr, C.132077); Gloucester Island, 20°01'S 148°27'E, dead (1 pr, C.097541); Whitsunday Islands, Hayman Island, 20°03'S 148°53'E, dead (1 v, C.071612); Cape Gloucester, Dingo Beach, 20°05'S 148°30'E, alive (1 pr, C.344039); Whitsunday Group, Langford Reef, 20°05'S 148°53'E, alive (1 pr, C.303777); Swain Reefs, Reef 21–182, 21°22'S 151°41'E, dead, 10 m (1 v, C.161862); Swain Reefs, Reef 21–189, 21°27'S 151°41'E, dead, 1–2 m (1 pr, C.148048); Swain Reefs, Reef 21–189, 21°27'S 151°41'E, dead, 9–10 m (1 v, C.343668); Swain Reefs, Bylund (Gillett) Cay, W shore, 21°43'S 152°25'E, dead, intertidal (2 v, C.343667). **WESTERN AUSTRALIA:** Abrolhos Islands, Pelsaert Group, Burnett Island, approx. 28°53'S 113°58'E, dead, 0–1 m (1 v, WAM); WAM; Abrolhos Islands, Gun Island, 28°53'S 113°52'E, alive, 3 m (1 pr, C.344054); Abrolhos Islands, Beacon Island, SW of Little Rat Island, 28°44'S 113°46'E, dead, 15 m (5 v, C.095520); Abrolhos Islands, W of Little Rat Island, 28°43'S 113°47'E, alive (1 pr, C.344035); Abrolhos Islands, N of Rat Island, Little Sandy Island, 28°42'S 113°46'E, alive (1 pr, C.344036); Abrolhos Islands, middle channel, 28°35'S 113°45'E, alive, 38 m (1 pr, Abrolhos Islands, Beacon Island, Goss Passage, 28°28'S 113°47'E, dead (2 v, WAM); Shark Bay, N of Dirk Hartog Island, 25°29'S 112°57'E, dead, 73–128 m (1 pr, WAM); 6 miles N of Quobba station, 24°19'S 113°24'E, dead, beach (3 v, WAM); Maud Landing, Coral Bay, 23°07'S 113°45'E, alive, 18 m (1 pr, WAM). **NORTHERN TERRITORY:** Darwin, Channel Rock Buoy, approx. 12°29'S 130°48'E, alive, 9–18 m (1 pr, WAM); Near Darwin, 12°28'S 130°50'E, dead (1 v, C.375616); Cobourg Peninsula, Araru Point, 11°11'S 131°53'E, alive (2 pr, C.103201); Cobourg Peninsula, Port Essington, Coral Bay, 11°11'S 132°03'E, dead, 0–8 m (1 pr, WAM); Cobourg Peninsula, Port Essington, W of Orontes Reef, 11°04'S 132°05'E, dead (1 v, WAM); Cobourg Peninsula, Smith Point area, 11°07'S 132°08'E, dead (2 v, C.103643; 2 v, C.121419; 1 v, C.122753); Gulf of Carpentaria, Groote Eylandt, 14°0'S 136°25'E, alive (1 pr, C.103812; 3 v, C.103822; 5 v, C.119523; 5 v, C.132072; 4 v, C.375618; 1 pr + 3 v, WAM); Arnhem Land, Gove Peninsula, Yirrkala, 12°15'S 136°53'E, dead (many v, C.060178; 16 v, C.119524; 11 v, C.375617). —PHILIPPINE ISLANDS: Bohol Island, Pamilacan Island, 9°30'N 123°55'E, dead, 1–3 m (2 v, C.161902); Bohol Island, Danajon Bank, Banacon Island, 10°12'N 124°10'E, dead (6 v, C.112219); NW Bohol Island, Danajon Bank, Calituban Island, 10°15'N 124°17'E, alive (1 pr, C.344055); Marinduque Island, 2 km W of Kawayan, Ataa (Ata) Island, 13°32'N 121°51'E, dead, 1–6 m (1 v, C.108197). —INDONESIA: Moluccas, Ceram, alive, 3–5 m (3 pr, ZMA Moll.142459); Irian Jaya, Schouten Islands, Island 0.5 ml SSW of Soweik (= Sawek), 0°49'S 135°30'E, alive (1 pr, C.119527); off Bali, alive, 3–6 m (5 pr, ZMA Moll.143747). —PAPUA NEW GUINEA: New Ireland, via Kavieng, Mongop, 2°53'S 151°22'E, dead (2 v, C.343673); Woodlark Island, 9°08'S 152°50'E, alive (2 pr, C.047369); Milne Bay District, China Straits, Loegeia (= Rogeia) Island, NE end, 10°39'S 150°39'E, alive (3 pr, C.343670); Louisiade Archipelago, Nimoa Island, Calvados Chain & Rossel Island, 11°18'S 153°15'–154°0'E, dead (10 v, C.117070). —SOLOMON ISLANDS: New Georgia Island, 8°05'S 157°50'E, dead (3 v, C.055629); Guadalcanal, W Honarua, alive, 15–20 m (10 pr, ZMA Moll.144004); Ngella Island, Tulagi, alive, 18–24 m (3 pr, ZMA Moll.142458). **CORAL SEA:** Tregrosse Reefs, Diamond Islets, West Cay, 17°26'S 150°48'E, dead (1 v, C.343669).

**Description.** Shell up to c. 70 mm high, most specimens smaller, to c. 40 mm; elongate, weakly inflated, almost equally convex, equivalve, almost aequilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 85–90°; most specimens pale to dark brown with white or cream maculations, interior brownish.

Both valves sculptured with c. 20–24 evenly spaced, squamose radial plicae; each plica flanked by a narrow secondary riblet on each side, commencing in late growth stage, almost lacking from some specimens. Anterior auricle of left valve with 6–10 squamose radial riblets, 4–6 weaker ones on posterior one; anterior auricle on right valve with 4–5 prominent radial riblets, much weaker on posterior. Dorsal margin of posterior auricle somewhat declined. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 4–6 teeth. Interior evenly furrowed, internal rib carinae prominent around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimens: QLD, GBR, Langford Reef, Whitsunday Group, AM C.303777, illustrated by Lamprell & Whitehead (1992: pl. 10, fig. 58) as *M. lentiginosa*: rv: H 44.3, L 39.1 mm; lv: H 44.1, L 38.6 mm; D 13.3 mm; WA, Roebuck Bay, Broome (AM C.097537): rv: H 46.8, L 40.6 mm; lv: H 46.5, L 40.3 mm; D 16.3 mm. Iredale (1939: 352) stated the dimension of “the shell figured” of *Mimachlamys gavena* as H 42, L 39, D 15 mm.

**Habitat.** Living in the littoral zone, byssally attached to undersides of coral slabs or amongst rocky boulders with weed on sandy bottoms.

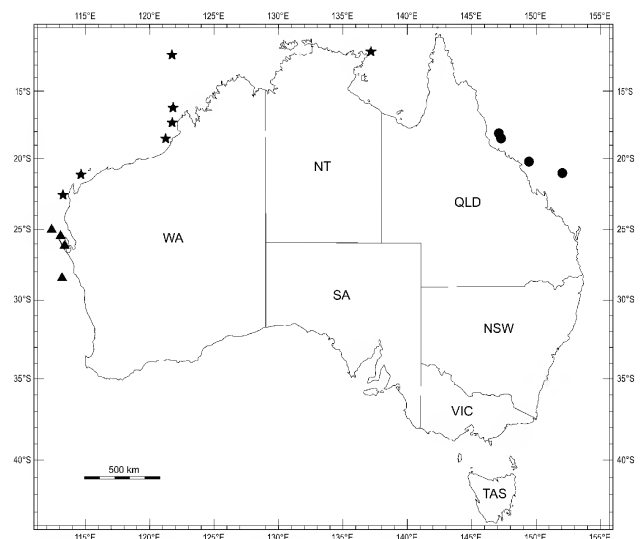
**Distribution.** Tropical western Pacific, from southern Japan southwards to the Philippines, Indonesia and northwestern to northeastern Australia, and eastwards to the Solomon Islands (as *Mimachlamys lentiginosa*; Raines & Poppe, 2006: 274); Japan to Australia, 3–25 m (as *M. lentiginosa*; Huber, 2010: 211); Philippines, intertidal zone to 90 m (Dijkstra, 2013: 96); Indonesia, intertidal zone (as *M. lentiginosa*; Dijkstra, 1991: 33); Papua New Guinea, 18–20 m, dead (as *M. lentiginosa*; Dijkstra, 1998a: 41). Maximum depth range of live-taken specimens is from the intertidal zone to 90 m. Present specimens from Australia alive in the intertidal zone to 38 m.

**Remarks.** The present specimens from Queensland and northern Australia are indistinguishable from the type material of *Mimachlamys punctata*. Juvenile specimens from Western Australia could easily be confused with *Mimachlamys funebris*. The two species have similar characters in early ontogeny, but are somewhat different in the adult stage (see Table 7). Moreover, the two species live in different habitats.

### *Mimachlamys sanguinea* (Linnaeus, 1758)

Figs 94, 95A,C, 96D

- Ostrea sanguinea* Linnaeus, 1758: 698, no. 167; Dijkstra, 1999: 413, figs 4A–B [lectotype]; Dijkstra, 2016: 116, fig. 19.  
*Ostrea senatoria* Gmelin, 1791: 3327, no. 61 (based on Chemnitz, 1784: 320, pl. 65, fig. 617).  
*Ostrea porphyrea* Gmelin, 1791: 3328, no. 65 (based on Chemnitz, 1784: 330, pl. 66, fig. 632).  
*Pecten aurantius* Lamarck, 1819: 175, no. 45.  
*Pecten florens* Lamarck, 1819: 175, no. 46.  
*Pecten indicus* Deshayes, 1832b: 410, pl. 3, fig. 5.  
*Pecten pseudolima* G. B. Sowerby II, 1842: 78, pl. 20, fig. 235.  
*Pecten layardi* Reeve, 1853: sp. 80, pl. 21, figs 80a–b.  
*Pecten fricatus* Reeve, 1853: sp. 161, pl. 34, fig. 161.  
*Pecten blandus* Reeve, 1853: sp. 162, pl. 34, figs 162a–b.  
*Pecten raffrayi* Jousseaume, 1886: 221, fig.  
*Mimachlamys ellochena* Iredale, 1939: 349, pl. 5, fig. 24.  
*Chlamys (Mimachlamys) asperrimoides* Powell, 1958: 70, pl. 11, figs 3–4, text-fig. 3.  
*Mimachlamys blanda* (Reeve).—Iredale & McMichael, 1962, p. 11.  
*Chlamys senatoria* (Gmelin).—Barnard, 1964: 430; Abbott & Dance, 1982: 309, fig; Dijkstra, 1990a: 9, 11; Dharma, 1992: 84, pl. 20, figs 3–3a; Oliver, 1992: 74, pl. 13, figs 1a–b.  
*Chlamys (Mimachlamys) senatoria* (Gmelin).—Springsteen & Leobrera, 1986: 329, pl. 93, fig. 19; Rombouts, 1991: 30 (in part), pl. 11, figs 6–6a; Dharma, 2005: 248, 364, pl. 99, figs 2a–d; pl. 147, fig. 2.  
*Mimachlamys senatoria* (Gmelin).—Dijkstra *et al.*, 1989: 24; Dijkstra, 1990: 6, figs; Dijkstra, 1991: 34; Lamprell & Whitehead, 1992: [24], pl. 10, fig. 56; Dijkstra, (1983–1994) 1993: 12, figs 1–5; Dijkstra & Marshall, 1997: 101,



**Figure 94.** Distribution of *Mimachlamys sanguinea* (Linnaeus) (circles), *M. scabricostata* (G. B. Sowerby III) (stars) and *M. spinicostata* sp. nov. (triangles).

pl. 9, figs 1–4; Dijkstra & Knudsen, 1998: 83, pl. 4, fig. 16; Dijkstra, 1998a: 42; Hayami, 2000: 903, pl. 448, fig. 24; Wang, 2002: 188; Xu & Zhang, 2008: 83, fig. 230.

*Mimachlamys asperrimoides* (Powell).—Lamprell & Whitehead, 1992: [24], pl. 10, fig. 57.

*Mimachlamys sanguinea* (Linnaeus).—Dijkstra & Kilburn, 2001: 305, figs 44–45; Raines & Poppe, 2006: 274–275, upper figs; pl. 221, figs 1–5; pl. 222, figs 1–5; pl. 223, figs 1–5; pl. 224, figs 1–8; Dijkstra & Marshall, 2008: 70, figs 55C, F, 58; Spencer *et al.*, 2009: 198; Huber, 2010: 211; Raines, 2010: 642, pl. 1012, figs 1–5; Dijkstra, 2013: 96, pl. 24, figs 2a–d, pl. 32, figs 4a–b.

**Note on synonymy.** Synonyms were established by Dijkstra & Marshall (1997: 101). For references cited by Linnaeus (1758: 698) see Dijkstra (1999: 413).

**Type data.** *Ostrea sanguinea* Linnaeus: lectotype (lv) LSL designated by Dijkstra (1999: 414), 3 paralectotypes (2 rv LSL, 1 lv MSNP). Type locality: “Habitat in *O. australiore*”. Restricted by Dijkstra (1999: 414) to the Maluku Archipelago [Moluccas], Indonesia.

*Ostrea senatoria* Gmelin: lectotype (pr) ZMUC BIV-45, designated by Dijkstra & Marshall (1997: 102). Type locality: “Oceano indico” [Indian Ocean].

*Ostrea porphyrea* Gmelin: lectotype (lv) ZMUC BIV-46, designated by Dijkstra & Marshall (1997: 102). Type locality: “Mari rubro” [Red Sea].

*Pecten aurantius* Lamarck: lectotype (pr) MNHN Moll21191, designated by Dijkstra (1994: 489). Type locality: “l’Océan indien?”

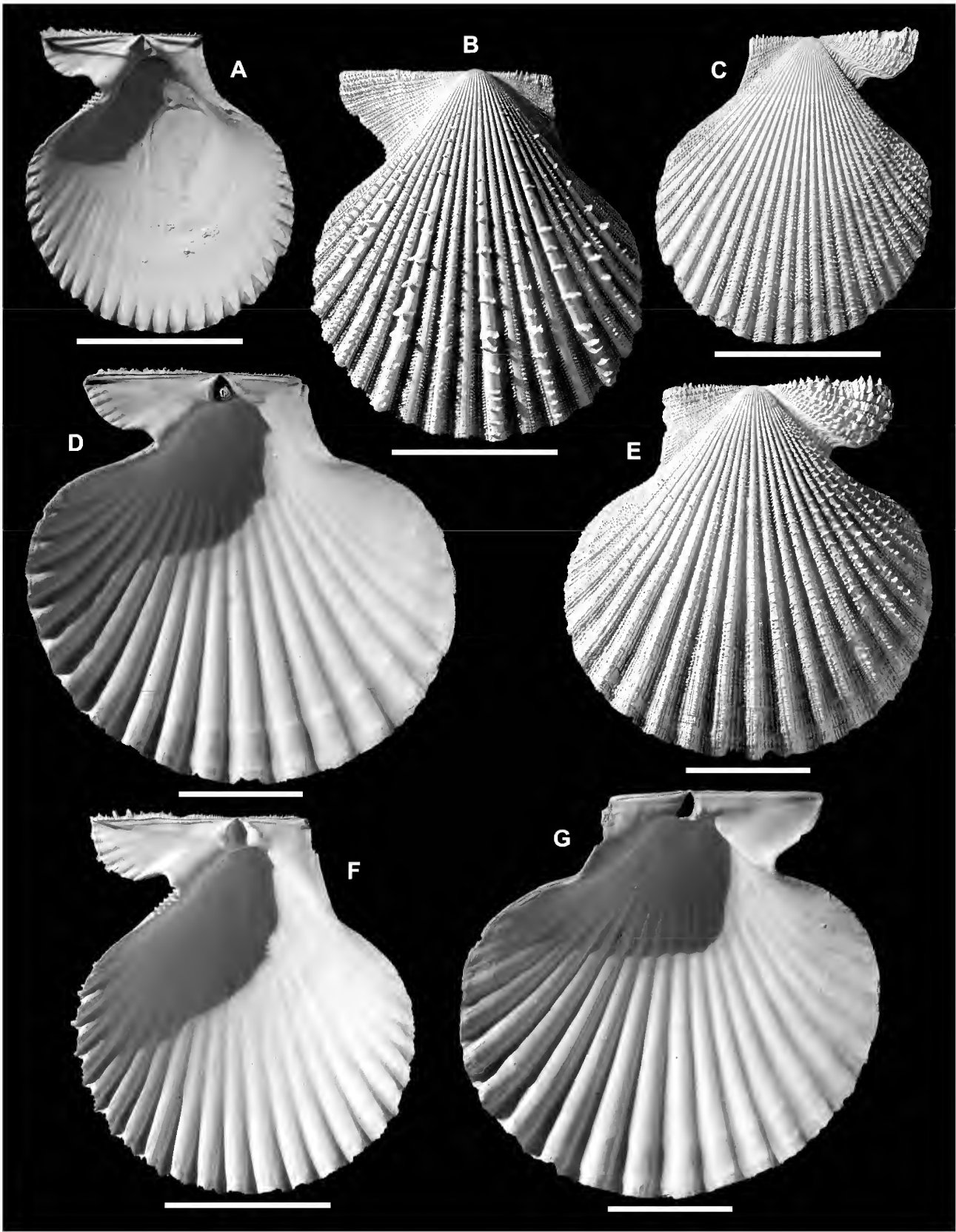
*Pecten florens* Lamarck: holotype (pr) MHNG1088/70. Type locality: “l’Océan indien?”

*Pecten indicus* Deshayes: type material not seen (repository unknown; not in MNHN or Université Lyon-1).

*Pecten pseudolima* Sowerby: three syntypes (pr) NHMUK 1950.11.14.54–56. Type locality: Philippine Islands, Bohol, Jacna.

*Pecten layardi* Reeve: six syntypes (pr) NHMUK1994.162. Type locality: “Ceylon” [Sri Lanka]; 3 syntypes (pr) ZMB Moll.114.611 (pr), 114.612 (2 pr), labelled “Ceylon/H. Cuming” (Dijkstra & Köhler, 2008: 37, fig. 2f).

*Pecten fricatus* Reeve: holotype (pr) NHMUK1994.161.



**Figure 95.** *A, C*, *Mimachlamys sanguinea* (Linnaeus), rv only, AM C.131702, 6–7 miles E of Keeper Reef, off Townsville, GBR, QLD, 43 m, rv interior (A), rv exterior (C). *B, F*, *Mimachlamys scabricostata* (G. B. Sowerby III), pair, AM C.303775, off Carnarvon, WA, 12–20 m; lv exterior (B), rv interior (F). *D, E, G*, *Mimachlamys spinicostata* sp. nov., 2 pairs; (D, G) holotype, AM C.073505, Shark Bay, WA, 26°07'S 113°25'E; rv interior (D), lv interior (G); (E) paratype, AM C.476729, in same sample as holotype; rv exterior (E). Scale bars represent 20 mm (A, C), 30 mm (B, D–G).

Type locality: Unknown.

*Pecten blandus* Reeve: five syntypes (pr) NHMUK 1950. 11.14.13–17. Type locality: Australia [Iredale & McMichael (1962: 11) stated that this was from “Port Jackson”, but this locality was not stated by Reeve].

*Pecten raffrayi* Jousseaume: holotype (pr) MNHN Moll21187. Type locality: Zanzibar.

*Mimachlamys ellochena* Iredale: holotype (rv) AM C.119511. Type locality: Australia, QLD, off Shaw Islands, Whitsunday Group, 37 m (Great Barrier Reef Expedition stn 17).

*Chlamys (Mimachlamys) asperrimoides* Powell: holotype (pr) AIM TM.1235. Type locality: South of Norfolk Island (Australia), 82–91 m, from cable.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: off Cardwell, 18°23.993'S 147°05.923'E, dead, 50 m (1 v, C.337118); off Townsville, 6–7 ml E of Keeper Reef, 18°45'S 147°23'E, dead, 43 m (5 v, C.131702); N of Mackay, off Shaw Island, 20°29'S 149°05'E, dead, 37 m (1 v, C.119511); Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, dead, 64–73 m (4 v, C.337121).—EGYPT: Red Sea, off Hurghada, alive, 15–20 m (5 pr, ZMA Moll.143590). DJIBOUTI: Gulf of Aden, alive, 15–30 m (5 pr, ZMA Moll.143591). ARABIAN GULF: Bahrain, Al Manamah, 26°12'N 50°38'E, dead, beach (1 v, C.121228). INDIA: off Madras, alive, 30–40 m (1 pr, ZMA Moll.148200). MASCARENE ISLANDS: Cargados Islands, 16°00'S 60°00'E, dead (6 v, C.119452). MOZAMBIQUE: off Bazaruto, alive, 20 m (3 pr, ZMA Moll.145863).—THAILAND: Andaman Sea, Ko Payang, alive, c. 25 m (2 pr, ZMA Moll.143666); S Phuket Island, between Cape Ca and Ko Bon, alive, 10–15 m (1 pr, ZMA Moll.142886).—CHINA: S China Sea, off Hainan, alive, 34 m (1 pr, ZMA Moll.139571).—PHILIPPINE ISLANDS: Cebu, off Bantayan, alive, 20–30 m (4 pr, ZMA Moll.144195); Davao, Samal Island, Matanos, alive, c. 30 m (9 pr, ZMA Moll.145526); Mindanao, Davao Gulf, Talikud Island, alive, 20–28 m (16 pr, ZMA Moll.144474).—INDONESIA: Moluccas, off Ambon, alive, 26 m (1 pr, ZMA Moll.142857); S Kalimantan, off Sampit, alive, c. 40 m (1 pr, ZMA Moll.143730); Kei Islands, alive, 30–34 m (4 pr, ZMA Moll.142892).—MALAYSIA: S of Singapore, alive, 55 m (1 pr, ZMA Moll.140095).—NEW CALEDONIA: Noumea, 22°16'S 166°27'E, dead (2 v, C.004334); Noumea, Magenta, Magenta Beach, 22°16'S 166°29'E, dead (5 v, C.080153); Noumea, Ile Ste. Marie, 22°18'S 166°29'E, dead (1 pr, C.363449). NORFOLK ISLAND: off Duncombe Bay, 29°0'S 167°56'E, dead, 31 m (many v, C.130122); Anson Bay, 29°01'S 167°55'E, dead (4 v, C.070473); 29°02'S 167°57'E, dead (18 v, C.059451); 1 v, C.059878). TASMAN SEA: Lord Howe Island, Point Howe, N tip, 28°59.8'S 167°55.3'E, alive, 12–15 m (2 v, C.363446; 2 pr, C.363447); NE side of Lord Howe Island, 31°51.7'S 159°08.3'E, dead, 27.5 m (1 v, C.160967); 29°02'S 167°57'E, alive, 91–107 m (2 pr, C.363448); Slaughter Bay, 29°03.9'S 167°56.7'E, dead (2 v, C.363445); Lord Howe Rise, 30°25.5'S 159°05.6'E, dead, 49–51 m (2 v, C.363439); 31°33'S 159°05'E, dead (5 v, C.363440); Lord Howe Rise, 31°34.9'S 159°0.3'E, alive, 73 m (5 v, C.363436); 31°37.1'S 159°13'E, dead, 51–55 m (3 v, C.363438); 31°38.2'S 159°03.6'E, dead, 44 m (4 v, C.363437). KERMADec ISLANDS (Dijkstra & Marshall, 2008: 70): off Raoul Island, 29°13.0'S 177°52.4'W, 610 m (1 v, NIWAK829); 29°13.1'S 177°53.5'W, 472 m (fragment, NIWA T225).

**Description.** Shell up to 105 mm high, most specimens smaller, to c. 70 mm, moderately inflated, left valve slightly more convex than right, circular to more dorsoventrally elongate, equivalve, almost equilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 85–90°; colour polychromatic, cream, yellowish, orange, reddish, brown, purple to violet, with pale radial streaks and mottles.

Both valves sculptured with 20–24 evenly spaced radial plicae with small, somewhat tripartite scales, each plica flanked by a secondary spinous radial riblet on each side. Antimarginal microsculpture in interspaces. Auricles with c. 10 delicate scaly radial riblets, c. 6 coarser ones on anterior auricle of right valve. Dorsal margin straight. Byssal notch moderately deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 5–7 teeth. Interior weakly furrowed to smooth, internal rib carinae prominent in narrow zone around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: QLD, GBR, 6–7 miles E of Keeper Reef, off Townsville, 43 m (AM C.131702), rv only: H 37.5, L 33.6 mm. Iredale (1939: 349) stated the dimensions of the holotype of *Mimachlamys ellochena* (rv) as H 33, L 30 mm.

**Habitat.** Living in the littoral to bathyal zones, most specimens byssally attached to corals or rocks or amongst coral rubble on soft sediment (sand or muddy sand).

**Distribution.** Throughout the (sub)tropical Indo-West Pacific, from southern Japan southwards to northeastern Australia, Kermadec Islands (Dijkstra & Marshall, 2008: 70), westwards into the Indian Ocean to northern South Africa, and eastwards to the central Pacific (not recorded from the Hawaiian Islands or French Polynesia) (Raines & Poppe, 2006: 274); Red Sea to the Philippines, 0–50 m (Huber, 2010: 211); Mozambique, intertidal one to 30 m, South Africa, 10–48 m (Dijkstra & Kilburn, 2001: 306); Red Sea, 9–55 m (as *Mimachlamys senatoria*; Dijkstra & Knudsen, 1998: 85); Philippines, 3–55 m (Raines, 2010: 642; Dijkstra, 2013: 97); Indonesia, 50–57 m (as *M. senatoria*; Dijkstra, 1991: 34); Papua New Guinea, 10–20 m (as *M. senatoria*; Dijkstra, 1998a: 42); Lord Howe Island, 57–85 m, Norfolk Island, 33–71 m, Kermadec Islands, 472–610 m, dead (as *M. senatoria*; Dijkstra & Marshall, 1997: 102–104). Maximum depth range of live-taken specimens is from the intertidal zone to 107 m. Present specimens from Queensland only dead at 37–73 m.

**Remarks.** Many names have been used in the literature for this highly polymorphic and polychromatic, widely distributed Indo-West Pacific species, and it has often been confused with other superficially similar congeneric species (Dijkstra & Marshall, 1997: 101; Dijkstra & Kilburn, 2001: 307). Shells are often covered with a variety of sponges (Dijkstra, 1993: 12). In contrast to other *Mimachlamys* species from Australia, this species is rare and not often found alive.

### *Mimachlamys scabricostata* (G. B. Sowerby III, 1915)

Figs 94, 95B,F, 96C,E

*Pecten (Chlamys) scabricostatus* G. B. Sowerby III, 1915: 168, pl. 10, fig. 14.

*Chlamys (Mimachlamys) scabricostata* (Sowerby).—Rombouts, 1991: 29, pl. 11, fig. 5.

*Mimachlamys scabricostata* (Sowerby).—Lamprell & Whitehead, 1992: [22], pl. 9, fig. 51; Slack-Smith & Bryce, 2004: 237; Raines & Poppe, 2006: 274, 275, lower figs; 277, upper fig; pl. 226, figs 1–7; Huber, 2010: 211.

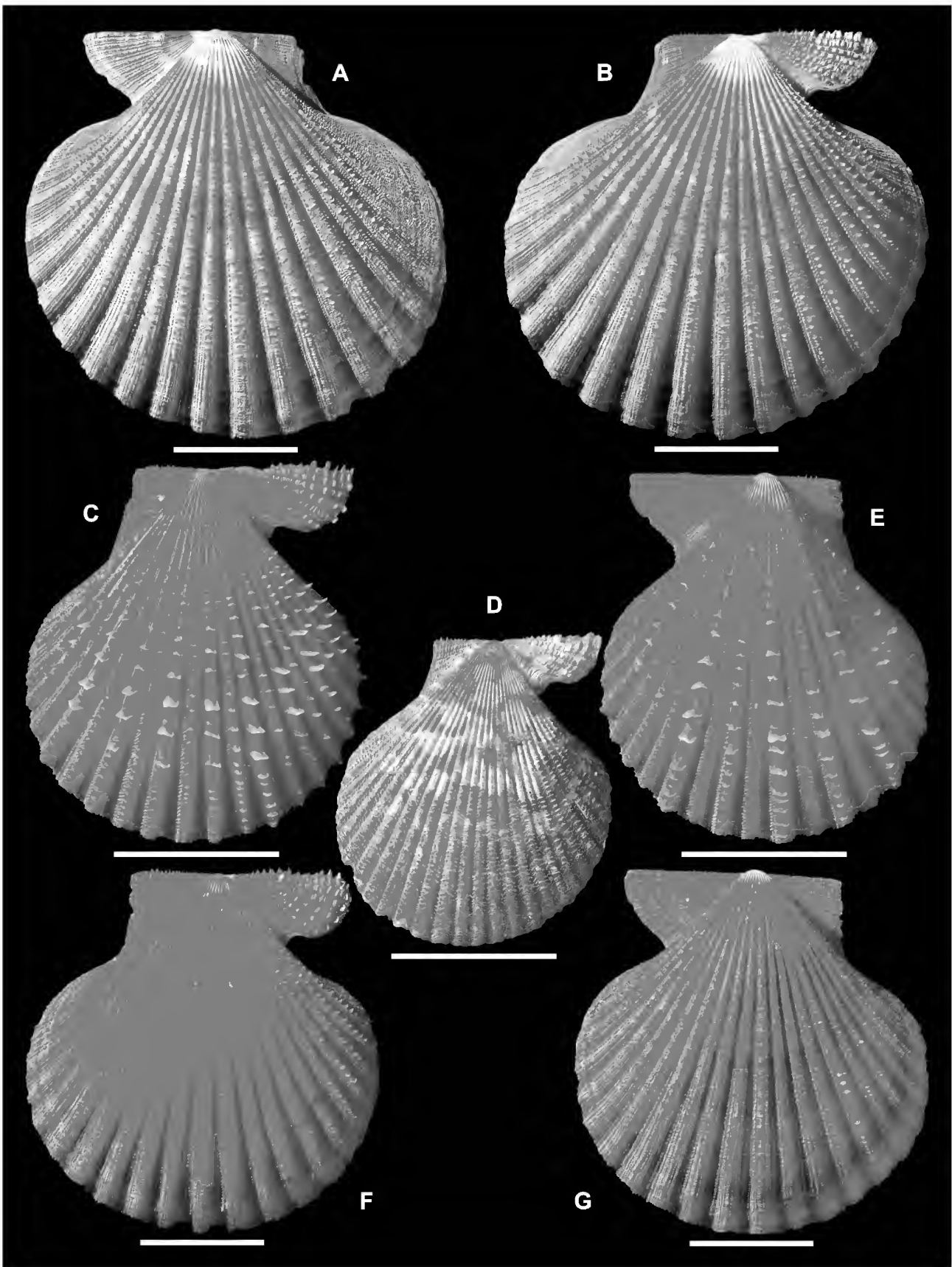
*Chlamys scabricostata* (Sowerby).—Wells, Slack-Smith & Bryce, 2000: 42.

**Type data.** *Pecten (Chlamys) scabricostatus* Sowerby: holotype (pr) NHMUK 1919.12.31.36. Type locality: Western Australia, “Swan River”.

**Comments on type data.** The type locality “Swan River” is incorrect. This species occur further north from c. 23–12°S along the northwestern coast of Western Australia to the Northern Territory.

**Additional material examined.**—AUSTRALIA: WESTERN AUSTRALIA: Cardabia, S of Point Cloates, 23°06'S 113°48'E, dead (2 v, C.119794); 17 ml S of Exmouth townside, Exmouth Gulf, 22°13'S 114°06'E, dead (1 v, C.357965); Onslow Beach, 21°38'S 115°07'E, alive, beach washed after cyclone (1 pr, C.094525); Onslow area, 21°38'S 115°07'E, dead (10 v, C.357943); Long Island, W of Onslow, 21°37'S 114°40'E, dead (2 v, C.069340); 40 mls S of Dampier, 21°0'S 116°06'E, dead (1 v, C.086110); Port Hedland, 20°18'S 118°35'E, dead (2 v, C.094524); 38 n.miles N of Port Walcott, 19°59'S 117°16'E, dead, 50 m (2 v, WAM S12806); Eighty (= Ninety) Mile Beach, near Wallal Downs, 19°47'S 120°38'E, dead (3 v, C.069400); Eighty Mile Beach, 19°30'S 121°09'E, dead (4 v, C.094523); off Eighty Mile Beach, 19°20'S 121°13'E, alive, 9–22 m (3 pr, C.132002); off Eighty Mile Beach, 19°33.3'S 121°21.7'E,





**Figure 96.** *A, B, F, G*, *Mimachlamys spincostata* sp. nov., 2 pairs; (*A, B*) holotype, specimen in Fig. 95D, G; lv exterior (*A*), rv exterior (*B*); (*F, G*), paratype, specimen in Figs 95E, 100E; rv exterior (*F*), lv exterior (*G*). *C, E*, *Mimachlamys scabricostata* (G. B. Sowerby III), specimen in Fig. 95B, F; rv exterior (*C*), lv exterior (*E*). *D*, *Mimachlamys sanguinea* (Linnaeus), specimen in Fig. 95A, C; rv exterior. Scale bars represent 30 mm (*A–C, E–G*), 20 mm (*D*).

alive, 26 m (1 pr, C.160998), off Eighty Mile Beach, 19°20'S 121°13'E, Pearlring ground, alive (2 pr, C.121269); Eighty Mile Beach, Anna Plains Homestead, 19°15'S 121°24'E, dead, beach (7 v, C.132000); Eighty Mile Beach, between Anna Plains & Nalgi, 19°15'S 121°24'E, dead (1 v, C.081191); Eighty Mile Beach, near N end, 19°07'S 121°29'E, dead (1 v, C.057133); 80 n.mil NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (many v [atypical], C.146776); Broome, Entrance Point, 18°01'S 122°12'E, dead (1 v, C.094521); Broome, 17°58'S 122°14'E, alive, 16 m (1 pr, C.119789); Broome, 17°58'S 122°14'E, alive (1 v, C.357974; 2 v, C.094519; 1 pr, C.103816); Broome, Roebuck Bay, 17°58'S 122°14'E, alive (1 pr, C.132001); Broome, Cable Beach, 17°56'S 122°12'E, dead (4 v, C.078074); off Lacepede Islands, 16°58'S 122°08'E, alive, deep water (2 pr [1 pr with prominent lamellae on plicae], C.119461); Beagle Bay, 16°56'S 122°32'E, dead, beach (24 v, C.094518); Lacepede Islands, West Island, 16°51'S 122°06'E, dead (1 v, C.094520); King Sound, 16°50'S 123°30'E, alive (1 pr, C.097512). **NORTHERN TERRITORY:** off Darwin, 12°04'S 123°50'E, dead, 132 m (2 v, C.357619); Gove Peninsula, Nhulunbuy town beach, 12°11'S 136°47'E, dead (1 v, C.132631).

**Description.** Shell up to 86 mm high (Huber, 2010), most specimens smaller, to c. 50 mm; moderately inflated, left valve slightly more convex than right, inequivalve, inequilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 90°; colour polychromatic.

Both valves sculptured with c. 20 almost evenly spaced, strongly squamous, rounded radial plicae, variable in prominence; the most prominent plicae (5–7 on most specimens) bear strongly developed spathulate lamellae; other plicae much weaker, bearing delicate subdivided scales. Auricles delicately sculptured with numerous, closely spaced, spinous radial riblets; anterior auricle of right valve with 5–7 squamous radial costae. Byssal notch deep, byssal fasciole moderately broad. Functional ctenolium well-developed, with c. 6 teeth. Interior weakly furrowed, internal rib carinae prominent in narrow zone around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: WA, off Carnarvon, 12–20 m (AM C.303775): rv; H 67.7, L 61.1 mm; lv: H 66.3, L 60.1 mm; D 24.2 mm.

**Habitat.** Living in the littoral zone, byssally attached to the undersides of slabs on intertidal reef flats at extremely low tide, or amongst sea grass (*Zostera*), or amongst rubble on soft sediment (sand and/or mud). Living specimens are covered with a very thick brown sponge (30–50 mm thick on each valve) (pers. comm. H. Morrison, 2000).

**Distribution.** More common from Western Australia (Cardabia to King Sound) than from the Northern Territory (off Darwin). Living specimens are not known from the Northern Territory, and we have not seen specimens from Queensland. Present specimens alive at 9–26 m.

**Remarks.** This species is morphologically close to *Mimachlamys spinicostata* sp. nov. from Shark Bay, Western Australia (formerly erroneously identified as *Pecten australis*), but differs in size (*M. scabricostata* up to c. 80 mm in height, *M. spinicostata* c. 120 mm), and in macrosculpture. *Mimachlamys scabricostata* has strongly developed spathulate lamellae on c. 5 slightly elevated primary radial plicae, whereas the spathulate lamellae are lacking on *M. spinicostata*. Moreover, the delicate secondary spinous radial sculpture is much better developed in *Mimachlamys spinicostata* than in *M. scabricostata*, in which it is almost lacking in the early growth stage and weak in the late growth stage of most specimens. Other characters such as shape, convexity and colour are indistinguishable.

It is possible that *Mimachlamys spinicostata* is a southern ecomorph of the present species; this requires molecular comparisons to resolve. For comparison with *Mimachlamys asperrima* see Beu & Darragh (2001: 145).

## *Mimachlamys spinicostata* sp. nov.

Figs 94, 95D–E, G, 96A–B, F–G, 100E

*Mimachlamys australis* (Sowerby).—Cotton, 1961: 105, fig. 91; Lamprell & Whitehead, 1992: [22], pl. 9, fig. 55; Slack-Smith & Bryce, 2004: 237 (as *Mimachlamys ? australis*) [misidentification as *Pecten australis* G. B. Sowerby II, 1842, = *Mimachlamys asperrima* (Lamarck, 1819)].

*Chlamys australis* (Sowerby).—Abbott & Dance, 1982: 309, fig.; Wells & Bryce, 1985: 158, pl. 60, fig. 583; Wells, Slack-Smith & Bryce, 2000: 42 (misidentification).

*Chlamys (Mimachlamys) australis* (Sowerby).—Rombouts, 1991: 27, pl. 10, fig. 4, pl. 28, figs 6–6a (misidentification).

*Mimachlamys* sp. nov.?. Beu & Darragh, 2001: 145, figs 52A, E.

**Holotype** (pr) AM C.073505, Western Australia, Shark Bay, 26°07'S 113°25'E, leg. Mrs B. M. Bannear. **Paratypes** (17) (pr + v) in AM, WAM and ZMA: 1 (pr), same lot as holotype, AM C.476729, illustrated; 2 (pr), Eastern group of Abrolhos Islands, Middle Channel, alive, WAM S13892; 3 (pr + v), AM C.097574; 2 (v) Shark Bay, Dirk Hartog Island, 25°45'S 113°03'E, dead, AM C.094526; 4 (pr), Shark Bay, 25°37'S 113°14'E, alive, 16.7–16.8 m, WAM S13893–96; 5 (pr), Shark Bay, 20 m, alive on muddy sand, ZMA Moll.409008.

**Additional material examined.** WESTERN AUSTRALIA: Rottnest Shelf, 25°17.96'S 112°59.13'E, dead, 100 m (2 v, WAM S12527); Abrolhos Islands, dead (1 v, WAM S12556); Abrolhos Islands, outside Wallabi Group, 28°25'S 113°33'E, dead (1 pr, C.094528).

**Description.** Shell up to c. 120 mm high, most specimens smaller, to c. 90 mm; moderately inflated, almost equally convex, equivalve, slightly inequilateral, anterior auricles much larger and longer than posterior ones, umbonal angle c. 90°; uniform orange, red, yellow, purple, brown, some specimens with pale maculations in early growth stage.

Both valves sculptured with c. 20 almost evenly spaced, delicately squamous, rounded primary radial plicae, almost equal in prominence; each plica flanked by a secondary spinous riblet, subdivided in late growth stage; 3–4 further narrow secondary spinous riblets in radial interspaces. Auricles delicately sculptured with numerous, closely spaced, spinous radial riblets; anterior auricle of right valve with c. 5 squamous radial costae. Interior more deeply furrowed than in all similar species, but internal rib carinae weak, short, present only around ventral margin. Byssal notch deep, byssal fasciole moderately broad. Functional ctenolium well-developed, with c. 6 teeth. Resilial and dorsal teeth moderately prominent. Covered with sponges in life.

**Dimensions.** Illustrated specimens: holotype, AM C.073505, rv: H 98.8, L 103.5 mm; lv: H 99.6, L 102.7 mm; D 38.0 mm; paratype, AM C.476729, rv: H 88.7, L 86.3 mm; lv: H 87.9, L 86.2, D 35.1 mm.

**Discussion.** *Mimachlamys spinicostata* sp. nov. has generally been known in the literature as *Mimachlamys australis* (Sowerby) (Cotton, 1961; Lamprell & Whitehead, 1992) or *Chlamys australis* (Abbott & Dance, 1982; Wells & Bryce, 1985; Rombouts, 1991), but Beu & Darragh (2001: 145), following the advice of T. R. Waller, correctly placed *P. australis* for the first time in the synonymy of *Mimachlamys asperrima* (Lamarck, 1819), although with a query. The type material of both species is indeed indistinguishable. Beu & Darragh (2001) compared *Mimachlamys spinicostata* sp. nov. only with the temperate Australian species *M.*

**Table 8.** Characters distinguishing the larger *Mimachlamys* species occurring in Australia: *Mimachlamys asperrima* (Lamarck), *M. gloriosa* (Reeve), *M. scabricostata* (G. B. Sowerby III) and *M. spinicostata* sp. nov.

characters	<i>Mimachlamys asperrima</i>	<i>Mimachlamys gloriosa</i>	<i>Mimachlamys scabricostata</i>	<i>Mimachlamys spinicostata</i> sp. nov.
size	c. 100 mm high	c. 120 mm high	c. 80 mm high	c. 120 mm high
shape	elongate to nearly circular	elongate to nearly circular	elongate	elongate to nearly circular
convexity	moderately inflated, lv slightly more convex than rv	moderately inflated, equally convex	moderately inflated, equally convex	moderately inflated, equally convex
shell thickness	thin to moderately solid	solid	solid	solid
anterior auricle lv	fine radial sculpture	slightly coarser radial sculpture	fine radial sculpture	fine radial sculpture
anterior auricle rv	fine radial sculpture	coarse radial sculpture	coarse radial sculpture	coarse radial sculpture
macrosculpture lv	22–24 radial ribs, rounded to angular	20–22 radial ribs, rounded	20 radial ribs, rounded throughout	20 radial ribs, rounded
rib sculpture	closely spaced fine spinose throughout	widely spaced lamellae	widely spaced lamellae (c. 5 ribs) and closely spaced fine spinose	closely spaced fine spinose throughout
secondary riblets	strongly developed	weakly developed	weakly developed	strongly developed
colour	polychromatic	polychromatic	polychromatic	more monochromatic

*asperrima*, but not with two closely related tropical congeneric species that are not recorded as fossils: *M. scabricostata* from the northwestern region of Australia and the more widely distributed species *Mimachlamys gloriosa* (Reeve, 1853) from the northeastern region of Australia and the Indo-West Pacific. Characters distinguishing these species are listed in Table 8.

**Habitat.** Living in the littoral to sublittoral zones on soft bottoms.

**Distribution.** Mainly from Shark Bay, Western Australia, southwards to the Abrolhos Islands. Present specimens alive at 16.7–20 m.

**Etymology.** The specific epithet (Latin, “spiniger”—spinous; “costatus”—with ribs; adjective) refers to the delicate spinous sculpture on the ribs of this species.

### *Minnivola* Iredale, 1939

*Minnivola* Iredale, 1939: 363. Type species (by original designation): *Minnivola isomeres* Iredale, 1939 (= *Ostrea pyxidata* Born, 1778); Recent, Queensland.

**Diagnosis.** Moderate-sized Mimachlamyidini with a somewhat concave left valve and convex right valve, mimicking the appearance of *Pecten*; semi-circular, with auricles slightly unequal in size, byssal notch moderately deep, functional tcnolium present, radial macrosculpture present, shallowly pitted microsculpture on pre-radial area of left valve, reticulate “pseudo-shagreen” microsculpture on left valve at least in early ontogeny, weak commarginal microsculpture on right valve, and on left valve in late ontogeny. Internal rib carinae moderately prominent around ventral margin. Hinge teeth weak.

**Distribution.** Miocene–Recent (Hayami, 1989: 16). Indo-West Pacific, living in the littoral zone on soft sediment.

**Discussion.** Hertlein (1969: N371) placed *Minnivola* in the *Pecten* (*Patinopecten*) subgroup, merely based on the reticulate microsculpture of the left valve. Other morphological characters are similar to those of *Pecten*, although it is now clear that this is another confusing convergence resulting from similarity in life habit rather than from close phylogenetic relationship. *Patinopecten* is currently placed in Pedinae, tribe Fortipectinini (see Kafanov, 1986; Waller, 1991, 2006a).

The molecular phylogeny by Mahidol *et al.* (2007: fig. 3) placed *Minnivola* in the same clade as several *Mimachlamys* species. T. R. Waller (USNM, pers. comm. 1 July 2017) has advised us that both *Minnivola* and *Volachlamys* species have a shallowly pitted pre-radial area on the left valve, as in *Mimachlamys*. They also share a unique form of “pseudo-shagreen” microsculpture, in which the individual cells are not closed over the outer surface to form a secondary shell surface, as occurs in true shagreen microsculpture in Pedini. In both *Minnivola* and *Volachlamys*, the internal rib carinae are weaker than in *Mimachlamys* species, suggesting that they occupy a primitive position in Mimachlamyidini. A position within Mimachlamyidini was also suggested for *Volachlamys* by the molecular phylogeny of Matsumoto (2003: fig. 2) and is clearly implied by the molecular phylogeny of Feng *et al.* (2011: figs 1–3). T. R. Waller has therefore concluded that both *Minnivola* and *Volachlamys*

likely belong in *Mimachlamydingi*, and we follow his opinion here. We have not rearranged the plates to follow this conclusion.

### *Minnivola pyxidata* (Born, 1778)

Figs 53F,H, 55A,C,F,I, 97

*Ostrea pyxidata* Born, 1778: 93; Born, 1780: 108, pl. 6, figs 5–6; Dijkstra, 2009: 113, figs 47–50 [figured syntype NHMW14110].

*Ostrea sulcata* Gmelin, 1791: 3325 (junior primary homonym of *O. sulcata* of Müller, 1776, and of Born, 1778).

*Pecten pyxidatus* (Born).—G. B. Sowerby II, 1842: 49, pl. 12, figs 24–25; Chenu, 1843: 3, pl. 9, figs 6–6d [1844, as *P. pixidatus* Sowerby]; Reeve, 1853: sp. 96, pl. 24, figs 96a–b; Küster & Kobelt, 1888: 57, pl. 15, figs 5–6, pl. 35, figs 1–2; Crosse & Fischer, 1892: 75; Lynge, 1909: 153; Dautzenberg & Bavay, 1912: 3; Abbott & Dance, 1982: 304, fig.; Bernard *et al.*, 1993: 52; Wang, 2002: 236, pl. 3, fig. 2; Xu & Zhang, 2008: 91, fig. 258.

*Pecten crebricostatus* Philippi, 1845: 100, pl. 1, fig. 2.

*Pecten (Vola) crebricostatus* (Philippi).—Küster & Kobelt, 1888: 264, pl. 70, figs 1–2.

*Pecten (Pecten) pyxidatus* (Born).—Oostingh, 1935: 150.

*Minnivola isomeres* Iredale, 1939: 364; Lamprell & Whitehead, 1992: [32], pl. 14, fig. 84; Raines & Poppe, 2006: 172, 173, upper figs; pl. 120, figs 2–3.

*Pecten isomeres* (Iredale).—Coleman, 1982: 223, pl. 628.

*Pecten (Minnivola) pyxidatus* (Born).—Springsteen & Leobrera, 1986: 326, pl. 93, fig. 2; Wang, 1989: 180, figs 5.1–2; Dijkstra, 1990: 9, 12; Rombouts, 1991: 53, pl. 20, fig. 2; Dharma, 2005: 250, pl. 100, figs 14a–c.

*Pecten pyxidata* [sic] (Born).—Dharma, 1992: 84, pl. 20, fig. 17.

*Minnivola pyxidata* (Born).—Lamprell & Whitehead, 1992: [32], pl. 14, fig. 85; Dijkstra, 1998a: 26; Hayami, 2000: 909, pl. 452, fig. 54; Subba Rao & Dey, 2000: 228; Swennen *et al.*, 2001: 74, fig. 073; Raines & Poppe, 2006, p. 172–173, lower figs; pl. 120, figs 1, 4–7; pl. 121, figs 1–7; Huber, 2010: 195; Raines, 2010: 616, pl. 999, figs 1–3.

*Minnivola pyxidatus* [sic] (Born).—Morton, 1996: 735–760, pl. 1, figs 1–22.

**Comments on synonymy.** Gmelin's (1791) description of *Ostrea sulcata* is based upon Born's (1780) reference to *Ostrea pyxidata*: “v. Born mus. Caes. Vind. test. t. 6, f. 5, 6” and is therefore an objective junior synonym of the present species.

Philippi (1845) described a new pectinid species from China, *Pecten crebricostatus*, which is identical to *M. pyxidata* in all characters and we regard it as a subjective junior synonym.

Iredale (1939) introduced a new pectinid species, *Minnivola isomeres*, from Queensland and placed it in the new genus *Minnivola*. However, this species is only a local morph (see remarks) and we regard it as another subjective junior synonym of *M. pyxidata*.

**Type material.** *Ostrea pyxidata* Born: syntype (pr) NHMW14110, figured in Born (1780: pl. 6 figs 5–6), refigured in Dijkstra (2009: 107, figs 47–50). Type locality: Not indicated (Born, 1778), “Patria ignota” (Born, 1780). Unknown.

*Ostrea sulcata* Gmelin: lectotype (pr) NHMW14106, probably figured by Born (1780, pl. 6, figs 5–6), also figured by Dijkstra (2009: 102, figs 5–8), designated by Dijkstra (2009: 104). Type locality: Not indicated (Born, 1778), “Patria ignota” (Born, 1780). Unknown.

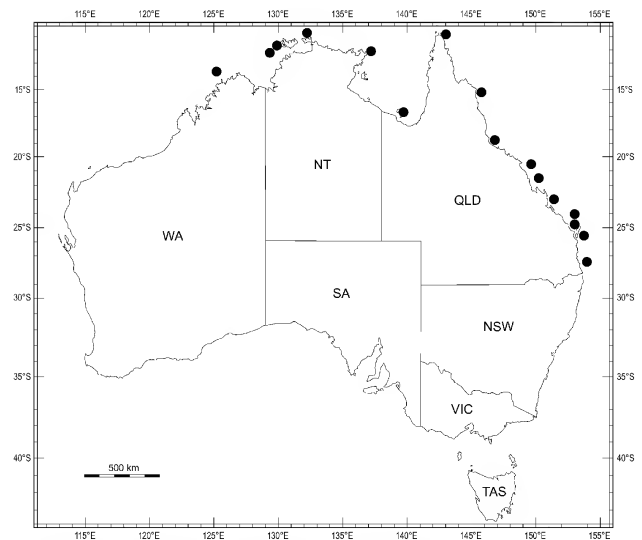


Figure 97. Distribution of *Minnivola pyxidata* (Born).

*Pecten crebricostatus* Philippi: type material not seen, probably in National Museum of Natural History, Santiago de Chile (G. Pastorino, National Museum of Natural History, Buenos Aires, pers. comm.), not available for examination at present. Type locality: China.

*Minnivola isomeres* Iredale: holotype (pr) AM C.047392 (Fig. 55C, I). Type locality: QLD, GBR, Bunker Group, Lady Elliot Island, 24°07'S 152°42'E, alive.

**Additional material examined.**—AUSTRALIA: QUEENSLAND: Gulf of Carpentaria, alive (4 pr, QM MO33656); SW Gulf of Carpentaria, 15°18'S 136°39'E, dead, 21 m (1 v, C.375430); Gulf of Carpentaria, S of Sweets Island, 17°06'S 139°37'E, dead, 9–22 m (10 v, C.375428); Gulf of Carpentaria, 28 ml S of Sweets Island, 17°06'S 139°37'E, alive (5 v, C.375429); Gulf of Carpentaria, 10 ml SW of Mapoon, 12°05'S 141°40'E, dead, 18 m (4 v, C.014077); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, alive, 7–26 m (9 v, C.036132); Torres Strait, Gannet Passage, NNE of Booby Island, 10°36'S 141°55'E, dead, 11 m (1 v, C.375426); GBR, off Cape Tribulation, 16°10'S 145°28'E, dead, 0–15 m (1 v, C.375423); Low Isles, 16°23'S 145°34'E, dead, 16–22 m (3 v, C.336919); off Cairns, 16°51.6'–16°51'S 146°01.2'–146°04'E, dead, 33–35 m (1 v, C.375420); Townsville, off Horseshoe Bay, Magnetic Island, 19°07'S 146°51'E, dead, 5.5–9 m (1 v, C.375422); off Bowen, 19°44'S 148°14'E, dead, 40 m (1 v, C.375418); GBR, E of Bowen, 19°45.7'S 148°19'E, dead, 46 m (1 v, C.375419); W of Hayman Island, 20°03'S 148°50'E, dead, 33 m (many v, C.375416); Whitsunday Passage, 20°13.5'S 148°47.5'E, dead, 24 m (11 v, C.375417); GBR, Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, alive (9 v, C.058938); Whitsunday Passage, 20°32.3'S 149°01.4'E, dead, 27 m (many v, C.375413); GBR, E of Mackay, 20°52'S 149°29'E, dead, 35 m (1 v, C.375415); Seaforth, N of Mackay, 20°54'S 148°58'E, dead (4 v, C.375414); GBR, E of Sarina, 21°27.5'S 150°08'E, alive, 42 m (4 pr + many v, C.119594); GBR, E of Sarina, 21°28'S 150°08.5'E, dead, 40 m (many v, C.375411); GBR, SE of Sarina, 21°47'S 150°34'E, alive, 59 m (10 v, C.375410); GBR, E of Broad Sound, 21°58.5'S 150°45'E, dead, 57 m (many v, C.375406); GBR, off Broad Sound, 22°06'S 150°49'E, dead, 53 m (10 v, C.375407); off Yeppoon, 22°40'S 151°16'E, dead, 58 m (1 v, C.375408); Keppel Bay, W of North Keppel Island, 23°04'S 150°53'E, dead, 3.5 m (1 v, C.375405); Keppel Bay, Yeppoon, 23°08'S 150°44'E, dead (6 v, C.130054); Keppel Bay, 23°25'S 150°55'E, dead (2 v, C.075254; 9 v, C.130053; 2 v, C.132207; 5 v, C.375465); Port Curtis, Rat Island, 23°46'S 151°19'E, dead (1 v, C.021828); Tannum Sands, S of Gladstone, 23°57'S 151°22'E, dead (1 v, C.375464); GBR, Bunker Group, Lady Elliot Island, 24°07'S 152°42'E, alive (holotype of *M. isomeres*, C.047392); off Burnett Heads, 24°46'S 152°25'E, alive, 30 m (1 pr, C.097547); Bargara, 24°49'S 152°28'E, dead (many v, C.130055); Hervey Bay, 25°06'S 152°49'E, alive (2 pr, C.102337); Hervey Bay, off Picnic Point, 25°06'S 152°49'E, alive, 9–12 m (4 pr, C.102329); off Fraser Island, 25°09.6'S 153°34'E, dead, 48 m (1 v, C.375461); Hervey Bay, Point Vernon, 25°15'S 152°49'E, dead (1 v, C.132208); Hervey Bay, near Urangan, 25°17'S 152°54'E, alive (2 pr, C.130056); Hervey Bay, Dundowran, 25°18'S 152°46'E, alive (2 pr, C.375402; 1 v, C.375463); Hervey Bay, Dundowran Beach, 25°18'S 152°46'E, alive (2 pr, C.097548; 5 v, C.375462); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (6 pr, C.097546); Moreton Bay, off Redcliffe Beach, 27°14'S 153°07'E, dead (1 pr, C.303796); Moreton Bay, Green Island, 27°26'S 153°14'E, dead (2 v, C.375459); Moreton Bay, off Peel Island, 27°30'S 153°21'E, dead, 9–11 m (19 v, C.375460); Moreton Bay, off Dunwich, Stradbroke Island, 27°30'S 153°24'E, dead, 5–7 m (10 v, C.375458); Moreton Bay, Peel Island, off SW side, 27°31'S 153°21'E, dead (1 pr, NTM P003278); WESTERN AUSTRALIA: SE corner of Cassini Island, 13°57'S 125°38'E, 40–45 m, dredged alive (1 pr, HM). NORTHERN TERRITORY: 8 km N of Cape Ford, Anson Bay, SW of Darwin, 13°19.14'S 129°56.28'E, dead, 29 m (1 pr, NTM P003278); 7 n.mls NE of Cape Ford, Anson Bay, SW of Darwin, 13°22.08'S 129°58.98'E, dead, 23 m (2 pr, NTM

P003232); 12 km W of Daley River mouth, Anson Bay, SW of Darwin, 12°19.14'S 129°59.16'E, alive, 31 m (1 pr, NTM P003289); Bathurst Island, 12°01'S 130°08'E, alive, 51 m (1 pr, WAM446); Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (10 v, C.375466); Darwin, 32 km off Point Charles, 12°10'S 130°22'E, dead (4 v, C.375467); Buchanan Island, S side of Melville Island, 11°49'S 130°39'E, dead (1 v, C.375468); W of Gunn Point, N of Darwin Harbour, 12°10.02'S 130°49.86'E, dead, 27 m (2 v, NTM P005396 [in part]); N of Lee Point, WSW of Gunn Point, NNE of Darwin Harbour, 12°13.02'S 130°50.04'E, dead, 22 m (2 v, NTM P004715); Shoal Bay, N of Lee Point, NNE of Darwin Harbour, 12°13.02'S 130°52.92'E, dead, 19 m (2 v, NTM P004774); Casuarina Beach, Darwin, adjacent to outlet of Sandy Creek, 12°21'S 130°53.3'E, on mid- and high-tidal drift lines, dead (1 v, NTM P011454); E of Darwin, Gunn Point Public Beach, 12°11.0'S 131°0'E, beach drift, dead (2 v, NTM P000132; 1 v, NTM P000440; 1 v, NTM P010150); Arafura Sea, c. 95 ml N of Cobourg Peninsula, 9°45'S 132°04'E, dead, 108 m (1 v, C.375470); Eastern Arnhem Land, Gove Harbour, off Drimmie Head, 12°13.746'S 136°41.317'E, dead, 14.5 m (1 v, NTM P012235); Gove Peninsula, Nhulunbuy town beach, 12°18.3'S 136°78.3'E, alive (1 pr, C.375471); Arafura Sea, 67 km NE of Croker Island, 10°36'S 132°56.5'E, dead, 62 m (2 v, C.375469). —CHINA: Kwangtung, alive, 24 m (3 pr, ZMA Moll.144257). TAIWAN: off SW coast, alive, 73 m (4 pr, ZMA Moll.140567). —PHILIPPINE ISLANDS: Sulu Sea, Siasi, off Laminusa, alive, 25–40 m (5 pr, ZMA Moll.144189); off Cebu, alive, 30–40 m (1 pr, ZMA Moll.146564). —MALAYSIA: Malacca Strait, alive, 46 m (10 pr, ZMA Moll.141278). —INDONESIA: N Sumatra, N of Tanjung Balai, alive, 36 m (4 pr, ZMA Moll.143733). —THAILAND: Siam Gulf, alive, 16 m (1 pr, ZMA Moll.143679); Andaman Sea, off Phuket Island, alive, 10–35 m (1 pr, ZMA Moll.142729); Kantang, Khor Libong, alive, 10–20 m (8 pr, ZMA Moll.143672). BURMA: Bay of Bengal, off Sandoway, alive, 35 m (1 pr, ZMA Moll.145585). INDIA: off Madras (Chennai), alive, 25–40 m (5 pr, ZMA Moll.140986).

**Description.** Shell up to c. 50 mm high, subcircular, rather thin, inequivalve, almost equilateral, left valve weakly concave, right valve strongly inflated, auricles almost equal in size, unequal in shape, umbonal angle c. 115°. Left valve of most specimens brownish with radially arranged pale dots of different sizes, right valve paler or whitish (see also Morton, 1996: 737, pl. 1).

Both valves sculptured with c. 20–30 weak radial plicae, each plica narrower than one interspace on left valve, each plica wider than one interspace on right valve. Left valve with reticulate (squamiformous) “pseudo-shagreen” microsculpture in radial interspaces early in ontogeny, interstitial sculpture commarginal late in ontogeny; interstitial sculpture weak or lacking on right valve. Auricles each with 4–8 delicate radial riblets. Interior weakly furrowed to almost smooth, internal rib carinae prominent in narrow zone around ventral margin. Hinge teeth weak. Byssal notch deep, functional ctenolium well-developed in adults.

**Dimensions.** Illustrated specimens: QLD, Hervey Bay, S of Woody Island, 9 m (AM C.097546): rv: H 32.1, L 34.5 mm; lv: H 30.9, L 33.8 mm; D 10.8 mm. Iredale (1939: 364) stated the dimensions of the holotype of *Minnivola isomeres* as H 29, L 32, D 10 mm.

**Habitat.** Living free, shallowly recessing (not byssally attached to substrate) from the littoral zone to 100 m on the continental shelf, on soft sediment (sand and/or mud). In this genus, the deep byssal notch and functional ctenolium of adults evidently reflects Miocene evolution from a *Mimachlamys*-like ancestor and retention of ancestral characters.

**Distribution.** Sumatra, offshore (Dharma, 1992: 84); Indian Ocean, Philippine Islands, South China Sea, Hong Kong, Hainan, Taiwan and Fujian, 5–100 m (Bernard *et al.*, 1993: 52); Gulf of Thailand, 12–20 m (Swennen *et al.*, 2001: 74); Queensland and New South Wales, to 10 m (Lamprell & Whitehead, 1992: 32; as *Minnivola isomeres*). Maximum depth range of live-taken specimens is c. 5–100 m, occurs generally in shallow waters. Although Lamprell & Whitehead (1992) recorded New South Wales as the southern limit of distribution, we have not seen material from this area. Now also known from the Northern Territory. Present material from Australia alive at 7–59 m.

**Remarks.** The Queensland morph (*Minnivola isomeres*) differs somewhat from typical specimens in having a smaller and more fragile shell, and is generally uniform in colour (brownish, purplish, whitish or cream). However, typical colour variations are also observed in Queensland. Radial macrosculpture and intercostal microsculpture are highly variable in both typical and local morphs.

For biology and functional morphology see Morton (1996: 735–760).

## *Volachlamys* Iredale, 1939

*Volachlamys* Iredale, 1939: 356. Type species (by original designation): *Pecten cumingii* Reeve, 1853 (= *Pecten singaporinus* G. B. Sowerby II, 1842); Recent, Queensland.

**Diagnosis.** Medium-sized Mimachlamyidini with circular shape in late ontogeny, valves relatively flattened; macrosculpture of evenly spaced, prominent radial plicae and commarginal lamellae throughout ontogeny, with shallowly pitted microsculpture on pre-radial area of left valve and interstitial scaly imbricate “pseudo-shagreen” microsculpture in the early radial stage, weak interstitial radial microsculpture present late in ontogeny of some specimens; internal rib carinae prominent around ventral margin; resilial teeth weak, dorsal teeth prominent, narrow; byssal notch deep, ctenolium well-developed.

**Distribution.** Miocene(?)–Recent (Hayami, 1989). Tropical Indo-West Pacific, living in the littoral to sublittoral zones on soft sediment.

**Discussion.** Hertlein (1969: N357) treated *Volachlamys* as a junior synonym of *Argopecten* Monterosato, 1889, a subgenus of *Chlamys*, placed in the suprageneric *Chlamys* group.

The extant tropical Indo-West Pacific genus *Volachlamys* resembles the tropical eastern Pacific and western Atlantic genus *Argopecten*, although it differs in convexity of the valves (more flattened in *Volachlamys* and more strongly convex in *Argopecten*) and in microsculpture. *Volachlamys* has interstitial imbricate “pseudo-shagreen” microsculpture in the early radial stage, whereas *Argopecten* has radial microsculpture. As noted above, *Volachlamys* also has a weakly pitted pre-radial area of the left valve, as in *Mimachlamys* and *Minnivola*, whereas this area is more deeply pitted in Aequipectinini. *Volachlamys* is included here in tribe Mimachlamyidini; the resemblance to *Argopecten* is a further confusing convergence produced by similarities in habit rather than by close phylogenetic relationship (T. R. Waller, USNM, pers. comm. 1 July 2017).

## *Volachlamys singaporina* (G. B. Sowerby II, 1842)

Figs 98, 100J,L, 101D–E

*Pecten singaporinus* Sowerby, 1842: 74, pl. 13, fig. 55, pl. 14, fig. 71; Reeve, 1853: sp. 74, pl. 20, fig. 74; E.A. Smith, 1884: 115; Küster & Kobelt, 1888: 94, pl. 25, figs 2–4. *Pecten pica* Reeve, 1853: sp. 115, pl. 27, figs 115a–b. *Pecten cumingii* Reeve, 1853: sp. 140, pl. 31, figs 140a–b. *Chlamys singaporinus* [sic] (Sowerby).—Hedley, 1918b: 265. *Volachlamys cumingii* (Reeve).—Iredale, 1939: 357; Dijkstra, (1983–1989) 1985: 25, fig. *Chlamys cumingi* [sic] (Reeve).—Coleman, 1982: 223, pl. 627. *Volachlamys singaporina* (Sowerby).—Dijkstra, (1983–1989)



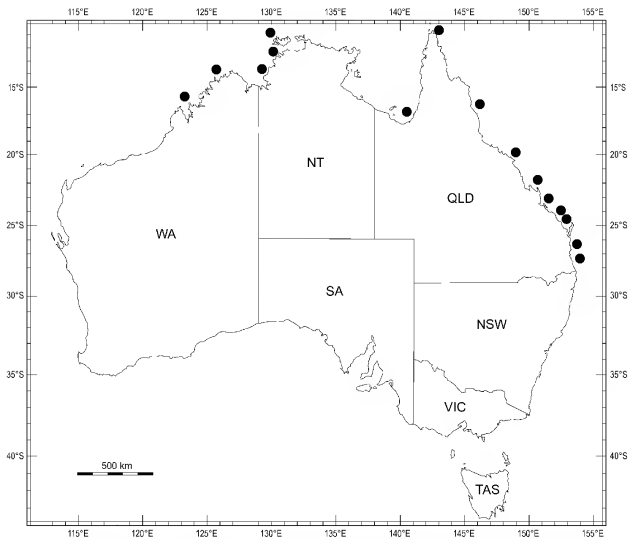


Figure 98. Distribution of *Volachlamys singaporina* (G. B. Sowerby 1855).

1985: 25, figs; Rombouts, 1991: 62, pl. 22, fig. 6; Dharma, 1992: 84, pl. 20, figs 7–7d; Lamprell & Whitehead, 1992: [24], pl. 10, fig. 61; Dijkstra & Kastoro, 1997: 276, figs 151–155; Dijkstra, 1998a: 44, pl. 9, fig. 5; Dharma, 2005: 248, 364, pl. 99, figs 13a–e; pl. 147, figs 3a–b; Raines & Poppe, 2006: 330–331, upper figs; pl. 288, figs 1–7; pl. 289, figs 1–7; Xu & Zhang, 2008: 89, fig. 254; Huber, 2010: 203.

*Chlamys (Argopecten) singaporina* (Sowerby).—Dijkstra, 1990a: 8.

*Volachlamys singaporinus* [sic] (Sowerby).—Wang, 1990: 15, pl. 2, fig. 7.

*Chlamys singaporina* (Sowerby).—Bernard *et al.*, 1993: 49.

**Type data.** *Pecten singaporinus* Sowerby: lectotype (pr) NHMUK1994127/1, designated by Dijkstra & Kastoro (1997: 279), 2 paralectotypes (pr) NHMUK1994127/2–3. Type locality: Singapore.

*Pecten pica* Reeve: three syntypes (pr) NHMUK1994139. Type locality: “New Zealand” (incorrect).

*Pecten cumingii* Reeve: five syntypes (pr) NHMUK1950. 11.14.3–7, including potential lectotype (figured by Reeve: pl. 31 fig. 140a). Type locality: Australia, southern QLD, Moreton Bay. One syntype (pr) ZMB Moll.114.613, labelled “*Pecten cumingii* Reeve/Moreton Bay/Cuming” (Dijkstra & Köhler, 2008: 35, fig. 2g).

**Comments on type data.** The type locality of *Pecten pica* Reeve is incorrect. *Volachlamys* species do not occur in New Zealand.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Arafura Sea, c. 210 ml NE of Croker Island, 8°18'S 133°58'E, dead, 132 m (1 v, C.160970 [in part]); Torres Strait, Saibai Island, Saibai Village, 9°22'S 142°36'E, alive (1 pr + 7 v, C.123279); Arafura Sea, c. 100 ml N of Croker Island, 9°30'S 132°34'E, dead, 124 m (1 v, C.160971 [in part]); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (4 v, C.036133); GBR, off Cape Grenville, Sunday Island, 11°56'S 143°12'E, dead (1 v, C.075234); Gulf of Carpentaria, beaches around Mapoon, 11°58'S 141°53'E, dead (7 v, C.014166); E Gulf of Carpentaria, SW of Nassau River, 16°08.5'S 141°18'E, dead, 3.6 m (1 v, C.107315); Buchans Point, N of Cairns, 16°44'S 145°40'E, dead (6 v, C.079588); Gulf of Carpentaria, off Albert River mouth, 17°24'S 139°47'E, dead, 4–9 m (4 v, C.107031); Gulf of Carpentaria, Karumba Point, 17°28'S 140°50'E, dead (1 v, C.095989); Gulf of Carpentaria, Karumba, 17°29'S 140°50'E, dead (1 v, C.369668; 2 v, C.014942); Gulf of Carpentaria, Karumba, near Pilot Station, 17°29'S 140°50'E, dead (1 v, C.107991); Beach at CSIRO Prawn Research Station, 7 km from Norman River mouth, Karumba, 17°29'S 140°50'E, dead (5 v, C.369666); Cardwell, 18°16'S 146°01'E, dead (4 v, C.068522); Bowen, 20°04'S 148°22'E, alive (2 pr, C.097671; 1 pr, C.097359); Whitsunday Passage, 20°13.5'S 148°47.5'E, dead, 24 m (1 v, C.369709); GBR, Whitsunday Passage, Lindeman Island, 20°27'S 149°02'E, dead (many v, C.369693); Conway Beach, near Proserpine, 20°29'S, 148°45'E, dead (1 v, C.103809); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (6 v,

C.369711); Whitsunday Passage, 20°32.3'S 149°01.4'E, dead, 27 m (many v, C.369710); E of Mackay, 20°52'S 149°29'E, dead, 35 m (1 v, C.369712); Seaforth, N of Mackay, 20°54'S 148°58'E, dead (7 v, C.059195); E of Sarina, 21°27.5'S 150°08'E, dead, 42 m (1 v, C.369692); E of Broad Sound, 21°58.5'S 150°45'E, dead, 57 m (3 v, C.369694); Pearl Bay, E of Shoalwater Bay, 22°25'S 150°44'E, alive (3 pr + 1 v, C.375978); Keppel Bay, North Keppel Island, 23°04'S 150°54'E, dead (1 pr, C.375950); Keppel Bay, Yeppoon, 23°08'S 150°44'E, dead (9 v, C.375986); Keppel Bay, Yeppoon, 23°08'S 150°45'E, alive (3 v, C.079573; 5 pr, C.375985; 7 pr, C.375987); Keppel Bay, off Yeppoon, 23°08'S 150°46'E, dead, 5 m (6 v, C.375951); Keppel Bay, N side Statute Point, 23°10'S 150°47'E, alive (1 pr, C.091789); Keppel Bay, Bluff Rock, S of Yeppoon, 23°10'S 150°48'E, alive (7 v, C.375984); Keppel Bay, 0.25 ml S of Emu Park, 23°15'S 150°49'E, dead (1 v, C.095176; 8 v, C.375982); Keppel Bay, Zilzie Point, c. 9 ml S of Yeppoon, 23°17'S 150°50'E, dead (2 v, C.369713); Capricorn Group, North West Island, 23°18'S 151°42'E, dead (1 v, C.369748); Keppel Sands, 23°20'S 150°47.5'E, alive (1 pr, C.069257); Keppel Bay, 23°25'S 150°55'E, alive, 46 m (7 v, C.097508; 4 pr, C.119635; 2 pr, C.132079); Port Curtis, N end of Facing Island, 23°46'S 151°19.8'E, dead (1 v, C.072236); Port Curtis, Quoin Island, 23°49'S 151°17'E, alive, 2–5.5 m (1 pr, C.369715; 1 v, C.375130); Port Curtis, Facing Island, 23°49'S 151°22'E, dead (3 v, C.044395); Calliope River mouth at Gladstone Power Station, 23°50.5'S 151°13.5'E, alive (1 pr, C.145945); Gladstone Harbour, 23°51'S 151°16'E, alive (2 pr, C.103824); Port Curtis, off Gatcombe Head, 23°54'S 151°22'E, dead, 13–18 m (10 v, C.018677); Port Curtis, Gladstone, 23°54'S 151°22'E, dead, 13–18 m (10 v, C.119637); Port Curtis, 23°55'S 151°23'E, alive, 13–22 m (1 v, C.369714; 4 pr, C.369716; 1 pr, C.047379; 3 pr, C.012048); Port Curtis, South Channel, Jenny Lind Buoy, 23°56.5'S 151°30.5'E, alive (3 pr, C.036983); Tannum Sands, S of Gladstone, 23°57'S 151°22'E, dead (5 v, C.369717); Port Curtis, Rodds Harbour, 24°0'S 151°34'E, alive (2 pr, C.080133; 2 pr, C.375979); Burnett Heads, 24°46'S 152°24'E, 6 pr, alive (C.375952); off Burnett Heads, 24°46'S 152°24'E, dead, 46 m (10 v, C.097511); Bargara, 24°49'S 152°28'E, dead (7 v, C.375981); Hervey Bay, 25°06'S 152°49'E, dead (1 v, C.375975); Hervey Bay, off Urangan, 25°15'S 152°55'E, alive, 10 m (1 pr, C.097509); Hervey Bay, Pialba, 25°17'S 152°50'E, dead (1 v, C.375976); Hervey Bay, Urangan, 25°17'S 152°54'E, alive (2 pr, C.103799); Hervey Bay, Dundowan Beach, 25°18'S 152°46'E, dead (18 v, C.097510; 1 v, C.375977); Hervey Bay, S of Woody Island, 25°18.5'S 152°56'E, alive, 9 m (4 pr, C.097506); Tin Can Bay, NE of Gympie, 25°53'S 153°01'E, dead (1 v, C.375980); Noosa, Noosa Inlet, 26°23'S 153°04'E, dead (2 v, C.375131); South coast, 26°30'S 153°10'E, alive (1 pr, C.083842); Caloundra, 26°49'S 153°10'E, dead (1 v, C.071167); Bribie Island, 27°05'S 153°11'E, alive (1 pr, C.080068); Moreton Bay, Scarborough, 27°12'S 153°07'E, dead (1 pr, C.375983); Moreton Bay, 27°15'S 153°15'E, alive, 3.5–11 m (8 v, C.075245; 1 pr, C.119631; 1 pr, C.019176; 2 pr, C.070214); Moreton Bay, Redcliffe Peninsula, off Margate, King Street Reef, 27°15.5'S 153°07.3'E, dead, 8 m (1 v, C.067854); Moreton Bay, off Woody Point jetty, 27°16'S 153°06'E, alive, 2–3 m (1 pr, C.303779). **WESTERN AUSTRALIA:** Buccaneer Archipelago, 15°57'S 123°26'E, dead (14 v, C.042426); SE corner Cassini Island, 13°57'S 125°38'E, 34–40 m, dredged (7 v, HM) [juv.]. **NORTHERN TERRITORY:** Tree Point, SW of Darwin, 14°01'S 129°36'E, alive (1 pr, C.369664); Daly River mouth, 13°19'S 130°15'E, dead (2 v, C.019479); Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (17 v, C.369672); Melville Island, near Garden Point, 11°24.5'S 130°24.7'E, dead (1 v, C.119634); Darwin, Sandbar No. 1, 12°26'S 130°48'E, dead (1 v, C.099778); Darwin area, Cullen Bay, dead (26 v, WAM12563 [in part]); Port Darwin, 12°28'S 130°50'E, dead, 15 m (1 v, C.057357 [in part]); Darwin, 12°28'S 130°50'E, dead (1 v, C.369665; 2 v, C.130506); S of Darwin, Middle Arm, Blackmore River at Southport, 12°38'S 130°54'E, alive (1 pr, C.370416); Arafura Sea, c. 199 ml N of Croker Island, 9°30'S 132°34'E, dead, 124 m (many v, C.087167); Arafura Sea, 125 km N of Goulburn Island, 10°23'S 133°36'E, dead, 62 m (1 v, C.369673); N of Arnhem Land, 9°49'S 137°12'E, dead (1 v, C.375132). —CHINA: Hong Kong, Cheung Chau Island, S end, 22°12'N 114°01'E, dead (1 v, C.095494). —SINGAPORE: Raffles Light, 1°10'N 103°45'E, dead (1 v, C.120182); Pulau Sudong, 1°12'S 103°44'E, dead (11 v, C.123691). —MALAYSIA: Pontian Kechil, 1°29'N 103°23'E, dead (2 v, C.129471); Melaka (= Malacca), W Malaysia, 2°12'N 102°15'E, dead (13 v, C.129540); Tanjung Klingh, near Malacca, 2°13'N 102°10'E, dead (3 v, C.369650). —INDONESIA: Java, Djakarta Bay, alive, 5 m (6 pr, ZMA Moll.142963); Arafura Sea, S of West Irian, 7°30'S 135°58'E, dead (1 v, C.369651).

**Description.** Shell up to 79 mm high (Huber, 2010), most specimens smaller, to c. 40 mm; dorsoventrally elongate (immature) to subcircular (mature), moderately inflated, left valve slightly more convex than right, equilateral, equivalve, anterior auricles larger and longer than posterior ones, umbonal angle c. 90°; greyish or cream with brown and/or whitish maculations and streaks, right valve paler.

Both valves sculptured with 18–24 (20–22 on most specimens) evenly spaced, smooth radial plicae with rounded crests. Radial interspaces bearing delicate commarginal lamellae. Anterior auricle of left valve with 6–8 weak radial riblets and very fine close-set commarginal lamellae, riblets almost absent on posterior auricle. Dorsal margin straight. Byssal notch deep, byssal fasciole rather broad. Functional ctenolium well-developed, with 4–6 teeth. Resilifer narrowly triangular. Interior weakly furrowed over most of valve height, plicate near ventral margin, internal plicae with edges weakly carinate in narrow zone around ventral margin. Resilial teeth weak, dorsal teeth prominent.

**Dimensions.** Illustrated specimen: QLD, Moreton Bay (AM C.019176): rv: H 50.3, L 52.1 mm; lv: H 50.3, L 51.6 mm; D 15.9 mm.

**Habitat.** Living in the intertidal to sublittoral zones on soft sediment (mud, sandy mud or muddy sand).

**Distribution.** Throughout the western Pacific, from the South China Sea as far southeast as northwestern (c. 15°S), northern and eastern Australia (c. 27°S) (Raines & Poppe, 2006: 330); China to Australia, 0–22 m (Huber, 2010: 203); Indonesia, 174–180 m, dead (Dijkstra & Kastoro, 1997: 279); Papua New Guinea (Dijkstra, 1998a: 45). Maximum depth range of live-taken specimens is from the intertidal zone to 46 m. Present specimens from Australia alive at 2–46 m.

**Remarks.** The Queensland morph (named *Pecten cumingii* by Reeve) differs slightly from typical material from Singapore in reaching a somewhat larger size (up to c. 60 mm high, typically most specimens reach 45 mm), with one or two fewer radial plicae (19–20, typically 21–22), and in its colour (brightly polychromatic, typically cream, greyish or brownish). Material examined from throughout the western Pacific, South China Sea, Malaysia and Indonesia varies in the number of radial plicae, decreasing southwards to eastern Indonesia and northeastern Australia. Other morphological characters are identical, and we consider this to be one variable species.

### Aequipectinini von Teppner, 1922

**Diagnosis.** Pedinae with most taxa of aequipectinoid shape, with a complex sculpture of radial costae or narrow plicae, evenly lamellose with a series of hollow sections or secondary interstitial commarginal lamellae; many taxa with commarginal ridges developing ventrally directed loops, convex in the dorsal direction and concave in the ventral direction, on flanks of radial plicae; microsculpture of prominent, deep, smooth pits in pre-radial stage; equilateral and with auricles becoming almost equal in late ontogeny; internal rib carinae prominent; hinge with enlarged resilial teeth.

### Key to genera of Aequipectinini occurring in Australia

- 1 Shell small to medium, aequipectinoid, auricles, unequal, vesicular radial macrosculpture, intercalated commarginal microsculpture ..... *Cryptopecten*
- Shell small, circular, solid, lv flattened, rv strongly convex, auricles small, radial sculpture simple ..... 2
- 2 Shell small, pectinoid, auricles almost equal, radial macrosculpture simple, microsculpture of commarginal lamellae ..... *Haumea*
- Shell small, circular, lv flattened, rv convex, auricles subequal, radial ribs solid or with hollow sections ..... 3
- 3 Shell small, pectinoid, auricles almost equal, macrosculpture of simple solid radial ribs or with hollow sections laterally, microsculpture commarginal or lacking in some species ..... *Serratovola*

### *Cryptopecten* Dall, Bartsch & Rehder, 1938

*Cryptopecten* Dall, Bartsch & Rehder, 1938: 93. Type species (by original designation): *Cryptopecten alli* Dall, Bartsch & Rehder, 1938 (= *Pecten (Chlamys) bullatus* Dautzenberg & Bavay, 1912); Recent, off south coast of Oahu, Hawaii, in 238–252 fathoms [435–461 m].

*Corymbichlamys* Iredale, 1939: 347, 367. Type species (by original designation): *Chlamys corymbiatus* [sic] Hedley, 1909 (= *Pecten nux* Reeve, 1853); Recent, off Hope Islands, QLD.

**Diagnosis.** Small to medium-sized Aequipectinini with valves highly variable in convexity, most species circular; laterally compressed; auricles almost equal; macrosculpture of 12–25 narrow, evenly lamellose radial plicae, interspaces with delicate imbricate scales; auricles sculptured with a few radial riblets; byssal notch relatively deep, functional ctenolium well-developed; internal rib carinae prominent; hinge with prominent resilial and dorsal teeth.

**Distribution.** Lower Miocene–Recent. Indo-West Pacific and western Atlantic, living in the littoral to bathyal zones (see also Hayami, 1984: 116).

**Discussion.** Hertlein (1969: N357) treated *Cryptopecten* as a subgenus of *Chlamys* Röding, 1798, placed in the supra-generic *Chlamys* group. He also considered *Gloripallium* Iredale, 1939 to be a junior synonym of *Cryptopecten*.

Waller (1986: 40) elevated the extant Indo-West Pacific genus *Gloripallium*, and placed it in Decatopectinini of Pectininae. *Cryptopecten*, however, has morphological characters strongly resembling those of *Aequipecten* Fischer, 1886, and should be placed in the tribe Aequipectinini of Pedinae. *Volachlamys* is removed above from Aequipectinini to tribe Mimachlamyidini. Waller (2011) included *Chagrapecten* Waller, 2011, *Gurabopecten* Waller, 2011, *Leptopecten* Verrill, 1897, *Lindapecten* Petuch, 1995, and *Paraleptopecten* Waller, 2011 in Aequipectinini. Other genera included in Aequipectinini are *Aequipecten*, *Argopecten* Monterosato, 1899, *Cryptopecten* and *Haumea* Dall, Bartsch & Rehder, 1938, and we now add *Serratovola* Habe, 1951.

Key to species of *Cryptopecten* from Australia

- 1 Shell c. 30 mm high, thin, almost circular, weakly inflated, rv more convex than lv, weakly prosocline, auricles unequal, valves with 17–20 squamose, bi-vesicular radial plicae, byssal fasciole narrow ..... *C. bullatus*
- Shell with 18–22 vesicular-sculptured radial plicae ..... 2
- 2 Shell c. 20 mm high, solid, circular to subcircular, moderately to strongly inflated, rv more convex than lv, auricles highly unequal, valves with 18–22 evenly spaced, vesicular-sculptured radial plicae, tripartite when worn, byssal fasciole wide ..... *C. mux*

*Cryptopecten bullatus*  
(Dautzenberg & Bavay, 1912)

Figs 100A,C, 101A

*Pecten (Chlamys) bullatus* Dautzenberg & Bavay, 1912: 17, pl. 27, figs 1–2.

*Chlamys (Aequipecten) tissotii* (Bernardi).—Kuroda, 1932: app. 95 (misidentification).

*Cryptopecten alli* Dall, Bartsch & Rehder, 1938: 93, pl. 23, figs 1–4, 7.

*Chlamys bullatus* (Dautzenberg & Bavay).—Barnard, 1964: 429, fig. 14c.

*Cryptopecten tissotii* (Bernardi).—Habe, 1951: 77; Habe, 1964b: 174, pl. 53, fig. 8; Okutani, 1972: 113, fig. 62; Habe, 1977: 84; Koyama *et al.*, 1981: 67 (misidentification).

*Cryptopecten alli* Dall, Bartsch & Rehder.—Poutiers, 1981: 332; Abbott & Dance, 1982: 308, fig. (holotype); Dijkstra, 1987: 8, fig.

*Cryptopecten complanus* Wang, 1983a: 402, 405, figs 1.1–7.

*Cryptopecten bullatus* (Dautzenberg & Bavay).—Hayami, 1984: 96, pl. 1, figs 1–6, pl. 2, figs 1–3, pl. 9, fig. 1, pl. 10, fig. 3, pl. 11, fig. 3; Wagner, 1989a: 60, figs 14–16; Dijkstra, 1991: 4, 35; Dijkstra, (1983–1994) 1992: 26, figs; Dijkstra, 1995: 60, figs 115–118; Dijkstra & Kastoro, 1997: 273, figs 138–145; Dijkstra & Marshall, 1997: 105, pl. 12, figs 1–5; Hayami, 2000: 905, pl. 450, fig. 39; Dijkstra, 2001: 92; Dijkstra & Kilburn, 2001: 309, fig. 49; Wang, 2002: 210, fig. 90; Raines & Poppe, 2006: 312, 315, upper figs; pl. 275, figs 1–7; Dijkstra & Marshall, 2008: 69, figs 55G–H, 57; Dijkstra & Maestrati, 2008: 109; Spencer *et al.*, 2009: 198; Dijkstra & Maestrati, 2010: 350; Huber, 2010: 203; Raines, 2010: 646, pl. 1014, figs 7–11; Dijkstra, 2013: 98, pl. 24, figs 3a–d, pl. 25, figs 2a–b; Dijkstra & Maestrati, 2013b: 477.

**Type data.** *Pecten (Chlamys) bullatus* Dautzenberg & Bavay: holotype (pr) ZMA Moll.3.12.006. Type locality: Siboga stn 105: Sulu Archipelago, 6°08'N 121°19'E, 275 m.

*Cryptopecten alli* Dall *et al.*: holotype (pr) USNM173194. Type locality: Albatross stn 3811: Hawaiian Islands, S coast of Oahu, 435–461 m.

*Cryptopecten complanus* Wang: holotype (pr) IOAS M11072. Type locality: East China Sea, 31°05'N 128°0'E, 147 m, sand, 30 May 1978 (see also Lutaenko & Xu, 2008).

**Additional material examined.** —AUSTRALIA: NEW SOUTH WALES: c. 360 km E of Newcastle, 33°04'S 156°07'E, dead, 230–275 m (1 fragm., C.165159). NORTHERN TERRITORY: 171 km N of Melville Island, 9°43'S 131°05'E, dead, 148 m (1 v, C.160969). —JAPAN: Wakayama, Minabe, alive, 125 m (3 pr, ZMA Moll.140641). —PHILIPPINE ISLANDS: off Balut Island, alive, 80–140 m (10 pr, ZMA Moll.141896). —INDONESIA: Kai Islands, alive, 212–221 m (1 pr, ZMA Moll.145669). HAWAIIAN ISLANDS: Oahu, off Pokai Bay, dead, 244–305 m (1 v, ZMA Moll.144042). CORAL SEA: Elizabeth Reef, 29°53.82'S 159°01.65'E, alive, 420 m (1 pr, C.165407). TASMAN SEA: Taupo Seamount, 33°06.25'S 156°09.3'E, alive, 154–164 m (3 pr, C.165237); Taupo Seamount, 33°14.36'S 156°09.52'E, alive, 132 m (1 pr, C.165241); Taupo Seamount, 33°16.85'S 156°09.15'E, alive, 244 m (2

pr, C.165243). KERMADEC ISLANDS: Macauley cone, Kermadec Ridge, 30°10.1'S 178°34.3'W, 287–328 m (1 v, NIWA TAN205/64) (Dijkstra & Marshall, 2008: 69). TASMAN SEA: off Lord Howe Island, 31°45.7'S 159°20.8'E, 565–960 m (2 v, NMNZ M.171159); Norfolk ridge, S of Norfolk Island, 29°41.8'S 168°02.6'E, 322–337 m (3 v, NMNZ M.171104). —NEW ZEALAND: Wanganella Bank, 31°47.2'S 167°51.6'E, 316–319 m (3 v, NIWA P14) (Dijkstra & Marshall, 2008: 69).

**Description.** Shell up to c. 30 mm high, most specimens smaller than 20 mm; thin, weakly inflated, right valve more convex than left, almost circular, weakly prosocline, inequilateral, auricles unequal in shape and size, umbonal angle c. 100–110°; colour polychromatic, most specimens reddish brown with pale oblique or zigzag stripes or blotches, a few specimens yellow or purple.

Both valves sculptured with 17–20 squamose, bi-vesicular radial plicae (18–19 on most specimens), interstices bearing commarginal lamellae, arcuate with convexity towards umbo on plical sides and in interspaces (more delicate on right valve). Anterior auricles slightly larger than posterior ones, anterior with 2 prominent radial riblets and 2–4 interstitial ones; posterior auricle with one prominent radial riblet and 3–5 narrower ones between prominent riblet and disc margin. Inner surface moderately strongly plicate, internal rib carinae commencing in early growth stage, prominent in relatively wide zone around ventral margin. Dorsal margin straight. Byssal notch rather deep, byssal fasciole moderately narrow. Functional ctenolium well-developed, with 4–5 teeth. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: NT, Arafura Sea, 171 km N of Melville Island, 148 m (AM C.160969), rv only: H 16.4, L 17.6 mm.

**Habitat.** Living in the sublittoral to bathyal zones, amongst coral rubble on sandy bottoms.

**Distribution.** Throughout the tropical Indo-West Pacific, from southern Japan southwards to northern Australia and to Wanganella Bank off NW New Zealand, westwards into the Indian Ocean to northeastern South Africa (not recorded from the Arabian Sea), and eastwards into the Pacific to the Hawaiian Islands and French Polynesia (Raines & Poppe, 2006: 314); South Africa (Natal) to Hawaii, 82–500 m (Huber, 2010: 203); South Africa, 160–170 m, dead (Dijkstra & Kilburn, 2001: 310); Philippines, 50–198 m (Raines, 2010: 646; Dijkstra, 2013: 99); Indonesia, 205–265 m (Dijkstra, 1991: 36; Dijkstra & Kastoro, 1997: 273); Chesterfield Islands, New Caledonia, Loyalty Islands and New Hebrides, 260–500 m (Dijkstra, 1995b: 60–61); Lord Howe Island, Norfolk Island and Kermadec Islands, 82–370 m (Dijkstra & Marshall, 1997: 106); Wallis and Futuna, Vanuatu and New Caledonia, 190–460 m (Dijkstra, 2001: 92); Norfolk Ridge, Fiji, Tonga and Marquesas, 220–395 m (Dijkstra & Maestrati, 2008: 109). Maximum depth range of live-taken

specimens is 82–500 m. Present specimens from Australia taken dead at 148–275 m.

**Remarks.** The present species is a **new record** for Australia. The convexity and sculpture of *Cryptopecten bullatus* vary with its bathymetrical range and geographical distribution. For further discussion see Hayami (1984: 98), Wagner (1989a: 61), Dijkstra (1991: 36) and Dijkstra & Marshall (1997: 106; 2008: 69).

### *Cryptopecten nux* (Reeve, 1853)

Figs 99, 100B, 101B–C

- Pecten coruscans* Hinds.—Reeve, 1853: sp. 143, pl. 32, fig. 143 (misidentification).
- Pecten nux* Reeve, 1853: errata; Küster & Kobelt, 1888: 163, pl. 45, figs 5–8; Paetel, 1890: 232; Smith, 1903: 621; Smith, 1904: 13; Lynge, 1909: 155; Melvill, 1909: 127.
- Pecten hastingsii* Melvill, 1888: 279, pl. 2, fig. 7; Trew, 1987: 44.
- Pecten guendolenae* Melvill, 1888: 279, pl. 2, fig. 6; Trew, 1987: 43.
- Chlamys smithi* G. B. Sowerby III, 1908: 18, pl. 1, figs 6–7; Viader, 1937: 62.
- Chlamys corymbiatus* Hedley, 1909: 423, pl. 36, figs 1–4.
- Pecten (Aequipecten) vesiculosus* Dunker.—Dautzenberg & Bavay, 1912: 148 (misidentification).
- Chlamys (Aequipecten) nux* (Reeve).—Cox, 1930: 124, pl. 14, fig. 11; Eames & Cox, 1956: 43.
- Chlamys nux* (Reeve).—Dautzenberg & Bouge, 1933: 427; Viader, 1937: 62.
- Pecten (Aequipecten) nux* Reeve.—Nomura, 1933: 55; Nomura & Zinbo, 1934: 117 [in part].
- Pecten (Aequipecten) kikaiensis* Nomura & Zinbo, 1934: 153, pl. 5, figs 9a–b.
- Aequipecten nux* (Reeve).—Lamy, 1935: 315.
- Cryptopecten nux* (Reeve).—Habe, 1951: 77; Habe, 1961: 118, pl. 53, fig. 9; Habe, 1964b: 174, pl. 53, fig. 9; Habe, 1977: 84; Kira, 1962: 174, pl. 53, fig. 9; Hayami, 1982: 235; Wang, 1983a: 403, figs 1(8–13); Hayami, 1984: 99, pl. 2, fig. 4, pl. 3, figs 1–2, pl. 9, figs 2–5, pl. 12, figs 1–2; Dijkstra, 1991: 36; Lamprell & Whitehead, 1992: [26], pl. 11, fig. 66; Bernard *et al.*, 1993: 50; Dijkstra & Marshall, 1997: 107; Dijkstra, 1998a: 42; Dijkstra, Drivas & Jay, 1998: 6, fig. 6; Dijkstra & Knudsen, 1998: 86, pl. 3, figs 12–13; Hayami, 2000: 905, pl. 450, fig. 40; Dijkstra, 2001: 92; Dijkstra & Kilburn, 2001: 310, figs 50–51; Wang, 2002: 211, fig. 91, text fig. 15; Taylor & Glover, 2004: 262; Raines & Poppe, 2006: 314–315, lower fig; pl. 276, figs 1–8; Dijkstra & Moolenbeek, 2008: 22; Dijkstra & Maestrati, 2008: 109; Xu & Zhang, 2008: 87, fig. 244; Dijkstra & Maestrati, 2010: 350; Huber, 2010: 203; Raines, 2010: 646, pl. 1014, figs 1–6; Dijkstra, 2013: 99, pl. 25, figs 1a–d, 3a–b; Dijkstra & Janssen, 2013: 204, figs 32–33; Dijkstra & Maestrati, 2013a: 371.
- Chlamys (Cryptopecten) nux* (Reeve).—Shikama, 1964: 50, fig. 93.
- Cryptopecten kikaiensis* (Nomura & Zinbo).—Habe, 1977: 84.
- Cryptopecten hastingsii* (Melvill).—Habe, 1977: 85.
- Cryptopecten bernardi corymbiatus* (Hedley).—Dijkstra, (1983–1994) 1988: 7, figs.
- Cryptopecten bernardi nux* (Reeve).—Dijkstra *et al.*, 1990: 9–10, fig.
- Chlamys (Cryptopecten) bernardi* (Philippi).—Rombouts, 1991: 23, pl. 23, figs 3–3a; Oliver, 1992: 72, text-figs 21a–b, 76, pl. 14, figs 3a–b (misidentification).
- Cryptopecten guendolenae* (Melvill).—Huber, 2010: 203.

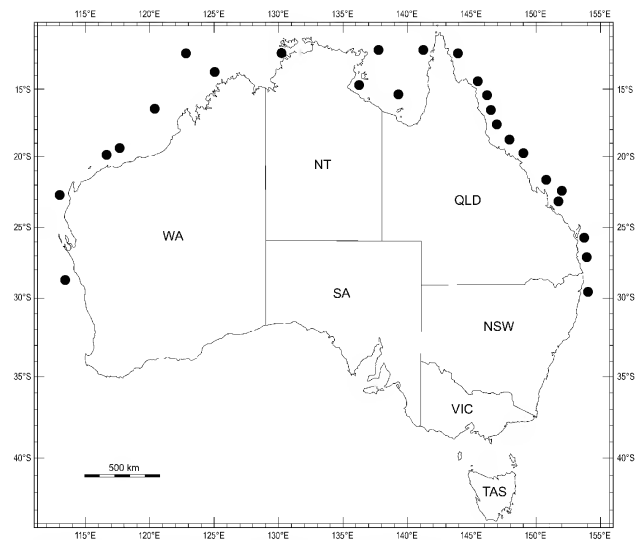


Figure 99. Distribution of *Cryptopecten nux* (Reeve).

**Type data.** *Pecten nux* Reeve: lectotype (pr) NHMUK1950.11.14.52, 2 paralectotypes (pr) NHMUK1950.11.14.50–51, designated by Wagner (1989a: 58). Type locality: Philippine Islands, Bohol, Panglao, designated by Wagner (1989a: 58).

*Pecten hastingsii* Melvill: holotype (pr) NMW1955.158.10. Type locality: Japan.

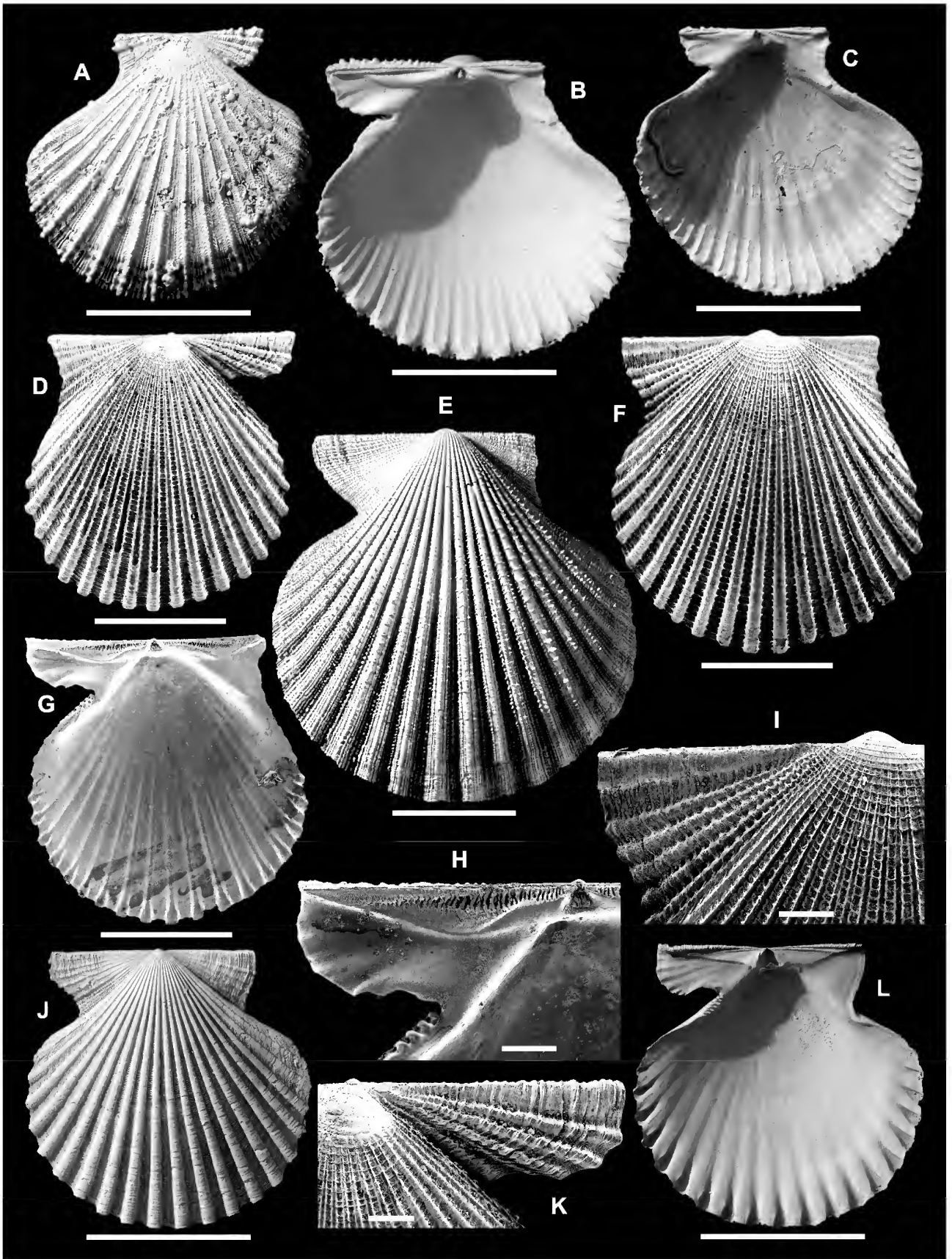
*Pecten guendolenae* Melvill: holotype (pr) NMW1955.158.02. Type locality: Mauritius.

*Chlamys smithi* Sowerby: holotype (pr) NHMUK1908.5.30.63. Type locality: Mauritius.

*Chlamys corymbiatus* Hedley: two syntypes (lv + rv) AM C.027532 (lv in Fig. 101C). Type locality: Australia, N QLD, Hope Islands, 5–10 fathoms [9–18 m].

*Pecten (Aequipecten) kikaiensis* Nomura & Zinbo: holotype (rv) IGPS50357. Type locality: Japan, Amami Islands, Kikai Island, Kamikatetsu, Wan Formation, late Pleistocene (Marine Isotope Stage 5e, 125 000 yrs).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: N Gulf of Carpentaria, 9°34'S 139°26'E, dead, 38 m (1 v, C.343744); Torres Strait, Darnley Island, 9°35'S 143°46'E, dead, 46–55 m (4 v, C.061519); Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (1 v, C.030274); N Gulf of Carpentaria, 10°01'S 139°29'E, dead, 57 m (1 v, C.343741); Cape York Peninsula, Albany Passage, 10°45'S 142°37'E, dead, 7–26 m (16 v, C.036127); Gulf of Carpentaria, 10 mls SW of Mapoon, 12°05'S 141°40'E, dead, 18 m (3 v, C.014076); N Gulf of Carpentaria, 12°58'S 139°30'E, dead, 64 m (1 v, C.343743); GBR, off Bow Reef, near Cape Sidmouth, 13°20'S 143°40'E, dead, 19 m (2 v, C.002557); 10 mls SE of Cape Sidmouth, 13°25'S 143°36'E, dead, 24 m (1 v, C.047346); E Gulf of Carpentaria, 14°20'S 140°34'E, dead, 59 m (1 v, C.165184); GBR, Howick Group, Coquet Island, 14°32'S 144°59'E, dead (2 v, C.049388); 0.5 ml SE of Lizard Island, 14°41'S 145°29'E, dead, 35 m (1 v, C.343789); E Gulf of Carpentaria, 14°50'S 140°42'E, dead, 44 m (1 v, C.343736); off Cape Flattery, Decapolis Reef, 14°50'S 145°17'E, dead, 12–14 m (1 v, C.343748); 0.5 ml W of Two Isles, 15°01'S 145°26'E, dead, 30 m (10 v, C.343749); S Gulf of Carpentaria, 15°29'S 139°31'E, dead, 49 m (1 v, C.343737); Cairns Reef lagoon & between Cairns Reef & Hope Island, 15°42'S 145°30'E, dead, 9–18 m (5 v, C.027532; many v, C.170684); between Cairns Reef & Endeavour Reef, 15°45'S 145°35'E, dead, 37 m (many v, C.044614); Endeavour Reef, 15°47'S 145°35'E, dead (6 v, C.343750); SE Gulf of Carpentaria, 15°51'S 140°27'E, dead, 38 m (1 v, C.343738); E Gulf of Carpentaria, W of Nassau River, 15°51'S 140°54'E, dead, 22 m (1 v, C.343734); GBR, Undine Reef, 16°08'S 145°40'E, alive (3 pr, C.343751); 1.5 ml NW of Low Isles, 16°22'S 145°33'E, dead, 20 m (1 v, C.343752; 1 v, C.161020); Low Isles, 16°23'S 145°34'E, dead (1 v, C.161019 [in part]); Low Isles, near Port Douglas, 16°23'S 145°34'E, dead, 16–22 m (many v, C.343754); off Cairns, 16°33'S 146°09'–146°09.6'E, dead, 55 m (5 v, C.343760); off Cairns, 16°34'S 146°15'–146°13.6'E, dead, 192 m (1 v, C.343749); Michaelmas Cay, 16°36'S 145°59'E, dead, 20 m (10 v, C.343761); off Cairns, 16°36'–16°35'S 146°14'–146°13.8'E, dead, 172–197 m (3 v, C.343755); off Cairns, 16°51'S 146°01'–146°04'E, dead, 33–35 m (5 v, C.343756); off Cairns, 16°52'–16°53'S 146°06'E, dead, 37–38 m (4 v, C.343758); off Cairns, 16°55'S 146°07'E, dead, 37–40 m (4 v, C.343757); Kurramine Beach, S of Innisfail, 17°47'S 146°06'E, dead (1 v, C.343762); Palm Islands, 18°40'S 146°33'E, dead, 27 m (many v, C.010359); Palm Islands, Fantome Island, 18°43'S 146°31'E, dead, 18.3 m (2 v, C.343765); off Townsville, 6–7 mls E of Keeper Reef, 18°45'S 147°23'E, dead, 43 m (1 v, C.343766); Palm Islands, off Eclipse Island, 18°46'S 146°33'E, dead, 13 m (1 v, C.343764); off Townsville, 18°48'S 146°55'E, dead, 32.5–34 m (5 v, C.343768); off Townsville, 18°49'S 146°58'E, dead, 34–35 m (15

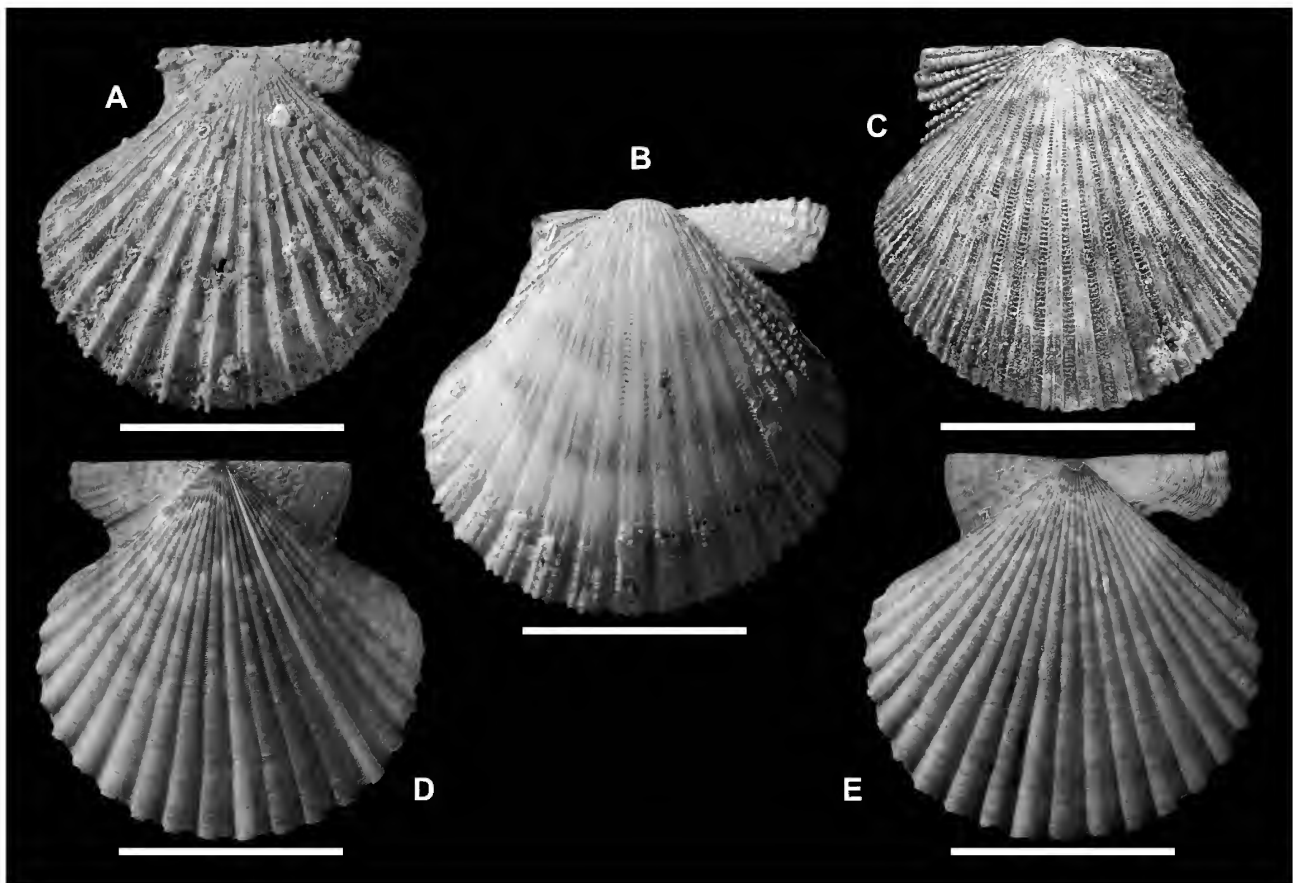


**Figure 100.** *A, C*, *Cryptopecten bullatus* (Dautzenberg & Bavay), rv only, AM C.160969, 171 km N of Melville Island, Arafura Sea, NT, 148 m; rv exterior (A), rv interior (C). *B*, *Cryptopecten nux* (Reeve), rv of pair, AM C.303782, Turkey Beach, Rodds Bay, QLD; rv interior. *D, F–I, K*, *Haumea rehderi* (Grau), separate valves, AM C.161025, Chevert Exped., Darnley Island, Torres Strait, QLD, 9°35'S 143°46'E, 55 m; rv exterior (D), lv exterior (F), rv interior (G), rv anterior auricle interior (H), lv anterior auricle exterior (I), rv anterior auricle exterior (K). *E*, *Mimachlamys spinicostata* sp. nov., paratype, lv of specimen in Figs 95E, 96F,G; lv exterior. *J, L*, *Volachlamys singaporina* (G. B. Sowerby II), pair, AM C.019176, Moreton Bay, QLD; lv exterior (J), rv interior (L). Scale bars represent 10 mm (A–C), 3 mm (D, F, G), 30 mm (E, J, L), 0.5 mm (H, I, K).



v, C.343767); Townsville, off Horseshoe Bay, Magnetic Island, 19°07'S 146°51'E, dead, 5.5–9 m (4 v, C.343763); off Townsville, northern coast of Magnetic Island, N end of Horseshoe Bay, 19°08'S 146°50'E, dead (4 v, NTM P011948); S of Townsville, 19°17'S 147°32'E, dead, 24 m (many v, C.343769); off Cape Upstart, 19°42'S 147°45'E, dead, 36 m (1 pr, C.343770); E of Bowen, 19°45'S 148°19'E, dead, 46 m (7 v, C.343772); off Bowen, 19°48'S 148°53'E, dead, 62 m (8 v, C.343773); off Bowen, 20°0'S 148°22'E, alive, 27–45 m (7 pr, C.343771); W of Hayman Island, 20°03'S 148°50'E, dead, 33 m (many v, C.120135); off Hayman Island, Whitsunday Islands, 20°03'S 148°53'E, alive, 9 m (1 pr, C.343775); Whitsunday Passage, 20°13'S 148°47'E, dead, 24 m (10 v, C.343777); Kennedy Sound, between Lindeman Island & Shaw Island, 20°25'–20°30'S 149°01'–149°04'E, dead (2 v, C.343774); Whitsunday Islands, Lindeman Island, 20°27'S 149°02'E, dead (many v, C.058933); off Shaw Island, N of Mackay, 20°29'S 149°05'E, dead, 37 m (many v, C.061525); Whitsunday Passage, 20°32'S 149°01'E, dead, 27 m (many v, C.343776); E of Mackay, 20°52'E 149°29'E, dead, 35 m (many v, C.116552); E of Sarina, 21°27'S 150°08'E, dead, 42 m (many v, C.343778); E of Sarina, 21°28'S 150°08'E, dead, 40 m (many v, C.120874); Swain Reefs, 3 km NE of W side of Bylund (Gillett) Cay, 21°42'S 152°26'E, dead, 64–73 m (19 v, C.343781); SE of Sarina, 21°47'S 150°34'E, dead, 59 m (many v, C.116490); E of Broad Sound, 21°58'S 150°45'E, dead, 57 m (many v, C.343780); off Broad Sound, 22°06'S 150°49'E, alive, 53 m (1 pr + 20 v, C.343779); off Yeppoon, 22°30'S 151°26'E, dead, 55 m (4 v, C.343787); off Yeppoon, 22°40'S 151°16'E, dead, 58 m (12 v, C.343783); off Yeppoon, 22°42'S 151°37'E, dead, 68 m (6 v, C.343788); NE of Rockhampton, 22°50'S 151°39'E, dead, 64 m (12 v, C.343782); E of Keppel Islands, 23°0'–23°12'S 151°10'–151°20'E, dead, 46–49 m (1 v, C.101115); Capricorn Channel, 4 mls E of North Reef, 23°09'S 151°58'E, alive, 64 m (1 pr, C.344006); Capricorn Group, North West Island, 23°18'S 151°42'E, dead (3 v, C.343784); 5 v, C.343785); Gladstone Harbour, 23°51'S 151°16'E, alive, 18–24 m (1 pr, C.343790); Bunker Group, off Lady Musgrave Island, 23°54'S 152°25'E, dead, 47 m (3 v, C.343786); Turkey Beach, Rodds Bay, 24°0'S 151°33'E, alive (1 pr, C.303782); off Maryborough, 25°47'S 153°33'E, dead, 64 m (5 v, C.343791); Frazer Island, off S end, 25°48'S 153°46'E, dead, 73 m (14 v, C.343793); Frazer Island, off S end, 25°57'S 153°34'E, dead, 58–60 m (2 v, C.343792); E of Moreton Bay, 26°91.7'S 153°55'E, dead, 115–175 m (1 v, C.160955); off Dunwich, Stradbroke Island, Moreton Bay, 27°30'S 153°24'E, dead, 5–7 m (1 v, C.343795); off Moreton Bay, 27°31'S 153°40'E, dead, 75–80 m (1 v, C.343794). **NEW SOUTH WALES:** off Tweed Heads, 28°17'S 153°44'E, dead, 73 m (1 v, C.343796); SE of Ballina, 29°06'–28°57'S 153°34'–153°38'E, dead, 44–53 m (1 pr, C.343797); off Iluka, 29°25'S 153°24'E, alive, 45–65 m (1 pr, C.344004); SE of Yamba, 29°28'–29°33'S 153°30'–153°25'E, alive, 51–55 m (1 pr, C.343798). **WESTERN AUSTRALIA:** W of Dongara, 29°49'S 114°24'E, dead, 128–132 m (1 v, WAM); 92 km W of Dongara, 29°07.05'S 113°57.04'E, dead, 110 m (1 v, WAM); SW of Point Cloates, 23°25'S 113°29'E, dead, 150 m (1 v, WAM); W of Point Cloates, 22°52'S 113°29'E, dead, 134 m (1 v, WAM); W of North West Cape, 21°50'S 113°46'E, dead, 137 m (2 v, WAM); North West Cape,

21°42'S 114°13'E, dead, 36 m (8 v, C.343692); North West Shelf, 26 n.mls NNE of Dampier Archipelago, 20°14'S 116°50'–116°50.6'E, alive, 40–41 m (1 pr + 3 v, C.343690); North West Shelf, 95 km NE of Dampier, 19°59'S 117°16'E, dead, 50 m (1 v, C.343694); North West Shelf, 44 n. mls NW of Port Hedland, 19°56'S 117°53'–117°53.4'E, alive, 40 m (3 pr, C.344005); 45 n.ml NW of Port Hedland, 19°55.2'–19°55.6'S 117°56.0'–117°55.6'E, dead, 40 m (2 v, C.165174 [in part]); North West Shelf, 19°55'S 117°55'E, alive, 40–45 m (1 pr, WAM521); North West Shelf, 52 n.mls NNE of Port Hedland, 19°30'–19°28'S 118°49'–118°55.4'E, alive, 36–37 m (4 pr + 2 v, C.148706); North West Shelf, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, alive, 110 m (2 pr, C.165231); North West Shelf, 72 n.mls NNW of Dampier, 19°28'–19°29'S 116°29'E, dead, 110 m (6 v, C.343689); 10 v, C.165181); North West Shelf, c. 90 mls N of Port Hedland, 19°07'S 118°15'E, dead, 88 m (1 v, C.343705); North West Shelf, 78 n.mls NNE of Port Hedland, 19°04'–19°04.2'S 119°04'–119°0.7'E, dead, 82 m (5 v, C.149935); North West Shelf, 80 n.mls NNE of Port Hedland, 19°03'–19°03.4'S 119°03'–119°03.5'E, dead, 82 m (many v, C.343687); North West Shelf, 85 n.mls NNW of Port Hedland, 19°00.8'S 118°01.3'E, dead, 112 m (4 v, C.343691); 8 v, C.165177 [in part]; 85 n.ml NNW of Port Hedland, 19°00.4'–19°00.3'S 118°01.0'–118°01.1'E, dead, 116–120 m (1 v, C.165175 [in part]); North West Shelf, 94 n.mls NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m (many v, C.343693); 17 v, C.165190 [in part]; North West Shelf, 110 mls N of Port Hedland, 18°46'S 119°17'E, dead, 106 m (1 v, C.343704); North West Shelf, c. 120 mls N of Port Hedland, 18°40'S 119°23'E, dead, 117 m (1 v, C.343706); North West Shelf, c. 100 mls NW of Broome, 16°58'S 120°47'E, dead, 194 m (3 v, C.343697); North West Shelf, c. 100 mls W of Cape Leveque, 16°18'S 121°40'E, dead, 69 m (1 v, C.343701); W of Broome, dead, 90 m (1 v, WAM475); North West Shelf, c. 240 mls NE of Broome, 14°37'S 123°40'E, dead, 80 m (3 v, C.343702); North West Shelf, c. 224 km N of Cape Leveque, 14°29'S 123°03'E, dead, 124 m (2 v, C.343699); Cassini Island, S side, 13°56'S 125°38'E, dead, 45–48 m (many v, WAM); Arafura Sea, Flat Top Bank, 12°16'S 129°15'E, dead, 27 m (1 v, C.343711); Timor Sea, Sahul Banks, 10°30'–12°10'S 123°30'–126°30'E, dead, 27 m (3 v, C.343712). **NORTHERN TERRITORY:** Darwin, 36 km off Point Charles, 12°10'S 130°22'E, dead, 27–37 m (3 v, C.060755); W of Gunn Point, N of Darwin Harbour, 12°10.02'S 130°49.86'E, dead, 27 m (1 v, NTM P005396 [in part]); Arafura Sea, c. 100 mls N of Croker Island, 9°30'S 132°34'E, dead, 124 m (1 v, C.343717); Arafura Sea, 91 km NE of Croker Island, 10°15'S 132°54'E, dead, 70 m (1 v, C.343719); Arafura Sea, 295 km N of Goulburn Island, 8°41'S 133°12'E, dead, 196 m (1 v, C.343718); Arafura Sea, 125 km N of Goulburn Island, 10°23'S 133°36'E, dead, 62 m (3 v, C.343720); Arafura Sea, c. 210 mls NE of Croker Island, 8°18'S 133°58'E, dead, 132 m (4 v, C.343715); Arafura Sea, c. 250 mls NE Croker Island, 8°09'S 134°50'E, dead, 115 m (5 v, C.343714); Arafura Sea, N of Wessel Islands, 8°36'S 135°08'E, dead, 82 m (1 v, C.343716); Arafura Sea, c. 200 mls NW of Wessel Islands, Amhem Land, 8°15'S 135°20'E, dead, 81 m (2 v, C.343722); Gulf of Carpentaria, Groote Eylandt, 14°0'S 136°25'E, dead (1 v, C.343723); N of Amhem Land, 10°48'S 136°30'E, dead, 50 m (1 v, C.343729); Gove Peninsula, Nhulunbuy town beach, 12°11'S



**Figure 101.** *A*, *Cryptopecten bullatus* (Dautzenberg & Bavay), specimen in Fig. 100A, C, rv exterior. *B*, *Cryptopecten nux* (Reeve), (B) specimen in Fig. 100B; rv exterior; (C) lv only, AM C.027532, syntype of *Chlamys corymbiata* Hedley, Hope Islands, N QLD, 5–10 fathoms [9–18 m]; lv exterior. *D*, *E*, *Volachlamys singaporina* (G. B. Sowerby II), specimen in Fig. 100J,L; lv exterior (D), rv exterior (E). Scale bars represent 10 mm (A–C), 30 mm (D, E).

136°47'E, dead (1 v, C.343731); N of Arnhem Land, 10°02'S 137°10'E, dead (2 v, C.343726); N of Arnhem Land, 9°49'S 137°12'E, dead (1 v, C.343725); Gulf of Carpentaria, 12°06'S 137°26'E, dead, 55 m (1 v, C.165189). —RED SEA: Gulf of Aqaba, off Wadi Murach, alive, 73–82 m (5 pr, ZMA Moll.142644). TANZANIA: Zanzibar Channel, alive, 55 m (1 pr, ZMA Moll.145578). —MAURITIUS: off Port Louis, alive, 238 m (2 pr, ZMA Moll.142641). SRI LANKA: N of Sri Lanka, Palk Strait, 10°02.5'N 80°02'E, dead, 22 m (4 v, C.160963). —THAILAND: S of Phuket Island, Koh Raya Yai, alive, 42 m (1 pr, ZMA Moll.143693). —JAPAN: Tanega-shima Island, dead, 80–100 m (10 v, ZMA Moll.144696). —CHINA: S China Sea, alive, 40 m (1 pr, ZMA Moll.142634). —PHILIPPINE ISLANDS: Davao, Samal Island, Matanos, alive, 165 m (9 pr, ZMA Moll.145093). SINGAPORE: 1°12'N 103°44'E, sand from Selat Sulong & vicinity, dead (1 v, C.343806). —INDONESIA: Kai Islands, alive, 124–850 m (2 pr, ZMA Moll.145666). —PAPUA NEW GUINEA: New Britain, 4°12'S 152°11'E, dead (2 v, C.045589); New Britain, Rabaul Harbour, Matupi Island, 4°14'S 152°12'E, dead (7 v, C.343799); Trobriand Group, Kiriwina Island, Between Magulata & Kabulina Points, 8°27'S 151°0'E, just off outer reef, dead, c. 73 m (1 v, C.160962); SW Port Moresby, Lolorua Island, 9°30'S 147°06'E, dead, 13–18 m (1 v, C.343805); Port Moresby, Manubada (Local) Island, off W end, 9°31'S 147°10'E, dead, 18–22 m (2 v, C.343804). —NEW CALEDONIA: Koumac, alive, 82–120 m (2 pr + 18 v, ZMA Moll.139672). VANUATU: off Aneityum Island, 20°16'S 169°51'E, dead, 85–100 m (2 v, C.343803); off Aneityum Island, 20°17'S 169°48'E, dead, 55–75 m (1 v, C.343802). TASMAN SEA: Lord Howe Rise, 31°34'S 159°0'E, alive, 73 m (2 pr + 2 v, C.300121); Lord Howe Rise, 31°38'S 159°03'E, dead, 44 m (2 v, C.300122).

**Description.** Shell up to c. 20 mm high, most specimens to 10–15 mm; solid, moderately to strongly inflated, right valve more convex than left, circular to subcircular, almost equivalve, equilateral to inequilateral, anterior auricles larger and longer than posterior ones, umbonal angle c. 90°; colour polychromatic, left valve more strongly pigmented; a few specimens monochrome yellow or purple.

Both valves with 18–22 evenly spaced, vesicular-sculptured radial plicae, when worn appearing more tripartite; interplical spaces bearing obvious commarginal lamellae. Auricles with 4–6 spinous radial riblets, most prominent on anterior auricle of right valve. Dorsal margin straight. Byssal notch deep, byssal fasciole moderately wide. Functional ctenolium well-developed, with 4–6 teeth. Resilifer triangular, slightly oblique. Interior weakly furrowed, internal rib carinae prominent in relatively wide zone around ventral margin. Resilial and dorsal teeth prominent.

**Dimensions.** Illustrated specimen: QLD, Turkey Beach, Rodds Bay (AM C.303782), single rv: H 18.5, L 19.0 mm. Hedley (1909: 423) stated the dimensions of a syntype of *Chlamys corymbiatus* as “Height 20; length 20; depth of single valve 7 mm”.

**Habitat.** Living in the littoral to upper bathyal zones, amongst shell rubble on sandy and/or muddy bottoms.

**Distribution.** Throughout the tropical and subtropical Indo-West Pacific, from southern Japan southwards to northern Australia, westwards into the Indian Ocean to southern Africa and into the Red Sea, and eastwards across the Pacific to French Polynesia (absent from the Hawaiian Islands) (Raines & Poppe, 2006: 314); Red Sea and Gulf of Aden, 40–73 m, alive, 71–447 m, dead (Dijkstra & Knudsen, 1998: 87; Dijkstra & Janssen, 2013: 204); South Africa, 49–64 m (Dijkstra & Kilburn, 2001: 311–312); Philippines to Australia, 13–150 m (Huber, 2010: 203); Philippines, 5–230 m (Raines, 2010: 646; Dijkstra, 2013: 100); Indonesia, 124–850 m, dead (Dijkstra & Kastoro, 1997: 275); Vanuatu, 45–153 m (Dijkstra & Maestrati, 2012: 403); Norfolk Ridge, Loyalty Islands, Solomon Islands, Fiji and Tonga, 97–120 m (Dijkstra & Maestrati, 2008: 109–110); Society Islands and Tuamotu, 96–1060 m, dead (Dijkstra & Maestrati, 2013a: 371); Austral Islands, 110–390 m, 783–1000 m (Dijkstra & Maestrati, 2010: 350–351). Maximum depth range of live-taken specimens is 5–1000 m. Present material from Australia alive at 9–110 m.

**Remarks.** *Cryptopecten nux* is highly variable in outline,

convexity, sculpture and colour (Hayami, 1984: 100; Dijkstra, 1991: 37). For further discussion see Dijkstra & Kilburn (2001: 312).

## *Haumea* Dall, Bartsch & Rehder, 1938

*Haumea* Dall *et al.*, 1938: 86. Type species (by original designation): *Haumea juddi* Dall *et al.*, 1938 (= *Pecten loxoides* G. B. Sowerby II, 1882); Recent, Hawaiian Islands.

**Diagnosis.** Small Aequipectinini of circular to prosocline shape, both valves convex, right valve the more convex in most specimens; macrosculpture of narrow, evenly spaced radial plicae and delicate, closely spaced, commarginal lamellae throughout ontogeny of most specimens; auricles relatively narrow; internal rib carinae present; hinge teeth broad and prominent, anterior resilial tooth prominent, posterior weak; byssal notch deep, ctenolium well-developed.

**Distribution.** ?Pliocene, Kenya (Cox, 1930); Pleistocene–Recent. Indo-West Pacific, living in the littoral to sublittoral zones.

**Discussion.** Hertlein (1969: N357) treated *Haumea* as a junior synonym of *Argopecten* Monterosato, 1889, a subgenus of *Chlamys*, as did Vaught (1989: 118), placed in the suprageneric *Chlamys* group by Hertlein, and in the subfamily Chlamydininae (i.e., Pedinae) by Vaught.

*Haumea* is considered here to be an extant Indo-Pacific genus, differing morphologically from the extant eastern Pacific and western Atlantic genus *Argopecten* in its smaller size, its more strongly prosocline shape (more elongate to circular in *Argopecten*), its smaller auricles, its more closely spaced interstitial commarginal lamellae, its very weak or lacking interstitial radial microsculpture (more prominent between the commarginal lamellae in *Argopecten*), its more prominent internal rib carinae, and its weaker dorsal teeth (very prominent in *Argopecten*). These characters indicate that *Haumea* is related to *Aequipecten*, *Argopecten*, and *Cryptopecten*, which are also all included in Aequipectinini (see Waller, 1991, 1993).

## *Haumea rehderi* (Grau, 1960)

Figs 87, 100D,F–I,K

*Pecten (Aequipecten) aequisulcatus* Carpenter.—Dautzenberg & Bavay, 1912: 19 (misidentification).

*Chlamys (Argopecten) rehderi* Grau, 1960: 15, pl. 2, figs 1–3. *Argopecten rehderi* (Grau).—Dijkstra, (1983–1994) 1988: 3, figs; Dijkstra, 1989: 2, 12, figs; Dijkstra *et al.*, 1989: 24; Dijkstra *et al.*, 1990: 9–10, figs; Rombouts, 1991: 8. *Chlamys (Argopecten) rehderi* Grau.—Dijkstra, 1990a: 11, pl. 2, figs 16–17.

*Haumea rehderi* (Grau).—Dijkstra, 1997: 332, figs 39–40; Dijkstra, 1998a: 44, pl. 9, figs 1–4; Raines & Poppe, 2006: 318–319, lower figs; pl. 274, fig. 2; Dijkstra, 2013: 100, pl. 21, figs 5a–b, pl. 25, figs 4a–d; Dijkstra & Maestrati, 2013a: 374.

**Type data.** Holotype (pr) USNM612201. Type locality: French Polynesia, Society Islands, Leeward Group, Bora Bora Island, Tereia Point, alive, 13–16 fathoms [24–29 m].

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Torres Strait, Darnley Island, 9°35'S 143°46'E, alive, 55 m (4 pr + 1 v, C.161025); Torres Strait, off Murray Island, 9°56'S 144°04'E, dead, 9–15 m (many v, C.161024); GBR, Low

Isles, 16°23'S 145°34'E, dead (2 v, C.161019); Palm Islands, 18°66.7'S 146°55'E, dead, 27 m (1 v, C.165161; 13 v, C.010257); Moreton Bay, off Peel Island, 27°50'S 153°35'E, dead, 9–11 m (1 v, C.165162). —SRI LANKA: off E coast, N of Kokkila, 9°21'N 80°49'E, dead, 13 m (1 v, C.161031). —THAILAND: Phuket Island, S Ko Lone, alive, 8–10 m (1 pr, ZMA Moll.146094). —INDONESIA: Makassar Strait, alive, 24 m (2 pr, ZMA Moll.142811). —SOCIETY ISLANDS: Tahiti, 17°53.3'S 149°56.7'W, dead, 29 m (2 v, C.161029). —PAPUA NEW GUINEA: New Britain, Rabaul Harbour, Matupi Island, 4°14'S 152°12'E, dead, beach grit (3 v, C.161034); SW of Port Moresby, off W side of Lolorua Island, 9°05'S 147°10.8'E, dead, 13–18 m (4 v, C.161032); Port Moresby, Fairfax Harbour, 0.5 ml off Wharf, 9°26'S 147°06'E, alive, 15–18 m (1 pr, C.161033); off Port Moresby, on sheltered NW side of Manubada Island, 9°31'S 147°10'E, dead, 23 m (1 v, C.161032). —NEW CALEDONIA: Nouméa, 22°26.7'S 166°45'E, dead (1 v, C.004333; 1 v, C.161035); Nouméa, alive, 28 m (1 pr, ZMA Moll.142802). —FIJI ISLANDS: Viti Levu, Nadi Bay, 16°57'S 178°47'E, dead, 9–35 m (11 v, C.161027; 11 v, C.161028); Viti Levu, Nadi Bay, Newtown Beach, 16°58'S 178°47'E, dead (1 v, C.161026). —SOCIETY ISLANDS: Tahiti, Papeari, alive, intertidal (1 pr, ZMA Moll.144613).

**Description.** Shell up to c. 10 mm high, most specimens smaller, to 6 mm; moderately inflated, equally convex, subcircular to circular, almost equivalve and equilateral, umbonal angle c. 95°; colour polychromatic, maculated with streaks and/or blotches, right valve paler.

Both valves sculptured with 18–23 narrow, evenly spaced, high, rounded radial plicae bearing weak commarginal lamellae. Each interplacal space equal in width to one plica, bearing prominent commarginal lamellae. Anterior auricle of left valve bearing 5–7 imbricate radial riblets, more prominent than on posterior auricle, weaker and more lamellose on posterior auricle. Anterior auricle of right valve with 4 strongly imbricate riblets. Byssal notch moderately deep, byssal fasciole narrow. Functional ctenolium well-developed, with 5–6 teeth. Interior of valves weakly furrowed, internal rib carinae prominent in narrow zone around ventral margin. Anterior resillial and dorsal teeth prominent, posterior teeth weak.

**Habitat.** Living in the littoral to sublittoral zones, amongst coral rubble or shell grit on soft bottoms (sand and/or mud).

**Distribution.** Tropical Indo-West Pacific, from the Philippines southwards to northern Australia, westwards to Sri Lanka, and eastwards into the Pacific to French Polynesia. Not recorded from the western Indian Ocean, northwestern Pacific (Japan) or the Hawaiian Islands (Raines & Poppe, 2006: 318); Philippines, 2–123 m, dead (Dijkstra, 2013: 101); Papua New Guinea, 30–36 m (Dijkstra, 1998a: 44); Vanuatu, 3–12 m (Dijkstra & Maestrati, 2012: 403–404); Society Islands, 24–29 m, alive, 32–38 m, dead (Dijkstra & Maestrati, 2013a: 374). Maximum depth range of live-taken specimens is from the intertidal zone to 60 m (Dijkstra, 2013: 101). Present material from Australia alive at 55 m.

**Remarks.** This species is a **new record** for Australia. The present specimens from Australia are indistinguishable from the type material.

*Haumea rehderi* can easily be confused with juveniles of the equal-sized, congeneric species *Haumea minuta* (Linnaeus, 1758), more generally known as *Haumea inaequalis* (G. B. Sowerby II, 1842), occurring in the tropical Indo-West Pacific. The two species can be distinguished by the convexity of the left valve (*Haumea rehderi* moderately inflated, *H. minuta* almost flat), the size of the anterior auricle of the right valve (*H. rehderi* has a much larger auricle with a deeper byssal notch), the radial sculpture of the right valve (*H. rehderi* has narrower plicae with wider interplacal spaces than *H. minuta*), and their colour (*H. rehderi* is much more polychromatic; most specimens of *H. minuta* are brown or maculated black on the left valve and white on the right valve).

## *Serratovola Habe, 1951*

*Serratovola Habe*, 1951: 81. Type species (by original designation): *Pecten tricarinatus* Anton, 1838 (junior primary homonym of *P. tricarinatus* DeFrance, 1825) (= *Pecten rubicundus* Récluz in Chenu, 1843); living, China.

**Diagnosis.** Aequipectinini with an almost flat to somewhat concave left valve and convex right valve, mimicking the shape of *Pecten*; subcircular, inaequivalve, slightly inaequilateral, auricles unequal in shape and almost equal in size, radial macrosculpture of solid or hollow segmented plicae, byssal notch and ctenolium rudimentary in late ontogeny. Internal rib carinae prominent near ventral margin. Resillial and dorsal teeth weak.

**Distribution.** Pliocene–Recent (Hayami, 1989: 16). Indo-West Pacific, living from the intertidal zone to the continental shelf.

**Discussion.** Habe (1951) introduced *Serratovola* as an extant genus, but Hertlein (1969: N367) considered it to be a synonym of *Pecten*. *Serratovola* differs from *Pecten* by its much smaller size, its subcircular shape, its less equal auricles, and the hollow sections in the radial plicae. It also has a pattern of commarginal lamellae in early ontogeny that is closely similar to that of *Aequipecten* species, and distinct from those of any Pectinini. T. R. Waller has advised us that in his opinion, based on its early microsculpture, *Serratovola* is a member of Aequipectinini convergent on the adaptive form of *Pecten*, and we follow his opinion. Therefore, we now recognize that the sediment-settling habit and consequent plano-convex shell form characteristic of *Pecten* (Pectinini) is also found in Mimachlamyidini (*Mimivola*) and Aequipectinini (*Serratovola*). This reveals yet again the confusing, convergent adult shell forms of Pectinidae and the need for careful evaluation of phylogeny based on as many characters as possible.

## *Serratovola pallula* Dijkstra, 1998

Figs 59A–B, 61A,G, 102

*Serratovola pallula* Dijkstra, 1998a: 28, pl. 4, figs 1–6; Raines & Poppe, 2006: 174, 177, upper figs; pl. 122, figs 1–2; Dijkstra, 2008: 60.

**Type data.** Holotype (pr) KBIN 25.955.471. Type locality: Papua New Guinea, Hansa Bay, S of Duangit, 60 m.

**Additional material examined.** —AUSTRALIA: QUEENSLAND: Gulf of Carpentaria, alive (1 pr, QM MO.33655); N Gulf of Carpentaria, 10°05.2'S 139°28.5'E, dead, 37 m (2 v, C.165214); N Gulf of Carpentaria, 10°51'S 139°32'E, dead, 55 m (1 v, C.165213); N Gulf of Carpentaria, 11°00.5'S 140°27'E, dead, 59 m (1 v, C.165211); N Gulf of Carpentaria, 11°15'S 140°29'E, dead (1 v, C.165215); N Gulf of Carpentaria, 12°05'S 139°19.5'E, dead, 62 m (1 v, C.165208); N Gulf of Carpentaria, 12°15.83'S 141°03.33'E, dead (2 v, C.165210); E Gulf of Carpentaria, 13°10.5'S 140°35'E, dead, 64 m (1 v, C.165185); Gulf of Carpentaria, 14°09.35'S 139°40.8'E, dead, 61 m (1 v, C.165188); Gulf of Carpentaria, 14°51'S 139°47'E, dead, 66 m (1 v, C.165187); S Gulf of Carpentaria, 15°12.5'S 140°31.5'E, dead, 55 m (1 v, C.165183). WESTERN AUSTRALIA: off Onslow, c. 10 ml NNW of Anchor Island, 21°38'S 115°07'E, dead, 119 m (2 v, WAM 547.91); off Onslow, 9 ml N of Onslow, 21°30'S 115°07'E, dead, 77 m (3 v, WAM 545.91); off Onslow, 20 ml NW of Anchor Island, 21°38'S 115°07'E, dead, 119 m (2 v, WAM 548.91); off Barrow Island, 20°98'S 114°90'E, 100–150 m, dredged alive by shrimp boats (1 pr, HM); off Onslow, 7 ml N of Long Island, 20°55'S 115°51'E, dead, 51 m (1 v, WAM 546.91); W of North West Cape, 21°50'S 113°46'E, dead, 137 m (1 v, WAM 549.91); 65 ml NE of Adele Island, 14°51'S 123°50'E, dead, 73 m (2 v, WAM 550.91); c. 200 ml ENE of Troughton Island, 12°39'S 128°53'E, dead, 64 m (1 v, WAM 551.91); W of Broome, 17°58'S 122°14'E, dead, 90 m (1 v, WAM 476.91); 45 n.ml NW of Port Hedland, 19°55.2'–19°55.6'S 117°56.0'–117°55.6'E, dead, 40 m (1 v, C.165174 [in part]); 67 n. miles NNE of Cape Lambert, 19°31.4'–19°29.9'S 117°26.0'–117°26.4'E, dead, 78 m (1 v, WAM S12562); North West Shelf, 19°28.9'–19°29.0'S 116°29.4'–116°29.0'E, alive, 110 m (2 pr, C.165231; many v, C.165181 [in part]); 1 v, C.165176, 2 v, C.165194; 16 v, C.165186);

Key to species of *Serratovola* from Australia

- 1 Shell c. 17 mm high, lv slightly concave, rv strongly convex, 19–20 broad angular radial plicae, interspaces narrow on lv, functional ctenolium weak ..... *S. pallula*
- Shell with flat lv, small angular plicae, equal interspaces ..... 2
- 2 Shell c. 35 mm high, lv flat, rv convex, 17–19 small angular radial plicae on lv, interspaces equal to or wider than plicae, ctenolium lacking ..... *S. rubicunda*

77 n.ml NNE of Port Hedland, 19°05'–19°04.9'S 118°58'–118°58.2'E, dead, 82 m (1 v, C.149918); 80 n.ml NNE of Port Hedland, 19°03.6'–19°03.4'S 119°03.4'–119°03.5'E, dead, 82 m (many v, C.147417); 85 n.ml NNW of Port Hedland, 19°00.8'S 118°01.3'E, dead, 112 m (7 v, C.165191; 2 v, C.165177 [in part]); 85 n.ml NNW of Port Hedland, 19°00.4'–19°00.3'S 118°01.0'–118°01.1'E, dead, 116–120 m (1 v, C.165204 [in part]; 1 v, C.165175 [in part]); 94 n.ml NNE of Port Hedland, 18°48'S 119°0'E, dead, 92–94 m (many v, C.165190 [in part]); c. 120 ml N of Cape Leveque, 14°46'S 123°15'E, dead, 106 m (2 v, C.165196). **NORTHERN TERRITORY:** Arafura Sea, c. 110 ml N of Melville Island, 9°34'S 131°22'E, dead, 135 m (1 v, C.165179); 100 km NE of Melville Island, 10°22.5'S 131°37'E, dead, 71 m (2 v, C.165180); Arafura Sea, c. 95 ml N of Cobourg Peninsula, 9°45'S 132°04'E, dead, 108 m (3 v, C.165182); Arafura Sea, c. 100 n.ml N of Croker Island, 9°30'S 132°34'E, dead, 124 m (many v, C.165199); Arafura Sea, c. 45 ml N of Croker Island, 10°17'S 132°38'E, dead, 65 m (17 v, C.165200); 67 km NE of Croker Island, 10°36'S 132°56.5'E, dead, 62 m (2 v, C.165202); 180 km N of Croker Island, 9°24'S 133°02'E, dead, 125 m (4 v, C.165201); 86 km NE of Croker Island, 10°25'S 133°05'E, dead, 66 m (1 v, C.165193); 68 km NE of Croker Island, 10°39'S 133°05'E, dead, 62 m (4 v, C.165203); 125 km N of Goulburn Island, 10°23'S 133°36'E, dead, 62 m (4 v, C.165172); 91 km N of Goulburn Island, 10°42'S 133°36'E, dead, 58 m (2 v, C.165169); 230 km N of Goulburn Island, 9°18'S 133°38'E, dead, 135 m (1 v, C.165173); 41 km NE of Goulburn Island, 11°10.5'S 133°43'E, dead, 47 m (4 v, C.165170); c. 60 ml NE of Goulburn Islands, 11°08'S 134°18.5'E, dead, 50 m (3 v, C.165171); N of Arnhem Land, c. 200 ml NW of Wessel Islands, 8°26'S 135°22'E, dead, 75 m (3 v, C.165197); c. 250 ml NE of Croker Island, 9°11'S 135°43'E, dead, 60 m (2 v, C.165192); N of Arnhem Land, 8°57.1'S 135°52.4'E, dead (1 v, C.165207); N of Arnhem Land, 10°46.5'S 136°05'E, dead, 49 m (2 v, C.165205); N of Arnhem Land, 10°50'S 137°10'E, dead, 59 m (3 v, C.165206); NW Gulf of Carpentaria, 11°0'S 137°25'E, dead, 55 m (1 v, C.165195); NW Gulf of Carpentaria, 10°68.0'S 137°42.50'E, alive, 46 m (1 pr, NTM P009987); N Gulf of Carpentaria, 11°30'S 140°26'E, dead, 65 m (1 v, C.165212).

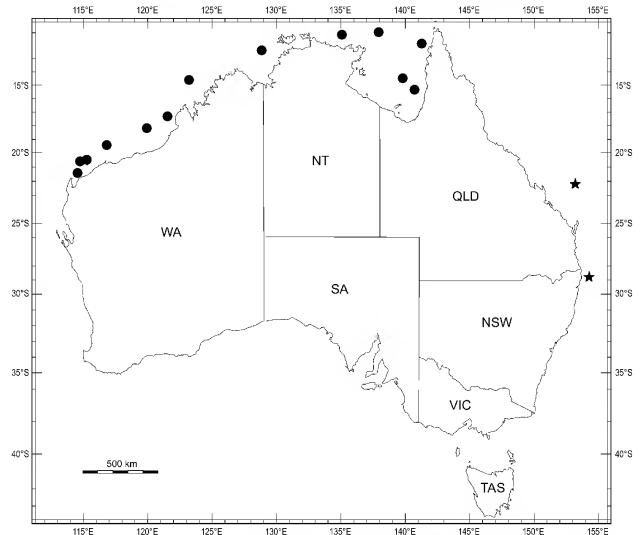
**Description.** Shell up to 17 mm high, inequivalve, equilateral, left valve concave, right valve strongly inflated, auricles almost equal in size. Left valve dotted cream-brown on brown, right valve uniform creamy-white.

Left valve with 19 broad, angulate radial plicae, interstices narrow near ventral margin. In early dissoconch stage exterior smooth apart from a few commarginal growth lines. Radial plicae with fine interstitial commarginal lamellae commence c. 1.5 mm below umbo. On central disc, hollow sections are formed on both sides of radial plicae, and interstices form narrow grooves. Approximately 5 mm above ventral margin of adults interstices become narrower, diverging near margin, bearing commarginal lamellae. Anterior auricle somewhat longer (7.8 mm in adults) than posterior one (6.4 mm). Both auricles with delicate commarginal lamellae and a few weak radial riblets, the latter more prominent near anterior disc margin. Dorsal margin straight. Outer ligament dark brown.

Right valve with 20 radial plicae with somewhat rounded crests, more angulate near periphery than near umbo; similar to those of left valve. Interstices wider than on left valve, with commarginal lamellae throughout. Auricles with weak radial riblets and closely spaced, irregular commarginal lamellae, continuing over radial riblets. Dorsal margin straight, with fine spines projecting dorsally. Byssal notch shallow. Functional ctenolium present, of only one tooth. Hinge teeth weak. Internal rib carinae prominent near ventral margin.

**Dimensions.** Illustrated specimen: WA, northwest shelf, 72 nautical miles NNW of Dampier, 110 m (AMC.165231); rv: H 17.6, L 17.7 mm; lv: H 17.4, L 17.7 mm; D 5.6 mm.

**Habitat.** Living free (not byssally attached) on soft sand or muddy sand in shallow waters, out to the continental shelf.



**Figure 102.** Distribution of *Serratovola pallula* Dijkstra (circles) and *S. rubicunda* (Récluz) (stars).

**Distribution.** Papua New Guinea and tropical northern Australia. Depth range of present live-taken specimens is 46–110 m (minimum depth range). Now also known from northern Queensland, the Northern Territory and northern Western Australia.

**Remarks.** *Serratovola pallula* is a **new record** for Australia. The present specimens from northwestern, northern and northeastern Australia are slightly different from the type specimens, having somewhat narrower, angular radial plicae and slightly broader radial interspaces on the left valve. Other morphological characters are identical.

*Serratovola rubicunda* (Récluz in Chenu, 1843)

Figs 59C,F, 61D, 102

*Pecten tricarinatus* Anton, 1838: 19 (junior primary homonym of *Pecten tricarinatus* DeFrance, 1825); Philippi, 1845: 99, pl. 1, fig. 4; Küster & Kobelt, 1888: 80, pl. 20, fig. 4; Dautzenberg & Bavay, 1912: 3; Bernard *et al.*, 1993: 52; Dijkstra, 1998a: 29, pl. 4, figs 7–8 (lectotype).

*Pecten asper* G. B. Sowerby II, 1842: 50, pl. 19, figs 196–197; Reeve, 1852: sp. 10, pl. 2, fig. 10 (junior primary homonym of *Pecten asper* Lamarck, 1819).

*Pecten rubicundus* Récluz in Chenu, 1843: 3, pl. 7, figs 4–5 (replacement name for *Pecten asper* Sowerby).

*Pecten passerinus* Hinds, 1845: 61 (replacement name for *P. asper* Sowerby).

*Pecten (Vola) asper* Sowerby.–Küster & Kobelt, 1888: 238, pl. 63, figs 2–3.

*Pecten (Serratovola) tricarinatus* Anton.–Kira, 1967: 136, pl. 49, fig. 5; Koyama *et al.*, 1981: 70; Dharma, 2005: 250, pl. 100, fig. 12.

- Serratovola tricarinata* (Anton).—Abbott & Dance, 1982: 304, fig.
- Serratovola aspera* [sic] (Sowerby).—Springsteen & Leobrera, 1986: 326, pl. 93, fig. 4.
- Serratovola tricarnatus* [sic] (Anton).—Wang, 1989: 181, pl. 1, figs 3–4.
- Serratovola rubicunda* (Récluz in Chenu).—Dijkstra, 1998: 29, pl. 4, figs 7–8; Raines & Poppe, 2006: 176–177, lower figs; pl. 123, figs 1–2; Dijkstra & Maestrati, 2008: 110, figs 46–47; Huber, 2010: 197; Raines, 2010: 616, pl. 999, figs 4–5; Dijkstra, 2013: 55, pl. 15, figs 2a–d, pl. 17, figs 4a–b, pl. 27, figs 4a–b.
- Serratovola passerina* (Hinds).—Hayami, 2000: 909, pl. 452, fig. 53; Xu & Zhang, 2008: 91, fig. 261.
- Serratovola tricarnatus* [sic] (Anton).—Wang, 2002: 241.
- Serratovola asper* (Sowerby).—Wang, 2002: 242, fig. 101.

**Comments on synonymy.** Anton (1838) overlooked *Pecten tricarinatus* DeFrance, 1825, a fossil pectinid from the environs of Rome, which has nomenclatural priority.

Sowerby's (1842) species name *Pecten asper* also was preoccupied by Lamarck (1819) for a fossil pectinid (see also ICZN, 1954: Opinion 311).

Récluz (1843) and Hinds (1845) both introduced new replacement names for *Pecten asper* Sowerby (*Pecten rubicundus* and *Pecten passerinus*, respectively). Récluz's name, *Pecten rubicundus*, has priority and should be used for the present species.

**Type data.** *Pecten tricarinatus* Anton: lectotype (pr) SMTD6937, designated by Dijkstra (1998a: 29), figured in Dijkstra (2008: 59, figs 19–24). Type locality: China.

*Pecten asper* Sowerby: possible syntypes (7 pr) NHMUK20080065, figured in Dijkstra (2008: 59, figs 13–18). Type locality: "New Guinea".

**Comments on type data.** A sample with possible type specimens of *Pecten asper* Sowerby from "New Guinea" is in the NHMUK general collection. This material was part of the Mrs de Burgh (d. 1880) collection. One of the specimens matches the measurements given in the original description and also resembles Reeve's figure, and seems likely to be a syntype. However, Reeve (1852) did not indicate that his illustrated specimen was from the de Burgh collection (pers. comm. K. M. Way).

**Additional material examined.** —AUSTRALIA: QUEENSLAND: SE of Swain Reefs, 22°31.4'S 152°32.6'E, dead, 100 m (many v, C.151488; 15 v, C.165198). NEW SOUTH WALES: ENE of Danger Point, 28°04'–27°59'S 153°50'E, dead, 137–146 m (1 v, C.116432); E of Tweed Heads, 28°11'–28°14'S 153°50'E, dead, 146 m (1 v, C.310685). —CHINA: off Guangdong, alive, 10–100 m (1 pr, ZMA Moll.145740). TAIWAN: SW of Taiwan, alive, 40 m (4 pr, ZMA Moll.140566). —PHILIPPINE ISLANDS: Bohol, alive, 100–120 m (1 pr, ZMA Moll.142737). —INDONESIA: off Bali, alive, 140 m (1 pr, ZMA Moll.142738).

**Description.** Shell up to c. 35 mm high, circular, inequivalve, equilateral, left valve flat or very weakly inflated, right valve

convex, auricles almost equal in size, unequal in shape; umbonal angle c. 115°; internal rib carinae short, prominent near ventral margin; hinge teeth weak; left valve with numerous red dots and/or streaks, right valve paler or whitish.

Left valve sculptured with 17–18 evenly spaced radial plicae of angular section (with sloping sides and narrow crests), solid or with hollow sections laterally. Each interspace slightly wider than one plica; interspaces bearing widely spaced commarginal lamellae; more closely spaced lamellae present on plicae late in ontogeny. Posterior auricle slightly larger and closely similar in shape to anterior one, both with similar sculpture of closely spaced commarginal lamellae and a few very weak radial ridges.

Right valve with 18–19 evenly spaced radial plicae, angular in section in early growth stage but with more rounded crests in late ontogeny, with similar microsculpture to left valve. Byssal notch very shallow, functional ctenolium lacking.

**Dimensions.** Illustrated specimen: QLD, S of Swain Reefs, 100 m, two unmatched valves (AM C.151488); rv: H 32.8, L 34.9 mm; lv: H 35.1, 37.5 mm.

**Habitat.** Living rarely in shallow waters, more frequently on the continental shelf, on soft sediment (sand and/or mud).

**Distribution.** Indo-West Pacific, Philippine Islands, Borneo, South and East China Sea, Taiwan, Xisha Islands to Honshu, Japan, 10–100 m (Bernard *et al.*, 1993: 52); Papua New Guinea, 45–100 m (Dijkstra, 1998a: 29); Solomon Islands, 191–381 m, dead; Fiji, 80–120 m; and Tonga, 79–82 m (Dijkstra & Maestrati, 2008: 111). Maximum depth range of live-taken specimens is c. 10–150 m, occurs generally on the outer continental shelf. Now also known from Queensland and New South Wales. Present material dead at 100–146 m.

**Remarks.** *Serratovola rubicunda* is a **new record** for Australia. The present material from Queensland and New South Wales is identical to *Serratovola rubicunda* in all characters. In the literature, *Serratovola* species from the Indo-West Pacific are often misidentified or references are mixed. For distinctions between the different species see Table 9.

*Serratovola angusticostata* Dijkstra, 2008, from Taiwan, the Philippine Islands, Indonesia and Papua New Guinea, has often been confused with *S. rubicunda* in the literature (see Dijkstra, 2008: 60). For morphological differences between the two species see Table 9 (below) and Dijkstra (2008: 62). *Serratovola gardineri* (Smith, 1903), from the northern Indian Ocean, differs from the present species by having angulated radial ribs (Dijkstra, 2008: 58, figs 5–6) with closely spaced commarginal lamellae on both valves (*S. rubicunda* more simply rounded) (Dijkstra, 2013: pl. 15, figs 2a–c).

**Table 9.** Characters distinguishing *Serratovola* species.

species	<i>S. rubicunda</i>	<i>S. gardineri</i>	<i>S. angusticostata</i>	<i>S. pallula</i>
inflation lv	flat	flat	flat	concave
inflation rv	convex	convex	convex	strongly convex
radial sculpture lv	rather broad	broad	very narrow	very broad
radial sculpture rv	solid rounded	angulate	tricarinate	angulate
interspaces lv	rather broad	narrow	very wide	very narrow
interspaces rv	rather broad	narrow	broad	rather broad
colour	red maculations	creamy	uniform brownish	creamy
distribution	Indo-West Pacific	N Indian Ocean	W Pacific	N Australia



**Table 10.** Distribution and main synonyms of Australian pectinoideans. Abbreviations (arranged clockwise around Australia from Queensland around to the Arafura Sea): QLD—Queensland; CS—Coral Sea; NSW—New South Wales; VIC—Victoria; TS—Tasman Sea (includes Norfolk and Lord Howe Islands, Middleton Reef); TAS—Tasmania; SA—South Australia; WA—Western Australia; TIS—Timor Sea; NT—Northern Territory; AS—Arafura Sea; and NR—new records for Australia.

taxa	QLD	CS	NSW	VIC	TS	TAS	SA	WA	TIS	NT	AS	NR	synonyms
<b>PROPEAMUSSIIDAE</b>													
<i>Propeamussium alcocki</i>	●	●	—	—	●	—	—	●	—	—	●	5	—
<i>Propeamussium caducum</i>	—	—	●	—	—	—	—	●	—	—	—	2	●
<i>Propeamussium investigatoris</i>	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Propeamussium meridionale</i>	—	●	—	—	●	—	—	—	—	—	—	2	—
<i>Propeamussium sibogai</i>	—	—	—	—	—	—	—	—	●	—	●	2	—
<i>Propeamussium siratama</i>	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Propeamussium watsoni</i>	●	●	●	—	—	—	—	—	—	—	—	3	●
<i>Parvamussium araneum</i>	●	—	—	—	—	—	—	—	—	—	—	1	●
<i>Parvamussium cancellorum</i>	—	—	●	—	—	—	—	—	—	—	—	1	●
<i>Parvamussium conspectum</i>	●	—	—	—	—	—	—	—	—	—	—	1	●
<i>Parvamussium lamprelli</i> sp. nov.	●	—	—	—	—	—	—	—	—	—	—	1	●
<i>Parvamussium maorium</i>	—	—	●	●	●	●	—	—	—	—	—	4	●
<i>Parvamussium multiliratum</i>	●	●	—	—	●	—	—	—	—	—	—	3	●
<i>Parvamussium pauciliratum</i>	●	●	—	—	—	—	—	—	—	—	—	2	●
<i>Parvamussium retiolum</i>	●	●	—	—	—	—	—	●	—	—	—	3	●
<i>Parvamussium scitulum</i>	●	●	●	—	●	—	—	●	—	●	—	6	—
<i>Parvamussium slacksmithae</i> sp. nov.	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Parvamussium squalidulum</i>	●	●	●	—	—	—	—	●	—	—	—	4	●
<i>Parvamussium thetidis</i>	●	●	●	●	●	●	●	●	—	●	—	9	—
<i>Parvamussium torresi</i>	●	●	—	—	—	—	—	●	—	—	—	3	—
<i>Parvamussium vesiculatum</i>	—	●	—	—	●	—	—	—	—	—	—	2	—
<i>Parvamussium whissoni</i> sp. nov.	—	—	—	—	—	—	—	●	—	—	—	1	●
<i>Cyclopecten cancellus</i>	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Cyclopecten horridus</i>	●	●	—	—	●	—	—	—	—	—	—	3	●
<i>Cyclopecten kapalae</i>	●	—	●	●	●	●	●	●	—	—	—	7	—
<i>Cyclopecten powelli</i>	—	—	—	—	—	—	—	●	—	—	—	1	●
<i>Cyclopecten reticulatus</i> sp. nov.	—	●	—	—	—	—	—	—	—	—	—	1	—
<i>Similipecten colmani</i> sp. nov.	●	—	—	—	—	—	—	●	—	●	—	3	●
<i>Catillopecten murrayi</i>	—	●	—	—	●	—	—	—	—	—	—	2	—
<i>Catillopecten tasmani</i>	—	—	●	—	●	—	—	—	—	—	—	2	●
<b>CYCLOCHLAMYDIDAE</b>													
<i>Cycloclamys nepeanensis</i>	●	—	●	—	—	—	—	—	—	—	—	2	—
<i>Chlamydella favus</i>	●	—	●	●	—	●	●	●	—	—	—	6	—
<b>PECTINIDAE</b>													
<i>Hyalopecten ponderi</i> sp. nov.	—	●	—	—	—	—	—	—	—	—	—	1	—
<i>Delectopecten alcocki</i>	●	●	—	—	—	—	—	●	—	—	—	3	●
<i>Delectopecten fosterianus</i>	●	—	●	●	●	—	●	●	—	—	—	6	●
<i>Delectopecten musorstomi</i>	●	—	—	—	●	—	—	—	—	—	—	2	●
<i>Palliolium minutulum</i>	●	—	—	—	—	—	—	—	—	—	—	1	—
<i>Pseudamussium challengerii</i>	—	—	●	●	●	—	●	●	—	—	—	5	—
<i>Mesopeplum fenestratum</i>	●	—	●	●	—	—	●	●	—	—	—	5	—
<i>Anguipecten picturatus</i>	●	●	—	—	—	—	—	—	—	—	—	2	●
<i>Anguipecten simoneae</i>	—	—	—	—	—	—	—	●	—	—	—	1	—
<i>Anguipecten superbus</i>	—	—	—	—	—	—	—	●	—	—	—	1	●
<i>Bractechlamys oweni</i>	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Bractechlamys vexillum</i>	●	—	—	—	—	—	—	—	—	—	—	1	—
<i>Decatopecten radula</i>	●	—	—	—	—	—	—	●	—	●	—	3	—
<i>Decatopecten strangei</i>	●	—	●	—	—	—	—	●	—	●	—	4	—
<i>Excellichlamys spectabilis</i>	●	—	—	—	—	—	—	●	—	—	—	3	—
<i>Glorichlamys elegantissima</i>	●	—	—	—	—	—	—	●	—	—	—	2	—
<i>Glorichlamys quadrilirata</i>	●	—	—	—	—	—	—	●	—	●	—	3	●
<i>Gloripallium pallium</i>	●	●	—	—	—	—	—	●	—	●	—	4	—
<i>Juxtamussium coudeini</i>	●	●	—	—	—	—	—	—	—	—	—	2	—
<i>Juxtamussium maldivense</i>	●	—	—	—	—	—	—	●	—	—	—	2	●
<i>Mirapecten mirificus</i>	—	●	—	—	—	—	—	—	—	—	—	1	—
<i>Mirapecten moluccensis</i>	—	—	—	—	—	—	—	●	—	—	—	1	●
<i>Mirapecten rastellum</i>	●	●	—	—	—	—	—	●	—	—	—	3	—
<i>Ylistrum balloti</i>	●	●	●	—	—	—	—	●	—	—	—	4	—
<i>Amusium pleuronectes</i>	●	—	●	—	—	—	—	—	—	●	—	3	—
													<i>pleuronectes australiae</i>

Continued on next page

Table 10. (Continued).

taxa	QLD	CS	NSW	VIC	TS	TAS	SA	WA	TIS	NT	AS	NR	synonyms	
<i>Amachlamys flabellata</i>	●	—	●	—	—	—	—	●	—	●	—	4	—	<i>leopardus</i>
<i>Amachlamys iredalei</i>	—	—	—	—	●	—	—	—	—	—	—	1	—	—
<i>Amachlamys kuhnholtzi</i>	—	●	●	—	●	—	—	—	—	—	—	4	—	<i>leopardus rena</i>
<i>Amachlamys reevei</i>	●	—	—	—	—	—	—	●	—	—	—	2	●	—
<i>Minnivola pyxidata</i>	●	—	—	—	—	—	—	●	—	●	—	3	—	<i>isomeres</i>
<i>Pecten fumatus</i>	●	—	●	●	●	●	●	●	—	—	—	7	—	<i>albus / meridionalis</i>
<i>Pecten dijksrai</i>	—	—	—	—	—	—	—	●	—	—	—	1	—	—
<i>Serratovola pallula</i>	●	—	—	—	—	—	—	●	—	●	—	3	●	—
<i>Serratovola rubicunda</i>	●	—	●	—	—	—	—	—	—	—	—	2	●	<i>asper</i>
<i>Complicachlamys wardiana</i>	●	—	—	—	—	—	—	●	—	●	—	3	—	—
<i>Coralichlamys madreporarum</i>	●	—	—	—	—	—	—	●	—	●	—	3	—	—
<i>Equichlamys bifrons</i>	—	—	—	●	—	●	●	●	—	—	—	4	—	—
<i>Hemipecten forbesianus</i>	●	●	—	—	—	—	—	●	—	—	—	3	—	—
<i>Laevichlamys andamanica</i>	●	●	—	—	—	—	—	—	—	—	—	2	●	<i>perfecta</i>
<i>Laevichlamys cuneata</i>	●	●	—	—	—	—	—	●	—	●	—	4	—	<i>irregularis</i>
<i>Laevichlamys deliciosa</i>	●	●	—	—	—	—	—	●	—	—	—	3	—	—
<i>Laevichlamys limatula</i>	●	—	—	—	—	—	—	●	—	—	—	2	—	—
<i>Laevichlamys mollita</i>	●	—	—	—	—	—	—	—	—	—	—	1	—	—
<i>Laevichlamys squamosa</i>	●	●	—	—	—	—	—	●	—	●	—	4	—	—
<i>Laevichlamys wilhelminae</i>	●	●	—	—	—	—	—	—	—	—	—	2	—	—
<i>Notochlamys hexactes</i>	—	—	●	●	—	●	●	●	—	—	—	5	—	<i>anguinea / tasmanica</i>
<i>Paschaminites coruscans</i>	●	●	—	—	●	—	—	●	—	—	—	4	—	—
<i>Pedum spondyloideum</i>	●	—	—	—	—	—	—	●	—	—	—	2	—	—
<i>Scaechlamys livida</i>	●	—	●	●	—	—	●	●	—	—	—	5	—	—
<i>Scaechlamys squamea</i>	●	—	—	—	—	—	—	●	—	●	—	3	—	—
<i>Semipallium aktinos</i>	●	—	●	●	—	●	●	●	—	—	—	6	—	—
<i>Semipallium dianae</i>	●	—	—	—	—	—	—	●	—	—	—	2	●	—
<i>Semipallium dringi</i>	●	—	—	—	—	—	—	●	—	—	—	2	—	<i>kengaluorum</i>
<i>Semipallium flavicans</i>	●	●	—	—	—	—	—	●	—	—	—	3	—	<i>tigris</i>
<i>Semipallium fulvicostatum</i>	●	—	—	—	●	—	—	●	—	—	—	3	—	—
<i>Semipallium hallae</i>	—	—	—	—	—	—	●	—	—	—	—	1	—	—
<i>Talochlamys pulleineana</i>	●	—	●	●	—	●	●	●	—	—	—	6	—	—
<i>Veprichlamys perillustris</i>	—	—	●	●	—	●	●	—	—	—	—	4	—	—
<i>Zygochlamys delicatula</i>	—	—	●	●	—	●	—	—	—	—	—	3	—	—
<i>Mimachlamys albolineata</i>	●	—	—	—	—	—	—	—	—	—	—	1	●	—
<i>Mimachlamys asperrima</i>	●	—	●	●	—	●	●	●	—	—	—	6	—	—
<i>Mimachlamys cloacata</i>	●	●	—	—	—	—	—	●	—	●	—	4	—	—
<i>Mimachlamys funebris</i>	—	—	—	—	—	—	—	●	—	—	—	1	—	—
<i>Mimachlamys gloriosa</i>	●	—	●	—	●	—	—	●	—	●	—	5	—	<i>subgloriosa</i>
<i>Mimachlamys heterophyseta</i>	—	—	—	—	—	—	—	●	—	—	—	1	—	—
<i>Mimachlamys punctata</i>	●	●	—	—	—	—	—	●	—	●	—	4	—	<i>lentiginosa</i>
<i>Mimachlamys sanguinea</i>	●	—	—	—	●	—	—	—	—	—	—	2	—	<i>senatoria</i>
<i>Mimachlamys scabricostata</i>	—	—	—	—	—	—	—	●	—	●	—	2	—	—
<i>Mimachlamys spinicostata</i> sp. nov.	—	—	—	—	—	—	—	●	—	—	—	1	—	<i>australis</i> Sow.
<i>Cryptopecten bullatus</i>	—	●	●	—	●	—	—	—	—	●	—	4	●	—
<i>Cryptopecten nux</i>	●	—	●	—	●	—	—	●	—	●	—	5	—	—
<i>Haumea rehderi</i>	●	—	—	—	—	—	—	—	—	—	—	1	●	—
<i>Volachlamys singaporina</i>	●	—	—	—	—	—	—	●	—	●	—	3	—	<i>cumingii</i>
total species	76	35	31	16	23	12	15	68	1	22	2	—	37	

**Table 11.** Depth ranges of Australian pectinoideans. Symbols: ●—live specimens; ×—dead specimens.

taxa	<	100	200	300	400	500	600	700	800	1000	1200	1400	1600	1800	2000	>
<b>PROPEAMUSSIIDAE</b>																
<i>Propeamussium alcocki</i>	—	—	—	—	●	—	×	×	●	●	●	—	—	—	—	—
<i>Propeamussium caducum</i>	—	—	—	—	—	×	●	●	—	—	—	—	—	—	—	—
<i>Propeamussium investigatoris</i>	—	—	—	●	●	—	—	—	—	—	—	—	—	—	—	—
<i>Propeamussium meridionale</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●
<i>Propeamussium sibogai</i> (depth unknown)																
<i>Propeamussium siratama</i>	—	—	×	×	●	—	—	—	—	—	—	—	—	—	—	—
<i>Propeamussium watsoni</i>	—	—	—	—	—	—	—	—	●	●	—	—	—	—	—	—
<i>Parvamussium araneum</i>	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium cancellorum</i>	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium conspectum</i>	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium lamprelli</i> sp. nov.	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—
<i>Parvamussium maorium</i>	—	×	×	×	●	×	×	●	×	—	—	—	—	—	—	●
<i>Parvamussium multiliratum</i>	—	—	—	—	×	×	×	—	—	—	●	—	—	—	—	●
<i>Parvamussium pauciliratum</i>	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium retiolum</i>	×	×	×	—	●	×	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium scitulum</i>	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium slacksmithae</i> sp. nov.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium squalidulum</i>	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium thetidis</i>	×	●	●	●	●	●	●	●	●	●	—	—	—	—	—	—
<i>Parvamussium torresi</i>	×	×	×	×	●	●	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium vesiculatum</i>	—	—	●	●	—	—	—	—	—	—	—	—	—	—	—	—
<i>Parvamussium whissoni</i> sp. nov.	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—
<i>Cyclopecten cancellus</i>	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cyclopecten horridus</i>	—	●	●	●	●	—	—	—	—	—	—	—	—	—	—	—
<i>Cyclopecten kapalae</i>	—	—	—	—	—	●	●	●	●	●	●	●	●	●	—	—
<i>Cyclopecten powelli</i>	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—
<i>Cyclopecten reticulatus</i> sp. nov.	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●
<i>Similipecten colmani</i> sp. nov.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Catillopecten murrayi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●
<i>Catillopecten tasmani</i>	—	—	—	—	—	—	—	—	—	●	—	—	—	—	—	—
<b>CYCLOCHLAMYDIDAE</b>																
<i>Cyclochlamys nepeanensis</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Chlamydella favus</i>	●	●	×	—	●	×	—	—	—	●	—	—	—	—	—	—
<b>PECTINIDAE</b>																
<i>Hyalopecten ponderi</i> sp. nov.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	—
<i>Delectopecten alcocki</i>	●	—	—	—	●	●	—	—	—	—	—	—	—	—	—	—
<i>Delectopecten fosterianus</i>	—	—	—	●	●	●	●	●	●	●	●	—	—	—	—	—
<i>Delectopecten musorstomi</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Palliolium minutulum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Pseudamussium challengeri</i>	—	—	×	—	●	●	●	×	●	●	—	—	—	—	—	—
<i>Mesopeplum fenestratum</i>	●	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Anguipecten picturatus</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Anguipecten simoneae</i>	—	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Anguipecten superbus</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Bractechlamys oweni</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Bractechlamys vexillum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Decatopecten radula</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Decatopecten strangei</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Excellichlamys spectabilis</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Glorichlamys elegantissima</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Glorichlamys quadrilirata</i>	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Gloripallium pallium</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Juxtamusium coudeini</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Continued on next page

Table 11. (Continued).

taxa	<	100	200	300	400	500	600	700	800	1000	1200	1400	1600	1800	2000	>
<i>Juxtamysium maldivense</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mirapecten mirificus</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mirapecten moluccensis</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mirapecten rastellum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ylistrum balloti</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Amysium pleuronectes</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Annachlamys flabellata</i>	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Annachlamys iredalei</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Annachlamys kuhnholtzi</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Annachlamys reevei</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Minnivola pyxidata</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Pecten fumatus</i>	●	×	×	—	×	×	×	×	×	×	—	—	—	—	—	—
<i>Pecten dijkstrai</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Serratovola pallula</i>	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Serratovola rubicunda</i>	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Complicachlamys wardiana</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Coralichlamys madreporarum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Equichlamys bifrons</i>	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Hemipecten forbesianus</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys andamanica</i>	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys cuneata</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys deliciosa</i>	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys limatula</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys mollita</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys squamosa</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Laevichlamys wilhelminae</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Notochlamys hexactes</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Paschinnites coruscans</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Pedum spondyloideum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Scaeoichlamys livida</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Scaeoichlamys squamea</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium aktinos</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium diana</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium dringi</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium flavicans</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium fulvicostatum</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Semipallium hallae</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Talochlamys pulleineana</i>	●	●	●	×	×	●	—	—	×	×	—	—	—	—	—	—
<i>Veprichlamys perillustris</i>	×	—	●	●	●	×	×	×	×	×	—	—	—	—	—	—
<i>Zygochlamys delicatula</i>	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys albolineata</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys asperrima</i>	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys cloacata</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys funebris</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys gloriosa</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys heterophyseta</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys punctata</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys sanguinea</i>	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys scabricostata</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mimachlamys spinicostata</i> sp. nov.	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cryptopecten bullatus</i>	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cryptopecten nux</i>	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Haumea rehderi</i>	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Volachlamys singaporina</i>	●	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
total species live	58	11	6	6	11	7	4	5	6	8	4	1	1	2	4	4

## Discussion

In this revision we treat 105 Recent pectinoidean species (30 Propeamussiidae, 2 Cyclochlamydidae and 73 Pectinidae), which occur in the intertidal to abyssal zones around Australia and in neighbouring seas. Nearly all the species of Propeamussiidae are from deep water (bathyal to abyssal), except *Chlamydella favus*, which also lives in the littoral zone. It is not surprising that, as a result of deep-water dredging programs, several new species turned up during the last few decades from the previously unexplored continental slope. The majority of these species have close affinities with the tropical Indo-West Pacific propeamussiid fauna (c. 70%), one with New Zealand (*Parvamussium maorium*), and the others are assumed to be restricted to Australia. The geographical and depth distribution of Australian scallops are shown in Tables 10 and 11.

The Australian pectinid fauna can be divided into two regions: tropical northern Australia (with c. 65 species), including the coasts of Queensland and Western Australia (north of the Tropic of Capricorn) and the Northern Territory, and temperate to cool southern Australia (with c. 17 species). The demarcation of these faunas is geographically at approximately 25°S, although several species overlap in New South Wales and Western Australia. Only two pectinoids occur all around Australia, the deep-water species *Parvamussium thetidis* and the shallow-water species *Semipallium aktinos*. The pectinid fauna of northern Australia is closely related to the tropical Indo-West Pacific one, and the pectinid fauna of southern Australia is either endemic or related to the fauna of New Zealand. Most pectinids live offshore and are associated with coral reefs, a few even embedded in live corals (*Pedum spondyloideum* and *Coralichlamys madreporarum*), on the underside of coral boulders, or amongst coral rubble in clear shallow waters. Only a few species also live in the intertidal zone, i.e., *Paschinnites coruscans* on exposed reef flats, *Complicachlamys wardiana* under stones near the coast, and *Scaeochlams livida* commonly under intertidal boulders near Sydney. Species of *Amusium*, *Pecten* and *Minnivola* prefer soft bottoms, usually sand, muddy sand or sandy mud, and live in colonies in sheltered bays or open waters. *Mimachlamys* species are often heavily encrusted with sponges. Most pectinids have a relatively wide distribution, but the endemic temperate species *Semipallium hallae* occurs in a very small area of South Australia, living cryptically in crevices of offshore limestone reefs.

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**Appendix A.** Taxonomic and nomenclatural terminology used in this publication (see also ICZN, 1999; Carter *et al.*, 2012).

- aculeate*—having spines or prickles  
*acute*—sharply angled  
*adductor muscles*—internal muscles that close valves of shell  
*adductor scar*—impression on interior of shell where adductor muscle is attached  
*albino*—white due to lack of colour pigments  
*angulate*—angled, formed with corners  
*anterior*—forward, towards the front or head end (opposite of posterior)  
*antero-*—combining form of anterior (e.g., anterodorsal)  
*antimarginal*—fine sculpture perpendicular to valve margin; crossing truly radial sculpture at an angle, particularly near posterior and anterior ends of valve  
*aragonite*—orthorhombic crystalline form of calcium carbonate  
*auricle(s)*—ear-like projections on anterior and posterior ends of dorsal margin; ears  
*auricular crura*—tubercles and ridges inside auricles  
*bathymetric*—pertaining to measurement of depth of water  
*beak*—projecting region above centre of hinge, marking earliest growth of shell (see also umbo)  
*bifid*—divided into two parts by a groove  
*bifurcate*—divided into two, especially in sculpture  
*blotch*—irregular area of contrasting colour  
*bridged*—in part covered  
*bulbous*—globular  
*byssal fasciole*—track left by developing byssal notch  
*byssal gape*—opening for passage of byssus remaining when shell is closed  
*byssal notch*—gap beneath anterior auricle on right valve for passage of byssus  
*byssal sinus*—embayment below anterior auricle on left valve corresponding to byssal notch of right valve  
*byssate*—with a byssus  
*byssus*—bundle of fibres to anchor animal to substratum; secreted by gland at base of foot  
*calcareous*—composed mostly of calcium carbonate  
*calcite*—rhombohedral crystalline form of calcium carbonate  
*cancellate*—having a pattern of intersecting radial and commarginal ribs (see also reticulate)  
*cardinal*—central part of hinge area directly below beaks  
*carina (pl. carinae)*—prominent, sharp-edged or keel-like radial ridge on surface of shell; in pectinoids, particularly used for internal rib  
*carinae*—sharp, raised ridges on edges of interior expressions of exterior plicae  
*carinate*—with a carina  
*cementation*—fixation to substratum by shell secretion  
*cline*—a geographically and gradually developing difference in appearance of a populations of one species  
*collar*—raised lip bordering a suture  
*commarginal*—parallel to ventral shell margin; used of sculpture such as riblets and lamellae  
*commensal*—living with another animal, a form of symbiosis  
*compressed*—flattened  
*concave*—curved or arched inwards; hollow  
*conspecific*—belonging to the same species  
*convex*—inflated outwards  
*corneus*—horny in texture  
*corrugated*—folded or ridged, broadly and heavily sculptured  
*costa (pl. costae)*—rib-like radial sculptural element that does not show on interior of valve, or forms only a shallow furrow; intermediate in prominence between a plica and a costella; a rib  
*costella (pl. costellae)*—low, narrow, rib-like radial sculptural element, weaker than a costa; a riblet  
*crenate (or crenulate)*—with regular notches or corrugations  
*crura (singular, crus)*—lamellar ridges on hinge plate  
*ctenolium*—row of small teeth on edge of byssal notch, separating byssal fibres  
*cumate*—wedge-shaped  
*decussate*—having a latticed surface formed by intersection of fine riblets  
*demarcated*—set off, as by a ridge, furrow or abrupt change in sculpture  
*denticle*—low, rounded tooth  
*dentition*—referring to hinge teeth  
*depressed*—low in proportion to diameter  
*diagnosis*—a statement in words of the characters that differentiate a taxon from other taxa with which it is likely to be confused  
*disc (or disk)*—central part of external surface of valve  
*dissoconch*—post-larval shell  
*divaricate*—antimarginal or diverging sculpture, often forming chevrons  
*dorsal*—towards hinge line; opposite to ventral (or lower) margin  
*ears*—lateral projections of dorsal margin; auricles  
*ecomorph*—a morphology resulting from living in a particular place; shell form affected by ecology rather than genetics  
*elongate*—extended, considerably longer in one dimension than another  
*epifaunal*—living attached to substratum, not in sediment; opposite of infaunal  
*equilateral*—anterior and posterior parts of the shell almost equal in size  
*equivale*—with valves equal in size and shape  
*extant*—having living representatives  
*extinct*—having no living representatives  
*fascicle*—a small bunch of radial ribs  
*flexuous*—with a bend or curve in the shell  
*fold*—a broad undulation; a plica  
*foliated layer*—shell microstructure of lath-like calcite crystals that form sheets like roof shingles  
*gape*—opening left between valves when shell is closed  
*gibbous*—swollen unevenly  
*globose*—roughly spherical shape  
*granular*—bearing granules as surface sculpture  
*granule*—a pustular surface sculpture  
*growth striae*—commarginal lines on shell surface marking growth intervals  
*height*—greatest dorsoventral dimension perpendicular to dorsal margin  
*heterodont*—with distinct, differentiated cardinal and lateral teeth  
*hinge line*—antero-posterior axis of the hinge  
*hinge teeth*—shelly structures fitting into sockets in opposite valve, insuring accurate shell closure  
*hinge*—collective term for structures of the dorsal margin that function in opening and closing the valves  
*homonym*—each of two or more available names having the same spelling and established for different nominal taxa  
*hyaline*—thin and almost transparent  
*hypertrophied scales*—large, inflated scales  
*imbricate*—roof-like shingles overlapping sculpture  
*incremental lines*—faint commarginal growth lines  
*inequilateral*—anterior and posterior parts of valves dissimilar in shape and size  
*inequivalve*—having the two valves dissimilar in shape, size or inflation  
*inflated*—swollen or strongly convex  
*intercalary*—between (e.g., smaller ribs between two major ribs)  
*intercostal*—between ribs  
*interspace*—region between adjacent ribs  
*interstitial*—space or interval between ribs  
*lamella (pl. lamellae)*—thin, raised ridge of external sculpture  
*lamellate*—covered with lamellae or scales  
*lamellose*—with thin scales or plates  
*lamina (pl. laminae)*—thin, raised ridge of the hinge  
*lateral*—side  
*left valve*—upper valve  
*length*—dimension along antero-posterior axis; normal to height  
*lenticular*—flattened and generally circular, lens-shaped  
*ligament*—elastic proteinaceous structure joining the two valves dorsally  
*ligamental pit (resilifer)*—triangular depression beneath umbones accommodating ligament  
*lira (pl. lirae)*—fine, thread-like sculptural element  
*lirate*—having thread-like sculpture  
*maculations*—spots, generally of irregular size, shape and distribution  
*margin*—the edge, particularly of a shell surface  
*medial*—central  
*monophyletic*—with a single evolutionary origin  
*nacreous*—shell microstructure of thin aragonite layers, characterized by iridescence  
*nestling*—living fixed in a crevice or crack  
*node*—a small knob  
*nodose*—sculptured with nodes or tubercles  
*nom. nov. (nomen novum)*—new name, replacing a homonym  
*oblique*—intermediate between dorsoventral and antero-posterior direction  
*obsolete*—sculpture that disappears or remains undeveloped  
*ocelli*—minute, simple eyes  
*opisthogyrate form*—with beaks pointed backwards, or posteriorly  
*orbicular*—circular in outline  
*original designation*—the designation of a name-bearing type of a nominal taxon when it is established  
*ovate or ovoid*—having an oval shape  
*pallial line*—scar on valve interior from attachment of marginal pallial muscles

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<p><i>pellucid</i>—transparent or translucent</p> <p><i>plica</i> (pl. <i>plicae</i>)—major radial sculptural element that folds entire shell thickness, forming a radial furrow on interior; more prominent than a costa</p> <p><i>plicate</i>—folded or twisted radially</p> <p><i>polyphyletic</i>—with more than one unrelated evolutionary origin</p> <p><i>posterior</i>—towards the back end (opposite of anterior)</p> <p><i>postero</i>—combining form of posterior</p> <p><i>pre-radial stage</i>—growth stage between prodissoconch and radially sculptured stage; earliest part of dissoconch</p> <p><i>prismatic</i>—shell microstructure consisting of calcitic or aragonitic prisms</p> <p><i>prodissoconch</i>—shell secreted by the larva, preserved at tips of umbones</p> <p><i>punctate</i>—surface with minute pits</p> <p><i>pustule</i>—knobby sculpture, generally smaller than a tubercle</p> <p><i>radial</i>—radiating in relatively unbroken straight lines from umbones to ventral margin</p> <p><i>resilifer</i> (<i>ligamental pit</i>)—a structure that supports the internal ligament; triangular pit beneath umbo</p> <p><i>resilium</i> (pl. <i>resilia</i>)—internal portion of ligament</p> <p><i>reticulate</i>—external sculpture of a network of intersecting elements</p> <p><i>rib</i>—an elongate radial or commarginal sculptural element</p> <p><i>riblet</i>—a narrow rib</p> <p><i>right valve</i>—lower valve</p> <p><i>rostrate</i>—pointed or beaked</p> <p><i>scabrous</i>—rough, scaly</p> <p><i>scale</i>—a thin, localized projection of shell sculpture</p> <p><i>sculpture</i>—relief pattern on the shell exterior</p> <p><i>serrate</i>—a saw-like margin</p> <p><i>sessile</i>—attached to some substrate, not free to move</p>	<p><i>shagreen</i>—net-like or honeycomb-like exterior sculpture resembling shark skin (shagreen) formed by two sets of oblique intersecting ridgelets, uniting dorsally to form a false surface above the true shell surface (e.g., <i>Equichlamys bifrons</i>); limited to Pedini</p> <p><i>spine</i>—long calcareous projecting sculpture</p> <p><i>spinose</i>—having spines or thornlike protuberances</p> <p><i>squamose</i>—sculpture of small scales</p> <p><i>stria</i> (pl. <i>striae</i>)—minute linear sculpture, indicating a growth stage</p> <p><i>striate</i>—sculpture of fine scratches, grooves, or lines</p> <p><i>sub</i>—combining form meaning nearly (e.g., suborbicular)</p> <p><i>subsequent designation</i>—the designation of a name-bearing type of a nominal taxon published after the nominal taxon was established</p> <p><i>substratum</i> (pl. <i>substrata</i>)—bottom sediment</p> <p><i>suture</i>—border line of shell disc; junction with auricle</p> <p><i>symbiotic</i>—two dissimilar organisms living in intimate or close association</p> <p><i>thread</i>—narrow riblet</p> <p><i>trigonal</i>—triangular in outline</p> <p><i>tripartite</i>—divided into three parts</p> <p><i>truncate</i>—sharply or squarely cut off</p> <p><i>tubercle</i>—a small knob or lump</p> <p><i>umbo</i> (pl. <i>umbones</i>)—uppermost part of a valve as seen from exterior; a central, rounded, protruding knob</p> <p><i>undulated</i>—waved</p> <p><i>variant</i>—a shell differing slightly in form or colour from other shells of the same species</p> <p><i>variegated</i>—with patches of different colours</p> <p><i>ventral margin</i>—the lower margin, opposite the dorsal margin</p> <p><i>ventricose</i>—strongly inflated or swollen</p> <p><i>xenomorphic</i>—assumption in form and sculpture of the substratum</p>
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### Appendix B. Bathymetric terminology used in this publication.

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<i>intertidal</i> —between spring high and low tide marks
<i>subtidal</i> —sea bed from 5–20 m depth
<i>littoral</i> —sea bed from 20–60 m depth
<i>sublittoral</i> —sea bed from 60–100 m depth
<i>continental shelf</i> —sea bed out to edge of continental slope (c. 200 m depth)
<i>continental slope</i> —sea bed from 200–1000 m depth
<i>bathyal</i> —sea bed from 200–2000 m depth
<i>abyssal</i> —sea bed from 2000–6000 m depth
<i>hadal</i> —sea bed below 6000 m depth

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### Appendix C. Nomenclatural terminology used in this publication.

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<i>holotype</i> —the single specimen designated or otherwise fixed as the name-bearing type of a nominal species or subspecies when the nominal taxon is established
<i>homonym</i> —one of two or more identical names applied to two distinct genera or species
<i>lectotype</i> —a syntype designated as the single name-bearing type specimen subsequent to the establishment of a nominal species or subspecies; required in cases where, for example, the syntypes include more than one species
<i>ms</i> (pl. <i>mss</i> )—manuscript, unpublished work
<i>neotype</i> —the single specimen designated as the name-bearing type of a nominal species or subspecies when there is a need to define the nominal taxon objectively and no name-bearing type is believed to exist
<i>paralectotype(s)</i> —each specimen of a former syntype series remaining after the designation of a lectotype
<i>paratype(s)</i> —each specimen of a type series other than the holotype
<i>preoccupied</i> —invalid because the same name has been used previously for a different animal
<i>syntype(s)</i> —each specimen of a type series from which neither a holotype nor a lectotype has been designated
<i>s.l.</i> ( <i>sensu lato</i> )—in the broad sense
<i>s.s.</i> ( <i>sensu stricto</i> )—in the strict sense
<i>synonym</i> —one of two or more different names that have been given to the same taxon

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### Appendix D. Stratigraphic terminology used in this publication (Gradstein *et al.*, 2012).

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Holocene	Recent (< 0.013 MY)
Pleistocene	2.59–0.013 MY
Pliocene	5.33–2.59 MY
Miocene	23.03–5.33 MY
Oligocene	33.9–23.03 MY
Eocene	56.0–33.9 MY
Paleocene	66.0–56.0 MY

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## Appendix E. Alphabetical genus and species namelist, including alternate spellings.\*

<i>Acropora</i>	<i>caducum</i>	<i>Dhontichlamys</i>	<i>griggi</i>	<i>loxoides</i>	<i>oskarssoni</i>	<i>punctata</i>	<i>squamosa</i>
<i>acroporicola</i>	<i>campbellica</i>	<i>dianae</i>	<i>grossiana</i>	<i>lucens</i>	<i>Ostrea</i>	<i>punctatus</i>	<i>squamosus</i>
<i>Actinopecten</i>	<i>campbellicus</i>	<i>dichroa</i>	<i>guendolenae</i>	<i>lucida</i>	<i>oweni</i>	<i>pusio</i>	<i>strangei</i>
<i>actinos</i>	<i>Camptonectes</i>	<i>dichrous</i>	<i>Gurabopecten</i>	<i>lucidus</i>	<i>pacificus</i>	<i>pustulosus</i>	<i>striatula</i>
<i>adumcus</i>	<i>cancellatum</i>	<i>difformis</i>	<i>hadalis</i>	<i>luculenta</i>	<i>Palliolium</i>	<i>pyxidata</i>	<i>striatulus</i>
<i>Aequipecten</i>	<i>cancellorum</i>	<i>digitatum</i>	<i>hallae</i>	<i>luculentum</i>	<i>Pallium</i>	<i>pyxidatus</i>	<i>striatum</i>
<i>aequisulcatus</i>	<i>cancellus</i>	<i>digitatus</i>	<i>hastingsii</i>	<i>luculentus</i>	<i>pallula</i>	<i>quadrilirata</i>	<i>subantarctica</i>
<i>afribenedictus</i>	<i>Caribachlamys</i>	<i>dijkstrai</i>	<i>Haumea</i>	<i>lutea</i>	<i>palmipes</i>	<i>quadriliratus</i>	<i>subbenedictus</i>
<i>aktinos</i>	<i>caroli</i>	<i>dilectus</i>	<i>hawaiensis</i>	<i>Luteamusium</i>	<i>Pandora</i>	<i>radula</i>	<i>subbifrons</i>
<i>alba</i>	<i>cassium</i>	<i>Dimarzipecten</i>	<i>hedleyi</i>	<i>Luteamusium</i>	<i>Paraleptopecten</i>	<i>raffrayi</i>	<i>subcostatum</i>
<i>albolineata</i>	<i>Catillopecten</i>	<i>dissimilis</i>	<i>Hemipecten</i>	<i>macassarensis</i>	<i>Paramusium</i>	<i>raoulensis</i>	<i>subgloriosa</i>
<i>albolineatus</i>	<i>ceciliae</i>	<i>distans</i>	<i>Heritschia</i>	<i>Macrochlamys</i>	<i>Paramusium</i>	<i>rastellum</i>	<i>sulcata</i>
<i>albus</i>	<i>cellularis</i>	<i>dringi</i>	<i>heritaphyseta</i>	<i>maculata</i>	<i>parva</i>	<i>reevei</i>	<i>sulphureus</i>
<i>alcocki</i>	<i>Chagrepecten</i>	<i>duodecimlamellatus</i>	<i>hexactes</i>	<i>maculosum</i>	<i>Parvamussium</i>	<i>rehderi</i>	<i>superbus</i>
<i>alli</i>	<i>Chalmys</i>	<i>Eburneopecten</i>	<i>Himmites</i>	<i>madreporarum</i>	<i>parvus</i>	<i>rena</i>	<i>taiaroa</i>
<i>amaliae</i>	<i>chinensis</i>	<i>edentiplica</i>	<i>histrionica</i>	<i>magneticum</i>	<i>pasca</i>	<i>retiaculum</i>	<i>Talochlamys</i>
<i>amurensis</i>	<i>Chlamydelta</i>	<i>electricum</i>	<i>histrionicus</i>	<i>maldivense</i>	<i>Pascahinnites</i>	<i>reticulatus</i>	<i>tasmani</i>
<i>Amusium</i>	<i>Chlamys</i>	<i>electrum</i>	<i>horridus</i>	<i>maldivensis</i>	<i>passerina</i>	<i>retiolium</i>	<i>tasmanica</i>
<i>Amussipecten</i>	<i>Ciclopecten</i>	<i>elegantissima</i>	<i>hoskynsi</i>	<i>malpelonium</i>	<i>passerinus</i>	<i>roseopunctatus</i>	<i>tasmanicum</i>
<i>Amussium</i>	<i>circularis</i>	<i>elegantissimus</i>	<i>Hyalopecten</i>	<i>Manupecten</i>	<i>patagonica</i>	<i>rubicunda</i>	<i>tasmanicus</i>
<i>Anachlamys</i>	<i>cloacata</i>	<i>ellochena</i>	<i>hybridus</i>	<i>maoria</i>	<i>patagonicus</i>	<i>rubicundus</i>	<i>tatei</i>
<i>andamanica</i>	<i>cloacatus</i>	<i>eous</i>	<i>Hymedesmia</i>	<i>maorium</i>	<i>Patinopecten</i>	<i>rubidus</i>	<i>tegula</i>
<i>anguinea</i>	<i>cmadoritinctum</i>	<i>Equichlamys</i>	<i>ina</i>	<i>maorum</i>	<i>paucilirata</i>	<i>rugosus</i>	<i>temuissima</i>
<i>anguineum</i>	<i>colmani</i>	<i>erythraeensis</i>	<i>inaequivalvis</i>	<i>margaritifera</i>	<i>pauciliratum</i>	<i>rutteni</i>	<i>testudineus</i>
<i>anguineus</i>	<i>complanus</i>	<i>eucosmia</i>	<i>incertum</i>	<i>mariae</i>	<i>pauciplicatum</i>	<i>ryukyuensis</i>	<i>texturatum</i>
<i>Anguipecten</i>	<i>Complicachlamys</i>	<i>eucymatus</i>	<i>incomparabilis</i>	<i>marshallensis</i>	<i>pauciplicatus</i>	<i>salacon</i>	<i>thaanumi</i>
<i>angusticostata</i>	<i>Comptopallium</i>	<i>Eivola</i>	<i>incubata</i>	<i>matonii</i>	<i>Parvamussium</i>	<i>sanguinea</i>	<i>thetidis</i>
<i>Annachlamys</i>	<i>concentrica</i>	<i>evecta</i>	<i>indica</i>	<i>maxima</i>	<i>Pecten</i>	<i>sanguinolenta</i>	<i>thyrideus</i>
<i>Anomia</i>	<i>consobrina</i>	<i>excavatus</i>	<i>instar</i>	<i>maximus</i>	<i>Pectinella</i>	<i>sanguinolentus</i>	<i>tigris</i>
<i>anonyma</i>	<i>consobrinus</i>	<i>Excellichlamys</i>	<i>intensum</i>	<i>medius</i>	<i>Pectinities</i>	<i>saniosus</i>	<i>tissotii</i>
<i>antiaustralis</i>	<i>conspetum</i>	<i>exotica</i>	<i>Interchlamys</i>	<i>melica</i>	<i>Pectinium</i>	<i>sansebastianus</i>	<i>tiitirangiensis</i>
<i>Antillipecten</i>	<i>contrainflatum</i>	<i>famigerator</i>	<i>intermedia</i>	<i>meridionale</i>	<i>pedum</i>	<i>scabricostata</i>	<i>torresi</i>
<i>araneum</i>	<i>Convexopecten</i>	<i>fava</i>	<i>interradiatum</i>	<i>meridionalis</i>	<i>pellucidulus</i>	<i>scabricostatus</i>	<i>Towaipecten</i>
<i>Arctinula</i>	<i>convexum</i>	<i>favus</i>	<i>interradiatus</i>	<i>mesenterina</i>	<i>peloritanus</i>	<i>Scaeo-chlamys</i>	<i>transenna</i>
<i>arcuatus</i>	<i>cookei</i>	<i>fenestrata</i>	<i>intuscostatus</i>	<i>Mesoplepum</i>	<i>perselneeri</i>	<i>schmeltzii</i>	<i>translucens</i>
<i>Argoderma</i>	<i>cooperi</i>	<i>fenestratum</i>	<i>investigatoris</i>	<i>Micramussium</i>	<i>perfecta</i>	<i>schilderi</i>	<i>tricarinata</i>
<i>Argopecten</i>	<i>Coralichlamys</i>	<i>fenestratus</i>	<i>iredalei</i>	<i>Micropecten</i>	<i>perfectus</i>	<i>scitulum</i>	<i>tricarinatus</i>
<i>Argus</i>	<i>coruscans</i>	<i>Filamussium</i>	<i>irregularis</i>	<i>midwayensis</i>	<i>perillustris</i>	<i>scrobiculatum</i>	<i>tricornatus</i>
<i>asper</i>	<i>corymbiata</i>	<i>filosus</i>	<i>islandica</i>	<i>milneedwardsi</i>	<i>peroniana</i>	<i>Sectipecten</i>	<i>triggi</i>
<i>aspera</i>	<i>corymbiatus</i>	<i>flabellata</i>	<i>isomeres</i>	<i>Mimachlamys</i>	<i>peshlutrae</i>	<i>secundus</i>	<i>Turbinaria</i>
<i>asperima</i>	<i>Corymbichlamys</i>	<i>flabellatus</i>	<i>jacobaeus</i>	<i>minimus</i>	<i>Peten</i>	<i>Semipallium</i>	<i>tydemani</i>
<i>asperimoides</i>	<i>coudeini</i>	<i>Flabellipecten</i>	<i>Janera</i>	<i>Minnivola</i>	<i>Phialopecten</i>	<i>Semipecten</i>	<i>undatus</i>
<i>asperimus</i>	<i>cranmerorum</i>	<i>Flavamussium</i>	<i>Janira</i>	<i>minor</i>	<i>Philippia</i>	<i>semiradiatus</i>	<i>undulatus</i>
<i>asperinus</i>	<i>crassicostata</i>	<i>flavicans</i>	<i>jamus</i>	<i>minuta</i>	<i>pica</i>	<i>senatoria</i>	<i>ustulatus</i>
<i>asperulata</i>	<i>crebricostatus</i>	<i>Flexopecten</i>	<i>japonicum</i>	<i>minutum</i>	<i>picta</i>	<i>septemradiatus</i>	<i>valdecostata</i>
<i>Asterias</i>	<i>cristatellum</i>	<i>florens</i>	<i>Jaworskia</i>	<i>Mirapecten</i>	<i>picturatus</i>	<i>Serratavola</i>	<i>valdecostatus</i>
<i>atkinos</i>	<i>cristatocostatus</i>	<i>foliaceus</i>	<i>jeffreysii</i>	<i>mireilleae</i>	<i>pictus</i>	<i>serratus</i>	<i>vancouverensis</i>
<i>aurantiaca</i>	<i>cristatum</i>	<i>forbesianus</i>	<i>josslingi</i>	<i>mirifica</i>	<i>Pinna</i>	<i>siebenrocki</i>	<i>Variamussium</i>
<i>aurantiacum</i>	<i>cristatus</i>	<i>formosum</i>	<i>juddi</i>	<i>mirificus</i>	<i>pixidatus</i>	<i>Similipecten</i>	<i>Varlamussium</i>
<i>aurantiacus</i>	<i>crouchi</i>	<i>fosterianum</i>	<i>Juxtamussium</i>	<i>modestus</i>	<i>placenta</i>	<i>similis</i>	<i>Venilia</i>
<i>aurantius</i>	<i>cruentatus</i>	<i>fosterianus</i>	<i>kapalae</i>	<i>mollita</i>	<i>Placopecten</i>	<i>simoneae</i>	<i>Veprichlamys</i>
<i>australiae</i>	<i>Cryptopecten</i>	<i>foulcheri</i>	<i>Kaparachlamys</i>	<i>mollitus</i>	<i>Placuna</i>	<i>singaporina</i>	<i>Verlamussium</i>
<i>australis</i>	<i>Ctenamussium</i>	<i>fricatus</i>	<i>kerguelorum</i>	<i>mohucensis</i>	<i>Pleuronectes</i>	<i>singaporinus</i>	<i>vesiculatus</i>
<i>Avicula</i>	<i>Ctenamusium</i>	<i>fulvicosta</i>	<i>kermadecensis</i>	<i>morganense</i>	<i>Pleuronectia</i>	<i>siratama</i>	<i>vesiculatus</i>
<i>Azumapecten</i>	<i>Ctenamussium</i>	<i>fulvicostata</i>	<i>kikaiensis</i>	<i>multiliratum</i>	<i>plica</i>	<i>slacksmithae</i>	<i>vesiculosus</i>
<i>balloti</i>	<i>cumingi</i>	<i>fulvicostatum</i>	<i>kiwaensis</i>	<i>multisquamatus</i>	<i>plicata</i>	<i>smithi</i>	<i>vexillum</i>
<i>ballotti</i>	<i>cumingii</i>	<i>fulvicostatus</i>	<i>knudseni</i>	<i>murrayi</i>	<i>polymorphoides</i>	<i>solaris</i>	<i>vitreus</i>
<i>Bathyamussium</i>	<i>cuneata</i>	<i>fumata</i>	<i>Korobkovia</i>	<i>musorstomi</i>	<i>Polynemamussium</i>	<i>Somalipecten</i>	<i>Vola</i>
<i>Bathypecten</i>	<i>cuneatus</i>	<i>fumatus</i>	<i>kuhnholtzi</i>	<i>nakazawai</i>	<i>ponderi</i>	<i>soerbyi</i>	<i>Volachlamys</i>
<i>bavayi</i>	<i>cuneolus</i>	<i>funebri</i>	<i>Laevichlamys</i>	<i>nanshaensis</i>	<i>porites</i>	<i>Spathochlamys</i>	<i>vulcani</i>
<i>bayonmaisense</i>	<i>curtistiana</i>	<i>fuscus</i>	<i>laevigata</i>	<i>nanus</i>	<i>porphyrea</i>	<i>speciosum</i>	<i>wardiana</i>
<i>bednalli</i>	<i>Cyclochlamys</i>	<i>gardineri</i>	<i>lamarckii</i>	<i>Neitheia</i>	<i>powelli</i>	<i>spectabilis</i>	<i>watsoni</i>
<i>Belchlamys</i>	<i>Cyclopecten</i>	<i>gavena</i>	<i>lamberti</i>	<i>nepeanensis</i>	<i>Praechlamys</i>	<i>spectrum</i>	<i>weberi</i>
<i>benedictus</i>	<i>dalli</i>	<i>geminatus</i>	<i>lamprelli</i>	<i>nigromaculatus</i>	<i>preissiana</i>	<i>spinicostata</i>	<i>whissoni</i>
<i>bernardi</i>	<i>Decadopecten</i>	<i>Gigantopecten</i>	<i>layardi</i>	<i>nobilis</i>	<i>princessae</i>	<i>spiniferum</i>	<i>wilhelminae</i>
<i>beudanti</i>	<i>Decatopecten</i>	<i>gilchristi</i>	<i>lemniscata</i>	<i>Nodipecten</i>	<i>Propeamusium</i>	<i>spondioloideum</i>	<i>Xenamussium</i>
<i>bifidus</i>	<i>Decopecten</i>	<i>Gloriapallium</i>	<i>lemniscatus</i>	<i>Notochlamys</i>	<i>Propeamusium</i>	<i>spondyloidea</i>	<i>xishaensis</i>
<i>bifrons</i>	<i>Delectopecten</i>	<i>Glorichlamys</i>	<i>lentiginosa</i>	<i>Notovola</i>	<i>prunum</i>	<i>spondyloides</i>	<i>Ylistrum</i>
<i>bistriatus</i>	<i>delicatula</i>	<i>gloriosa</i>	<i>lentiginosus</i>	<i>novaeguinae</i>	<i>Pseudamusium</i>	<i>spondyloideum</i>	<i>Zamorapecten</i>
<i>blanda</i>	<i>delicatulul</i>	<i>gloriosus</i>	<i>leopardus</i>	<i>novaezelandiae</i>	<i>Pseudamusium</i>	<i>Spondylus</i>	<i>zeteki</i>
<i>blandus</i>	<i>deliciosa</i>	<i>Gloripallium</i>	<i>Leopecten</i>	<i>nux</i>	<i>pseudojamviniensis</i>	<i>squalidulum</i>	<i>ziczac</i>
<i>Borehamia</i>	<i>Dendopecten</i>	<i>Glyptamusium</i>	<i>Leptopecten</i>	<i>oblectata</i>	<i>pseudolima</i>	<i>Squamamusium</i>	<i>zoniferum</i>
<i>Bractechlamysdendyi</i>		<i>grandis</i>	<i>limatula</i>	<i>oblectatum</i>	<i>Pseudopalliorum</i>	<i>squamata</i>	<i>Zygochlamys</i>
<i>Bractechlamys</i>	<i>dennanti</i>	<i>Graptamusium</i>	<i>Lindapecten</i>	<i>obliqua</i>	<i>Psychrochlamys</i>	<i>squamatus</i>	
<i>brettinghami</i>	<i>Dentamusium</i>	<i>gravi</i>	<i>Lissochlamys</i>	<i>obliquus</i>	<i>psuachella</i>	<i>squamata</i>	
<i>bullatus</i>	<i>Dentipecten</i>	<i>greenlandicus</i>	<i>livida</i>	<i>Occultamusium</i>	<i>pulleineana</i>	<i>squamiformis</i>	
<i>byronensis</i>	<i>Deperetia</i>	<i>gregoryi</i>	<i>lividus</i>	<i>Oppenheimopecten</i>	<i>pulleineanus</i>	<i>squamigerum</i>	

\* Rather than presenting an index, these name-strings provide search-terms to use in the PDF of this work which is freely available at <https://doi.org/10.3853/j.2201-4349.70.2018.1670>

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Label and specimen data should, as a minimum requirement, indicate where specimens are deposited, in addition to locality, date and collector. Original specimen data—especially that of type material—is preferred over interpreted data. If open to interpretation, cite original data between quotation marks or use “[sic]”.

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