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Two new Middle Miocene spatangoids (Echinoidea) from the Murray Basin, South Australia

FRANCIS C. HOLMES[1], CHRISTOPHER AH YEE AND JANICE KRAUSE[2]

[1]15 Kenbry Road, Heathmont, Victoria 3135, Australia, and Invertebrate Palaeontology, Museum Victoria, PO Box 666, Melbourne, Victoria 3001, Australia (fholmes@bigpond.net.au)
[2]P.O. Box 581, Hamilton, Victoria 3300, Australia

Abstract Holmes, F.C., Ah Yee, C., and Krause, J. 2005. Two new Middle Miocene spatangoids (Echinoidea) from the Murray Basin, South Australia. *Memoirs of Museum Victoria* 62(1): 91–99.

Two new spatangoid taxa are described from the Glenforslan Formation cropping out in the Murray River cliffs near Blanchetown, South Australia. One taxon, *Murraypneustes biannulatus* gen. et sp. nov., a large species of spatangoid with two 'peripetalous' fascioles (one circling the margin and the other close to the distal end of the relatively short petals), two distinct sizes of aboral primary tubercles, and a depressed apical system. The other spatangoid described, *Spatagobrissus dermodyorum* sp. nov. differs from the only other fossil species of this genus recorded from Australia, *S. laubei* (Duncan, 1877), in having a much shorter labrum, markedly larger peristome and periproct and larger primary tubercles within the peripetalous fasciole.

Keywords Echinoidea, Spatangoida, *Murrraypneustes*, *Spatagobrissus*, new taxa, Middle Miocene, South Australia

Introduction

Of all the Australian Tertiary sedimentary sequences that contain extensive echinoid faunas, the 150 km of Murray River cliffs, from Overland Corner, east of Waikerie, to Murray Bridge, South Australia, have over the last 120 years been more comprehensively studied by palaeontologists, students and amateur collectors than any other similar area. In the Miocene stratigraphic sequences along the Murray River and elsewhere in Australia, species belonging to the Spatangoida constitute approximately 50 percent of the recorded taxa of irregular echinoids. In view of the number of spatangoids occurring in this section of the Murray River cliffs, the discovery in 2003 of three specimens of a new genus belonging to this order, seemingly unrelated to any other genus known from the continent's fossil record, was unexpected.

The specimens were found within 300 m of each other in a single bed of the Glenforslan Formation, cropping out on the left bank of the Murray River, 7 km NNE of Blanchetown, South Australia [Museum Victoria locality PL3203]. Further investigation of the surface exposure of the formation in the general vicinity of this discovery failed to produce any additional specimens of the new genus.

Materials and methods. Specimen numbers prefixed P, on which the studies are based, are housed in the Invertebrate Palaeontology collection, Museum Victoria (NMV). In addition to type material, the new species of *Spatagobrissus* is represented by several specimens in private collections. Measurements were made with a dial calliper to an accuracy of 0.1 mm. Parameters are expressed as a percentage of test length (%TL) or test width (%TW).

Age and stratigraphy

The Glenforslan Formation, synonymous with the Lower Morgan limestone, conformably overlies the Finniss Formation and is of early Middle Miocene (Batesfordian, Langian) age. The thickness of the unit is relatively consistent at 13–15 m although this is reduced in southern exposure due to post-Middle Miocene uplift and subsequent erosion. The formation is sublithified to lithified, weathering to whitish-cream colour in outcrop (Lukasik and James, 1998). It is composed of cycles of mollusc-bryozoan floatstone, with a microbioclastic packstone matrix, grading upward into *Celleporaria* rudstone tops (infaunal bivalve and gastropod-rich microbioclastic matrix with large branching and sheeted *Celleporaria*) which also contain pectens and oysters. Echinoids tend to be found at or above the rudstone-floatstone contact at the base of the cycles, the latter containing delicate branching and uni-laminar sheet bryzoans of 1–3 cm length. Sediments are pervasively mottled, obscuring all physical sedimentary textures. The middle

Glenforslan Formation is interpreted as being deposited in relatively shallow waters, possibly less than 10 m, based on the presence of calcareous algae and mixotrophic foraminifers (Lakasik, pers. com. 2005). It forms part of the richest warm-water biotic record from southern Australia at a time of maximum transgression of the sea across the continental shelf (McGowran and Li, 1994, and papers cited therein).

The three specimens of the new genus were found about 7.4 m above the base of the formation, approximately 2 m above the *Lepidocyclina* Zone.

Associated fauna

Nineteen species of echinoids have been recorded from the Glenforslan Formation within 500 m upstream and downstream of PL3203 (Table 1), compared with 28 confirmed species known to occur within the Morgan Group (Glenforslan, Cadell, and Bryant Creek Formations).

Table 1. Echinoids recorded within the vicinity of locality PL3203. Letters in brackets indicate the frequency of occurrence of each species. [A], abundant; [C], common; [F], fairly common; [U], uncommon; [R], rare. References to authors and supporting literature cited below, but not listed in the main text references, can be found in Holmes (1993).

Cidaroida
- *Goniocidaris murrayensis* Chapman and Cudmore, 1934 [C]

Arbacoida
- *Murravechinus paucituberculatus* (Gregory, 1890) [F]

Temnopleuroida
- *Cryptechinus humilior* (Bittner, 1892) [C]
- *Orthologhus morganensis* Philip, 1969 [C]
- *O. pulchellus* (Bittner, 1892) [C]

Clypeasteroida
- *Monostychia australis* Laube, 1869 [A]
- *M*. sp. 'C' in Holmes, 1999 [F]
- *Scutellinoides patella* (Tate, 1891) [C]

Spatangoida
- *Brissopsis tatei* Hall, 1907 [U]
- *Brissus* sp. nov? [R]
- *Cyclaster archeri* (Tenison Woods, 1867) [C]
- *Eupatagus rotundus* Duncan, 1877 [U]
- *Eupatagus* sp. indet. [U]
- *Hemiaster (Bolbaster) planedeclivis* Gregory, 1890 [C]
- *Lovenia* cf. *forbesi* (Tenison Woods, 1862) [C]
- *Murraypneustes biannulatus* gen. et sp. nov. [R]
- *Pericosmus compressus* (Duncan, 1877) [R]
- *Protenaster antiaustralis* (Tate, 1885) [U]
- *Spatagobrissus dermodyorum* sp. nov [F]

Systematic Palaeontology

Order **Spatangoida** Claus, 1876

Suborder **Micrasterina** Fisher, 1966

Family ***Incertae sedis***

Remarks. The combination of generic features, particularly the presence of a marginal 'peripetalous' fasciole, intermittent horizontal fasciole bands and a rudimentary non re-entrant peripetalous fasciole clear of the distal ends of paired petals, clearly distinguish the new genus *Murraypneustes* from virtually all other taxa assigned to the Micrasterina, in particular the 22 genera included in the Asterostomatidae Fisher, 1966. Only one of these genera, *Asterostoma* Agassiz, 1847, has tentatively been retained in the Asterostomatidae (together with *Stomaporus* Cotteau, 1888, a genus originally assigned to the Brissidae Gray, 1855) by Smith et al. (2003). Of the remaining 21 genera, Smith et al. have conditionally reassigned 13 to other families, only six of which are included in the Micrasterina. The remaining eight are listed as *incertae sedis or* as belonging to an unnamed taxon. Until a detailed revision of these latter genera is published, it is considered imprudent to assign the new genus to a specific family.

Murraypneustes gen. nov.

Type and only known species. Murraypneustes biannulatus sp. nov.

Diagnosis. Large ovoid spatangoid with centrally depressed adapical surface, apex well posterior of centre. Apical system ethmolytic with 4 gonopores. Aboral primary tubercles of 2 distinct sizes, small and randomly spaced, the larger proximal to the ambitus. Labrum long, narrow, partially tuberculate, extending to third ambulacral plate. Two 'peripetalous' fascioles present; one marginal, passing above the periproct (pseudolateral); the second, rudimentary, non re-entrant and clear of the distal ends of paired petals. Intermittent horizontal fasciole bands also occur between the 2 'peripetalous' fascioles. Subanal fasciole in contact with marginal periproct.

Etymology. For the Murray River cliffs, the origin of the fossils, and "pneustes", a common suffix used for spatangoid echinoids. Gender masculine.

Remarks. The following analysis of morphological features of genera similar to *Murraypneustes* gen. nov. is based primarily on Mortensen (1950a) and Smith et al. (2003). Although approximately 30 genera within the Micrasterina have been investigated, only eight warranted further scrutiny; four currently unassigned to a family by Smith et al. (2003), *Elipneustes* Koehler, 1914, *Eurypatagus* Mortensen, 1948, *Linopneustes* A. Agassiz, 1881, and *Platybrissus* Grube, 1865; three belonging to the Maretiidae (Lambert, 1905), *Eupatagus* L. Agassiz, 1847, *Mazzettia* Lambert and Thiéry, 1915 and *Spatagobrissus* H. L. Clark, 1923; and Macropneustidae genus *Lajanaster* Lambert and Sanchez Roig, 1924.

Using a broad comparison of 38 features, *Linopneustes* stands out from the other seven genera as having closest affinity with *Murraypneustes*; four of its recorded six species, *L. longispinus* (A. Agassiz, 1878), *L. fragilis* (de Meijere, 1903), *L. spectabilis* (de Meijere, 1903), and *L. brachipetalus* Mortensen, 1950b having distinct marginal peripetalous fascioles passing above the periproct. In the other two, *L. murrayi* (A. Agassiz, 1879) and *L. excentricus* de Meijere, 1903, the peripetalous fasciole is not marginal but somewhat higher up on the test (Mortensen, 1950a: 221). Although *L. fragilis* has multiple fasciole bands around the ambitus,

L. murrayi a rounded margin (Smith, pers. com. 2005) and *L. longispinus* relatively short closing petals; *Murraypneustes* is distinguished by its centrally depressed aboral surface forming four apices (domed on *Linopneustes*) with the highest point of the test posterior to the apical disk (anterior in *Linopneustes*), the presence of two 'peripetalous' fascioles and intermittent horizontal fasciole bands, two distinct sizes of small randomly spaced aboral primary tubercles, the larger restricted to the area outside the upper 'peripetalous' fasciole, and a prominent angular subanal fasciole.

Based on the same criteria, three other genera show a moderate degree of morphological similarity to *Murraypneustes*, namely *Elipneustes*, *Mazzettia*, and *Eupatagus*.

Elipneustes, however, can be distinguished by its very long, parallel-sided, open-ended, flush petals with conjugate pore pairs; single, narrow, marginally situated peripetalous fasciole; peristome situated immediately below the apical disk; small thickset plastron with minimal posterior swelling; and much larger primary tubercles scattered over all the aboral interambulacra.

Mazzettia, a poorly known fossil genus, has an elongated heart-shaped test with a low sharp margin, very long weakly-bowed petals closing distally, no recorded peripetalous fasciole and only occasionally a weak shield-shaped subanal fasciole, an elongated labrum just reaching the relatively small plastron, and random but closely spaced coarse tubercles aborally.

Eupatagus, although possessing well developed peripetalous and subanal fascioles is easily categorised by its lack of an anterior sulcus, predominately short lanceolate closed petals, primary tubercles of varying density restricted to the area within the peripetalous fasciole in aboral interlambracra 1–4, and very small evenly spaced tubercles distally over the remainder of the aboral surface. Comparison of other features is difficult because of variability among the very large number of described species. In particular, the eight Australian fossil species vary considerably in profile, are generally more rounded, and have an extremely wide range of primary tubercle densities when compared with the type species on which the generic description is based.

Two other genera, *Platybrissus* and *Eurypatagus*, are distinguished by their complete lack of fascioles, although the former may have a subanal fasciole present in juvenile specimens.

Lajanaster, although depressed aborally, has no anterior sulcus, a relatively sharp ambitus, a markedly narrow plaston, and primary tubercles confined to the posterior column of anterior and lateral interambulacra within the peripetalous fasciole.

Spatagobrissus was included in the comparative analysis, primarily as a new species of the genus occurs at the same locality (PL3203) as *Murraypneustes*. In most respects the former is very similar to Eupatagus but has shorter petals and only small tubercles over the whole of the aboral surface.

Murraypneustes biannulatus. sp. nov.

Figures 2A–F, 3A–C, 4A, B, 5

Type material. Holotype, NMV P312370 from early Middle Miocene Glenforslan Formation (Batesfordian), Morgan Group, 7 km NNE of Murray River Lock 1, Blanchetown, South Australia [NMV locality PL3203].

Paratypes, NMV P312371 and P312372 from the same location.

Diagnosis. As for genus.

Description. Test moderately large, ovoid in outline with shallow anterior sulcus and pointed, slightly truncated posterior. Specimens range from 72 to 81 mm in length, with maximum width 81–86%TL occurring at 45%TL from anterior ambitus. Test 44.1%TL high (uncompressed specimen) with apex of all specimens well posterior of centre, 63–67%TL from anterior ambitus.

Centre of test on adapical surface depressed around apical disk and proximal end of paired petals to form minor apices in interambulacra 1, 4 and 5, and conjointly, a raised area across ambulacrum III and interambulcra 2 and 3. Adoral surface mildly concave in vicinity of peristome with ambulacrum III slightly recessed anteriorly and the plastron forming a fairly pronounced keel posteriorly, terminating at the anterior edge of the subanal fasciole.

Primary tubercles on adapical surface of 2 distinct sizes, both widely and randomly spaced. Larger of the two restricted to the distal 35% of the radius on interambulacrum 5, and 25% elsewhere. Adorally, larger primary tubercles closely and evenly spaced throughout, with exception of naked areas in ambulacra I and V and phyllode plates of ambulacra II, III and IV. Overlapping scrobicules on adoral surface form distinct diagonal ridges. Small tubercles closely spaced immediately below ambitus increase in size to that of larger primary tubercles below curvature of margin. Large primary tubercles, perforate with undercut mamelon and crenulated platform, and maximum scrobicular diameter of approximately 2.5 mm, twice size of smaller counterparts. Ring of scrobicular tubercles not always present.

'Peripetalous' and subanal fascioles present, the former, though not continuously visible on any specimen clearly passes above periproct, while latter is distinctly angular, forming hexagonal outline where in contact with lower edge of periproct. Intermittent horizontal fasciole bands also present laterally above and parallel to marginal 'peripetalous' fasciole. Uppermost very narrow and more continuous fasciole, although clear of distal ends of petals, appears to be a rudimentary peripetalus fasciole not indented interradially (Fig. 3).

Apical system anterior of centre, 39.5–42.2%TL from anterior ambitus to centre of disk, level or slightly below proximal end of paired petals. Ethmolytic, with 4 small closely spaced gonopores approximately 0.3 mm in diameter, anterior pair closer together than posterior pair. Detail of ocular plates indeterminate. Hydropores numerous, approximately 70 visible in one specimen, centrally located but extending between posterior pair of gonopores and possibly ocular plates I and V (Fig. 4A, B).

Petals lanceolate, moderately wide at midlength, closed distally, situated in gentle concave depressions incorporating adradial edges of adjacent interambulacra and continuing proximally across apical disk. Anterior paired petals shorter than posterior pair, extending on average 60% of the radius measured along the surface of the perradial suture from centre of

apical disk to ambitus; posterior pair about 56% radius. Inner pores of petals oval, outer pores slot-like, slightly curved and 50% wider. Pore pairs not conjugate but linked by a fine ridge which extends along both sides of each pore (Fig. 5). Maximum width of interporiferous zone slightly more than twice width of poriferous zone. Anterior paired petals diverge at approximately 135° and contain on average 23 pore pairs, posterior petals 297° and 26 pairs. Secondary tubercles extend randomly across interporiferous and poriferous zones and for a distance outside petals without primary tubercles. Ambulacrum III not petaloid, basically flush with adjoining interambulacra for about 50% radius, then gradually becoming concave towards anterior sulcus. Other details unknown, no sign of pores or regularly spaced tubercles being visible on specimens.

Peristome reniform, centre situated 27–30%TL from anterior ambitus, longitudinal dimension approximately 6.5%TL, transverse dimension 12%TL. Phyllodes short and not particularly well developed.

Labrum long and narrow, averaging 20.5%TL, slightly curved at junction with peristome and abutting the plastron at centre of third pair of adjacent ambulacral plates. Numerous small tubercles adjacent to peristome with a few larger ones towards the posterior end (Fig. 2C).

Plastron closely tuberculate, width approximately 75% length measured from posterior edge of labrum to anterior edge of subanal fasciole. Strong posterior taper suggests sixth and subsequent plates of ambulacra I and V indent behind paired episternal plates.

Periproct opening marginal, not visible from above, tear shaped, slightly wider than high, set in a slight truncation approximately 65° to the horizontal.

Etymology. biannulatus (L) – two-ringed, referring to the presence of two 'peripetalous' fasciole rings.

Family **Maretiidae**

Spatagobrissus H. L. Clark, 1923

Type species. Spatagobrissus mirabilis H. L. Clark, 1923, by original designation.

Diagnosis. See H. L. Clark (1923: 402)

Spatagobrissus dermodyorum sp. nov

Figures 6A–E, 7A–C, 8A–E

Type Material. Holotype. NMV P312570 from early Middle Miocene Glenforslan Formation (Batesfordian), Morgan Group, in the vicinity of NMV locality PL3203, 7 km NNE of Murray River Lock 1, Blanchetown, South Australia.

Paratypes, NMV P312571–P312373 from the same general area. Other material used for statistical purposes is held in Museum Victoria and private collections.

Description. Test small, subcircular in outline with minimal posterior truncation and no anterior sulcus. Specimens range 30.0–45.5 mm in length with maximum width 82–90%TL occurring 51–58 %TL from anterior ambitus. Maximum height 49.5–60%TL at 52.6–65.5%TL from anterior ambitus. Adapical surface moderately inflated, evenly curved transversely above well-rounded margin with ambitus situated at about 30%TH. Adoral surface very mildly convex but with prominent posterior keel caused by sharp rise of ambulacra I and V posterior to centre. In lateral view, posterior truncation covers about 35%TH.

Apical system ethmolytic with 4 genital pores, centre 31.3–38.6%TL from anterior ambitus (Fig. 7A). Paired petals short (26.5–32.5%TL measured along surface of perradial suture from centre of apical disk), narrow (7.0–9.0%TL), lanceolate, closing to closed, posterior pair marginally longer than anterior pair. Anterior pair diverge at about 135°, posterior pair 310°. Pore pairs conjugate, inner pores oval, outer-tear shaped. Anterior row of pore pairs in anterior paired petals distinctly narrower than posterior row and atrophied adapically. Interporiferous zone up to 1.5 times width of poriferous zone at widest point. Ambulacrum III flush adapially, with 2 rows of indistinct longitudinally orientated pore pairs and interporiferous zone containing few secondary tubercles and numerous miliaries.

Peripetalous fasciole subcircular, not indented. Numerous small, randomly spaced perforate, crenulate, primary tubercles occur in interambulacra within fasciole. Outside fasciole, tubercles in posterior half of test very small, but anterior to centre, gradually increasing in size towards interambulacra 2 and 3.

Peristome reniform, mildly sunken, width 16.0–19.3%TL, length 8.9–10.3%TL with anterior border 23.4–26.8%TL from anterior ambitus. Phyllodes moderately developed with slot-shaped pores in circular depressions. Labrum short and wedge-shaped extending only to centre of second pair of adjacent ambulacral plates. Anterior edge raised above surrounding ambulacra and slightly projecting over peristome. Miliary tubercles present with few secondary tubercles in anterior half (Fig. 7B).

Plastron long, width about 55–60% length, with ambulacral plates indenting posteriorly. Subanal fasciole circular to transversely oval, enclosing 3 pore pairs each side of interradial suture, and with slight anterior projection at posterior end of prominent plastronal keel. Posterior edge of fasciole marginally clear of periproct opening. Adorally, ambulacra I and V relatively wide, covered with very fine, randomly spaced miliary tubercles up to sixth plate, then by tubercles of similar size to rest of adoral surface.

Periproct, tear-drop shaped, generally positioned vertically on truncated posterior margin but slightly visible from above on some specimens; height 17.1–19.1%TL, width 13.2–16.0%TL.

Etymology. Named for Michael and Marie Dermody, owners of Glenforslan Station.

Remarks. *Spatagobrissus dermodyorum* sp. nov. differs primarily from the Middle Miocene Port Campbell Limestone species, *Spatagobrissus laubei* (Duncan, 1877), in having narrower test with more posterior maximum width (Fig. 8A), markedly larger peristome and periproct (Fig. 8D, E), and very much shorter labrum (Fig. 8B). In addition, anterior paired petals are shorter and posterior petals longer (Fig. 8C), with divergent angle of latter greater than *S. laubei*. Aboral primary

tubercles larger within peripetalous fasciole and interambulacra 2 and 3, while fine tubercles outside fasciole on posterior half of test are much smaller in diameter. Adorally, plastron wider and longer, and ambulacra I and V narrower.

The extant type species *Spatagobrissus mirabilis* is characterised by a larger (up to 110 mm long) and less inflated test, more posteriorly located apical system in line with maximum width, greater area enclosed by peripetalous fasciole, shorter peristome, and periproct situated on an obliquely truncated surface below the ambitus. Primary tubercles within the peripetalous fasciole of *S. mirabilis* are also larger and more closely spaced than in *S. dermodyorum*.

Spatagobrissus incus Baker and Rowe, 1990, an extant species endemic to southeast Australian waters, particularly between Flinders Island (Tasmania) and western Spencer Gulf, South Australia, has a larger and more rounded test (up to 80 mm long) and, similar to *S. mirabilis*, more posteriorly located apical system and greater area enclosed by peripetalous fasciole.

Compared with *S. dermodyorum*, it also has a much wider and longer plastron and narrower adoral ambulacra I and V. Miskelly (2002: 156) noted two pairs of pore pairs occur in each side of the subanal fasciole, a feature also recorded for *S. laubei* (McNamara et al., 1986: 80). This contrasts with the three pairs found on *S. dermodyorum* (Fig. 7C).

Discussion

The major diagnostic features of *Murraypneustes*, particularly the position of the two 'peripetalous' fascioles, the intermittent horizontal fasciole bands, and the random pattern and separation of two distinct sizes of primary tubercles across the aboral surface, give little indication of its lineage. Certainly, within the Australian Cenozoic sequences that predate the early Middle Miocene Glenforslan Formation, all the 13 recorded genera of Micrasterina have their peripetalous fasciole close or in contact with the paired petals. Only the brissid *Cyclaster* is recorded as having developed multiple fascioles in some specimens (McNamara et al., 1986: 68).

Similarly, there are no extant genera in Australian waters that have any specific combination of characters that link them to *Murraypneustes*. Even the extant species *Linopneustes brachipetalus*, found off the east coast of Australia, has long petals in contact with its marginal peripetalous fasciole.

The lack of any juvenile specimens of the new genus, or indeed any marked variation in the size of the three known specimens, precludes any useful comment on the disposition and specific function of its somewhat unusual arrangement of fascioles, as such development takes place at a very early stage of ontogeny.

Excluding *Murraypneustes*, only *Hemiaster*, of the nine spatangoid genera known to occur in the Glenforslan Formation sequence which embraces locality PL3203 (Table 1), has no extant record in Australian waters. The eight remaining genera are today almost exclusively benthic filter feeders, living inshore or on the continental shelf. Five, *Brissopsis*, *Brissus*, *Cyclaster*, *Lovenia* and *Pericosmus*, occur in tropical waters, and three, *Eupatagus*, *Protenaster* and *Spatagobrissus* in temperate waters (Rowe and Gates, 1995). Species of these eight extant genera, with the possible exception of *Cyclaster*, are known to occur at depths of less than 20 m in Australian or New Zealand waters. This depth range is consistent with the sedimentary deposition of the Glenforslan Formation. On the other hand, Indo-Pacific species of *Linopneustes*, including *L. brachypetalus*, are found at depths exceeding 270 m (range 272–1788 m), with only the West Indies species, *L. longispinus*, extending up into sublitoral waters (70–570 m) (Mortensen, 1950a).

Based on the available evidence, it is reasonable to assume *Murraypneustes dermodyi* was a benthic filter feeder inhabiting relatively shallow, warm (?sub-tropical) waters.

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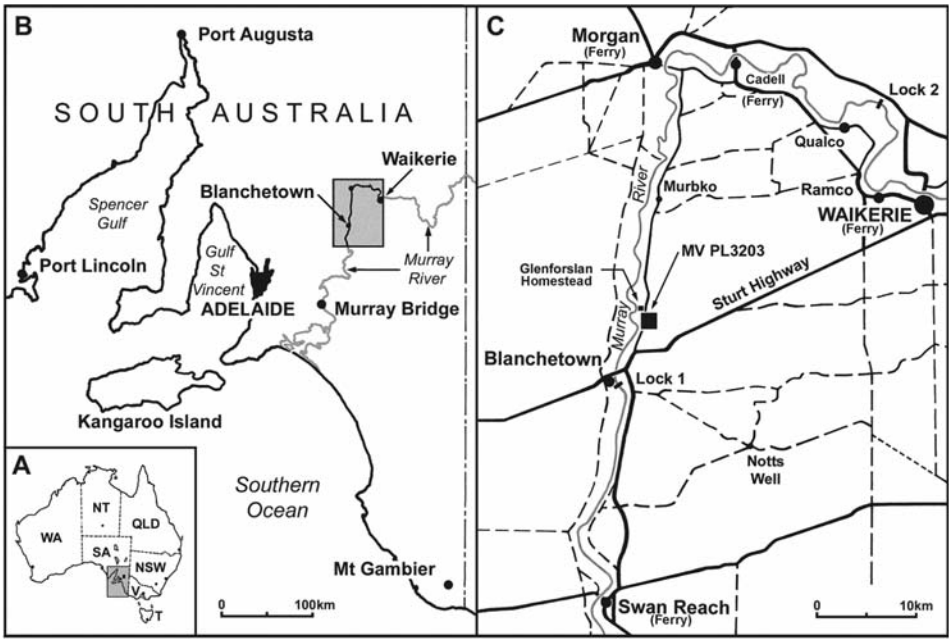

Figure 1. A, B, general location maps; C, map of the Murray River between Waikerie and Swan Reach, South Australia, showing locality of NMV locality PL3203, north of Blanchetown.

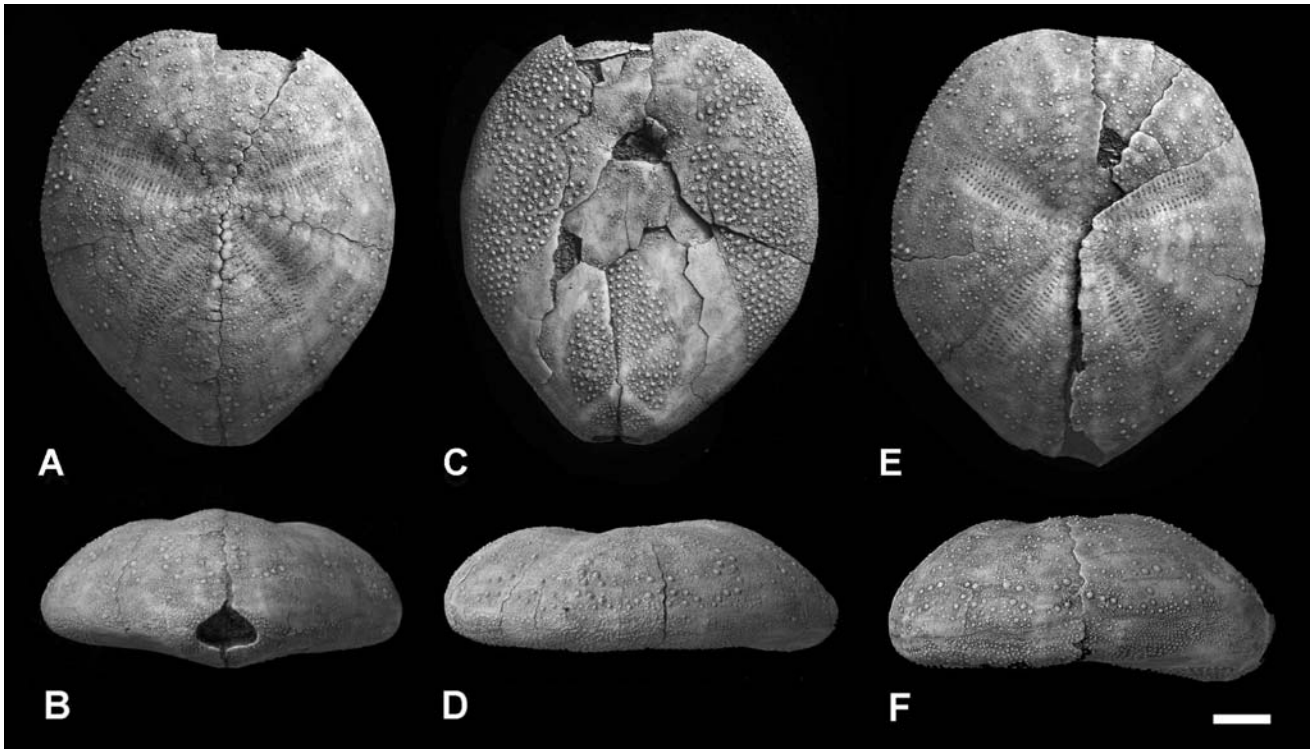

Figure 2. *Murraypneustes biannulatus* gen et sp. nov. A–D, adapical, posterior, adoral and left lateral views of holotype NMV P312370; E, adapical view of paratype NMV P312371; F, left lateral view of paratype, NMV P312372. All from the early Middle Miocene Glenforslan Formation in the vicinity of NMV locality PL3203, north of Blanchetown, South Australia.

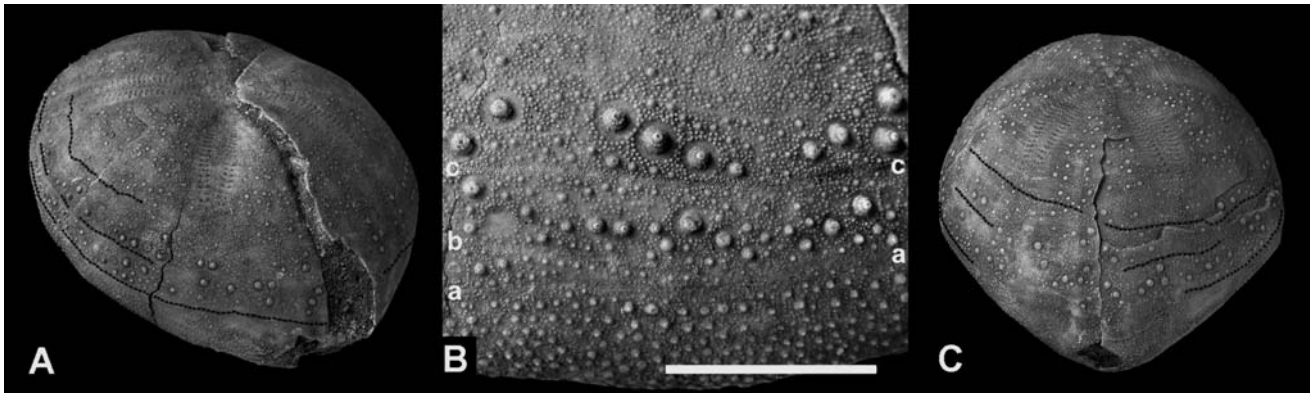

Figure 3. Fasciole details of *Murraypneustes biannulatus* gen. et sp. nov. A, B, oblique lateral view and ambulacrum IV detail above margin of paratype, NMV P312371; C, oblique posterior view of paratype, NMV P312372. Scale bar 10 mm.

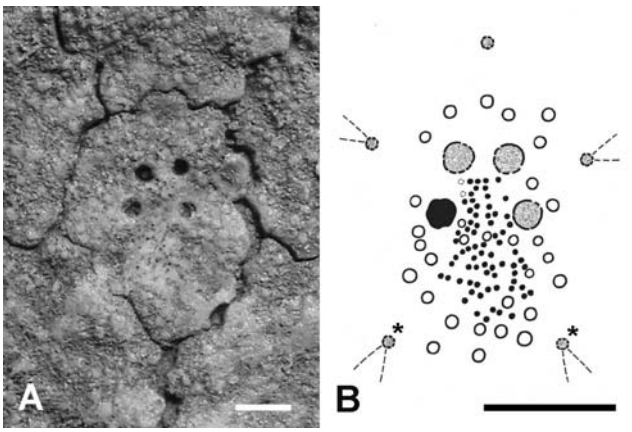

Figure 4. Apical disk details of *Murraypneustes biannulatus* gen. et sp. nov. A, holotype NMV P312370; B, drawing of paratype, NMV P312372, showing extent of hydropores (black circles), tubercles (white circles), and gonopores and oculars (black or stippled). Location of posterior oculars (marked *) is assumed. Scale bars 1 mm.

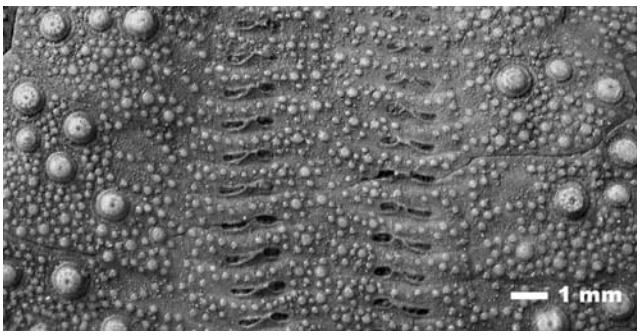

Figure 5. *Murraypneustes biannulatus* gen. et sp. nov. Detail of pore pairs and tubercles in and adjacent to ambulacrum V of paratype, NMV P312372.

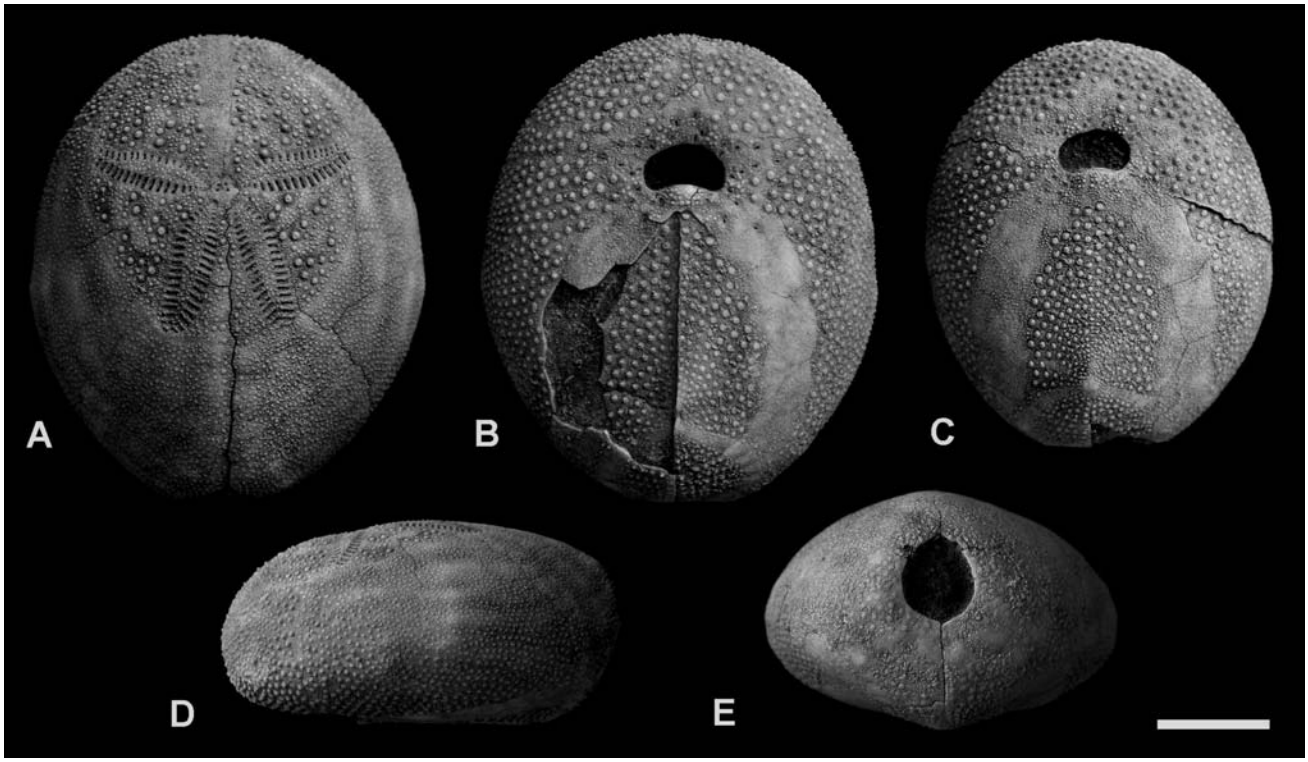

Figure 6. *Spatagobrissus dermodyorum* sp. nov. A, B, D, adapical, adoral, and left lateral views of holotype, NMV P312570; C, adoral view of paratype, NMV P312571; E, posterior view of paratype, NMV P312572 All specimens from the early Middle Miocene Glenforslan Formation in the vicinity of locality NMV PL3203, north of Blanchetown, South Australia. Scale bars 10 mm.

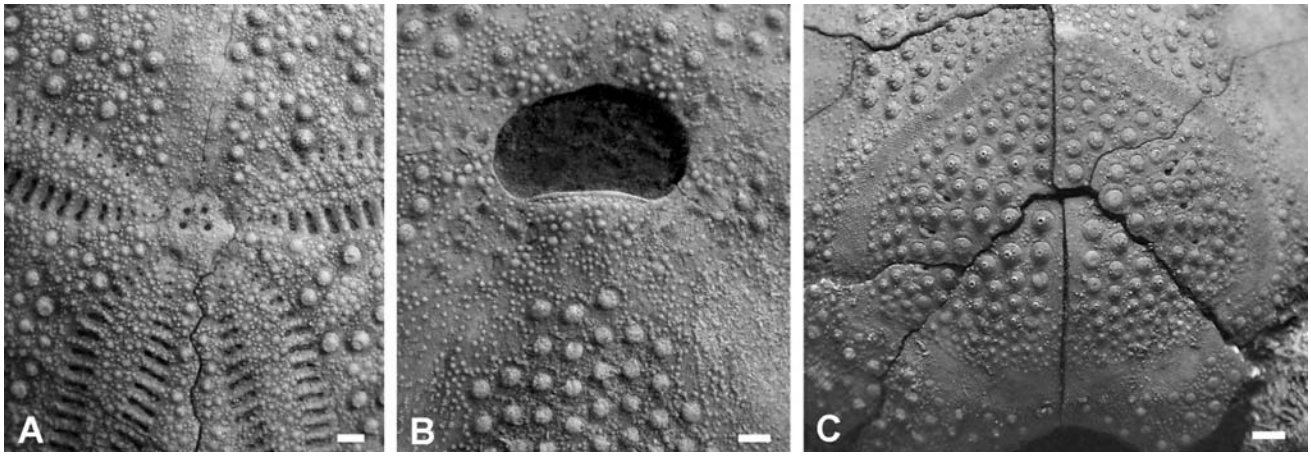

Figure 7. *Spatagobrissus dermodyorum* sp. nov. A, detail of petals and apical disk of holotype, NMV P312570; B, peristome and labrum tuberculation of paratype, NMV P312571; C, subanal fasciole and pore pairs of paratype, NMV P312573. Scale bars 1mm.

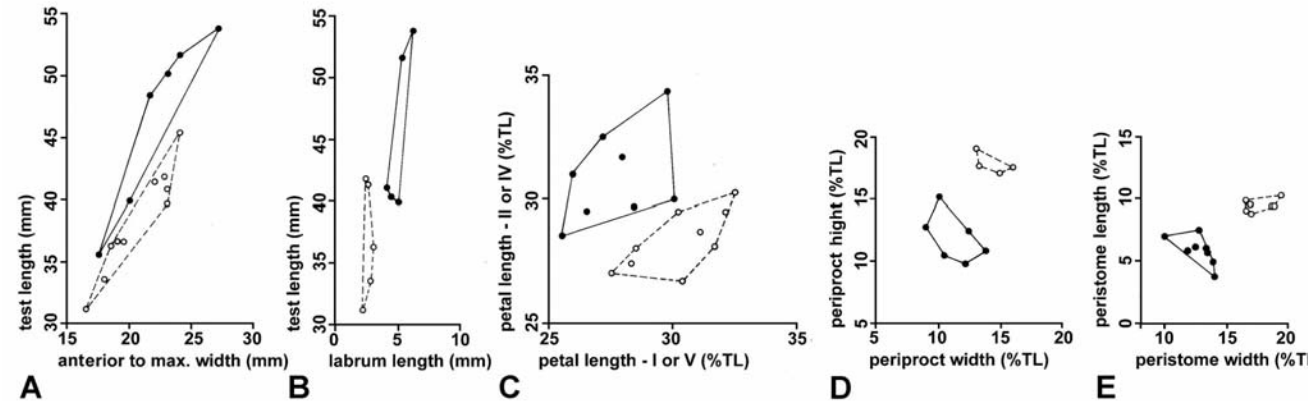

Figure 8. Comparative biometric data on specimens of *Spatagobrissus laubei* (Duncan, 1877) from the Middle Miocene Port Campbell Limestone, Port Campbell, Victoria (•), and *S. dermodyorum* sp. nov. from the early Middle Miocene Glenforslan Formation, Blanchetown district, South Australia (o).