

The evolutionary significance of scale-like spines on the Australian and SW Pacific Cainozoic ostracods *Ponticocythereis manis* Whatley & Titterton, 1981 and *Trachyleberis floridus* sp. nov.

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ABSTRACT - *Ponticocythereis* species are a discrete phylogenetic group within the Trachyleberididae that evolved in the SW Pacific and Australasian regions during the Tertiary. The presence of similar scale-like spines on the unrelated species *Ponticocythereis manis* Whatley & Titterton, 1981 and *Trachyleberis floridus* sp. nov. is presented as an example of convergent evolution. *J. Micropalaeontol.* 15(2): 161–168, October 1996.

INTRODUCTION

The ostracod species *Ponticocythereis manis* Whatley & Titterton, 1981 and *Trachyleberis floridus* sp. nov. both possess rather similar scale-like spines. These lateral surface carapace features are seen in few other ostracod species and are here discussed in terms of their evolutionary significance.

Figured specimens of *P. manis* were collected from NE Shortland Island, near Rokau Island in the Solomon Islands chain, SW Pacific (Whatley & Titterton, 1981; sample no. O.S.6: p.158) and are housed in the British Museum (Natural History).

Figured specimens of *T. floridus* were collected from earliest Middle Miocene silty clays outcropping at the mouth of Grice's (Gunyoung) Creek, Mornington, Victoria, Australia (Warne, 1988; locality 3e, fig. 3, p. 9), and from latest Lower Miocene marls outcropping in the Batesford Limestone Quarry near Geelong, Victoria, Australia (Warne, 1988; locality 2, fig. 2, p.9). They are housed in the Museum of Victoria and prefixed by MVP.

SPINE TYPES AND SPINE POSITIONS

There are two types of spines found on the carapaces of *P. manis* and *T. floridus*. These are blades (BS; pl. 1, fig. 7b) and scales (SS; pl. 1, figs 6a&b, 7a&b). When abraded, these may appear as single tubes (st; pl. 1, fig. 10) or clustered tubes (ct; pl. 1, fig. 10).

Blade-like spines occur along the anterior and ventral margins of both species. Scale-like spines cover the rest of the external surface of the carapace in each species, except in the vicinity of the anterior and posterior marginal depressions.

Spine positions are characteristic and distinct for each species. These are mapped for both valves of *P. manis* and for the right valve of *T. floridus* (Fig. 1).

COMPARATIVE MORPHOLOGY, SYSTEMATIC RELATIONSHIPS AND PHYLOGENY

Systematic framework of *Ponticocythereis*

The genus *Ponticocythereis* probably includes a phylogenetically discrete group of species within the Trachyleberididae

Sylvester-Bradley, 1948. This genus has a distinct palaeo/biogeographical distribution. It is restricted to the SW Pacific and Australasia. The earliest record of a *Ponticocythereis* species is in the Tertiary of southeastern Australia where *P. militaris* McKenzie, 1967 makes its first appearance during the early Middle Miocene (Warne, 1987).

Whatley & Titterton (1981) modified McKenzie's (1967) diagnosis of *Ponticocythereis* to accommodate species with intercostal spines, micropunctae, micropapillae or delicate open reticulation. It is here emphasized that the association of three spinose ribs, blade or scale-like spines, posteriorly pointing spines and the development on the posterior inner lamellae of an oval pit and corresponding knob in the opposite valve, is a combination typical of *Ponticocythereis* species. Other significant features of *Ponticocythereis* are a strongly developed shelf-like structure below the antero-medium part of the hinge, development of a small tooth anterior to the left valve antero-terminal socket and a denticulate postero-medial bar that is elevated and expanded posteriorly (Whatley & Titterton, 1981).

The relationships between *Ponticocythereis* and *Actinocythereis*

Spinose ribs are found on both *Ponticocythereis* and *Actinocythereis s.l.* species. Furthermore, *P. manis*, in common with some *Actinocythereis* species, has intercostal spines. A typical Australian *Actinocythereis* species is *A. tetrica* (Brady, 1880). *A. tetrica* differs from *Ponticocythereis* species in lacking posteriorly pointing blade or scale-like lateral surface spines (Fig. 2). The absence of these carapace characters distinguishes *Actinocythereis s.l.* from *Ponticocythereis*.

Some specimens of *A. tetrica* possess a weakly developed oval pit or knob on the posterior inner lamellae. *Actinocythereis rugibrevis* (Hornibrook, 1952) n. comb. from the Cainozoic of New Zealand possesses a small tooth anterior to the left valve terminal hinge socket. The absence of these carapace features are not, therefore, useful in distinguishing *Actinocythereis s.l.* from *Ponticocythereis*.

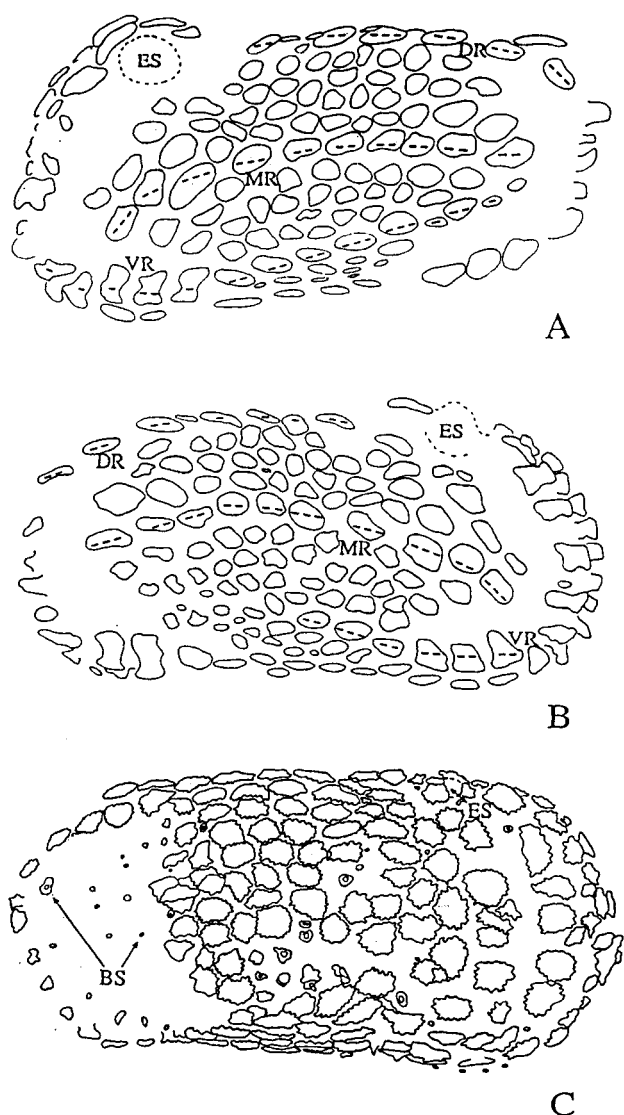


Fig. 1. Spine position maps: (ES = eye spot, DR = dorsal rib, MR = median rib, VR = ventral rib, BS = broken spine). (A) *Ponticocythereis manis* Whatley & Titterton, left valve, paratype, OS 11757, $\times 100$. (B) *Ponticocythereis manis* Whatley & Titterton, right valve, paratype, OS 11756, $\times 100$. (C) *Trachyleberis floridus* sp. nov., right valve, holotype, MVP 122579, $\times 80$.

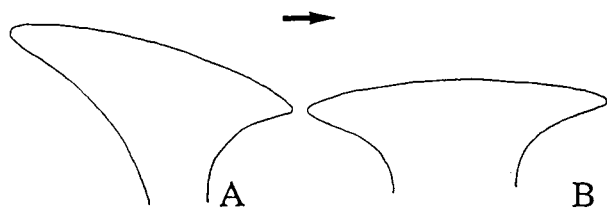


Fig. 2. Schematic cross-section of scale-like spines; approximate enlargement $\times 800$ (arrow points towards anterior). (A) Posteriorly pointing scale-like spine such as found on *Ponticocythereis manis* Whatley & Titterton. (B) Scale-like spine with no preferred orientation such as found on *Trachyleberis floridus* sp. nov.

The relationship between *Ponticocythereis* and *Trachyleberis*

All *Trachyleberis* species lack lateral spinose ridges. The absence of these features distinguishes *Trachyleberis* from *Ponticocythereis*.

Within the Australasian/SW Pacific region two *Trachyleberis* species groups are common. The morphological relationship each has to *Ponticocythereis* is different.

The first includes the relatively small forms *T. brevicosta* Hornibrook, 1952 and *T. floridus* sp. nov.. These two species lack a small tooth anterior to the left valve terminal hinge socket, a well developed posterior inner lamellae pit or knob structure and posteriorly pointing spines. The absence of these features, as well as lateral surface ribs distinguishes this group of *Trachyleberis* species from *Ponticocythereis*. *T. floridus* and *T. brevicosta* may possess blade or scale-like spines, similar to species of *Ponticocythereis*. The terminal expansions of the spines in some specimens of *T. brevicosta* are similar to those found on some specimens of *T. scabrocuneata* (Brady, 1880) *s.l. sensu* Hu (1986). In neither case are they as well developed as in *T. floridus*. McKenzie *et al.* (1991) referred to the spines on *T. brevicosta* as stud-like. Hu (1986) referred to the spines on some specimens of *T. scabrocuneata* as being pimple-like.

The second group of *Trachyleberis* spp. includes relatively large, often robust forms such as, *T. thomsoni* Hornibrook, 1952; *T. tridens* Hornibrook, 1952 and *T. careyi* McKenzie, Reyment & Reyment, 1991. Blade or scale-like spines have not been observed on these species. In contrast to the first group of *Trachyleberis* species, but in common with *Ponticocythereis* species, these forms possess a small tooth anterior to the left valve terminal hinge socket. Like the first group of *Trachyleberis* species, they lack a posterior inner lamellae pit/knob structure and posteriorly pointing spines.

The relationship between *Ponticocythereis* and *Acanthocythereis*

The species *Acanthocythereis ascoli* (Puri, 1963) possesses bulb-like terminal spine expansions (pl. 27, fig. 9 in Bonaduce *et al.*, 1975). Unlike in *Ponticocythereis* species, these spines are arranged on the costae of a distinct and strong reticulation and are not posteriorly pointing or associated with ribs. They also occur in 'bunches' of 3–5 bulbs to each spine.

The relationship between *Ponticocythereis* and *Verrucocythereis*

Plate-like spines are developed in the Quaternary Mediterranean species *Verrucocythereis bulbospinata* (Uliezny). These are not as well developed as in *P. manis* and do not give *V. bulbospinata* a scaly appearance. Furthermore, the spines on *V. bulbospinata* are associated with a distinct reticulation, but not with ribs.

The relationship between *Ponticocythereis* and *Pterygocythereis*

Pterygocythereis velivola (Brady, 1880) is an Australasian/Indo-Pacific species that belongs to a phylogenetic genus possessing blade-like spines that also includes the

Mediterranean, Adriatic and American species' *Pterygocythereis jonesi* (Baird, 1850), *Pterygocythereis ceratoptera* (Bosquet, 1852) and *Pterygocythereis americana* (Ulrich & Bassler, 1904) respectively.

The genus *Pterygocythereis* Blake, 1933 is closely allied to the genera *Alatacythere* Murray & Hussey, 1942, *Ponticulocythere* Dingle, 1981 and *Alataleberis* McKenzie & Warne, 1986. Species of all these genera have a well developed ala, clearly distinguishing them from other trachyleberid genera such as *Ponticulocythereis*, *Trachyleberis*, *Actinocythereis* and *Acanthocythereis*. Further distinctions relate to the different internal features of *Pterygocythereis* as described by Guernet (1990). The common occurrence of blade-like spines in *Ponticulocythereis* and *Pterygocythereis* therefore does not appear to indicate a close phylogenetic relationship. This conclusion is supported by the presence in adult *Ponticulocythereis* specimens and lack in *Pterygocythereis* specimens of a median lateral surface rib.

CONVERGENT EVOLUTION

The aim of the previous discussions was to demonstrate the discrete phylogeny of *Ponticulocythereis* and therefore the discrete phylogenetic relationship between *P. manis* and *T. floridus*.

As a consequence of this discrete relationship, the co-occurrence of scale-like spines on *P. manis* and *T. floridus* appears to be an example of convergent evolution.

Whatley & Titterton (1981) record *P. manis* from the Solomon Islands as inhabiting tropical intertidal regions in the vicinity of coral reefs. Hartmann (1981) records *P. manis* (= *Actinocythereis verrucifera* Hartmann, 1981) from northern Australia as living on algae in coral reefs at aquatic temperatures of 26°C (tropical marine climate) in waters of normal marine salinity. He found dead specimens of this littoral species in coral sand.

The best preserved adult specimens of *T. floridus* sp. nov. encountered, were found in the absence of juvenile specimens in an earliest Middle Miocene neritic (outer shelf) silty clay from southeastern Australia (type locality). A less well preserved, but autochthonous population occurs in a latest Lower Miocene shallower neritic (inner-shelf) marl also from southeastern Australia (see locality details under systematic palaeontology). These latest Lower Miocene to earliest Middle Miocene strata were deposited when southeastern Australia was experiencing subtropical to warm temperate palaeoclimatic conditions (Warne, 1988 and references therein).

In summary, both species appear to inhabit/inhabited warm temperate to tropical normal shallow marine environments. Their delicate ornament is presumed to indicate that they live/lived in sheltered conditions away from the the influence of wave action. The scale-like ornament may serve/have served as armour against predators. These ecological similarities perhaps suggest that convergent evolution in spine type between *P. manis* and *T. floridus* is a consequence of adaptation to similar environments.

As *P. manis* and *T. floridus* both belong to the family

Trachyleberididae consideration needs to be given to the possibility that they inherited the genetic capacity to express scale-like spines from a common ancestor, with the phenotypic expression of this spine type in diverging lineages being similarly dependent on favourable environmental conditions. However, differences in the orientation of scale-like spines between the two taxa seems good evidence against the simple co-inheritance of this character. Furthermore, scale-like spines do not occur early in the ontogeny of *P. manis* as might be apparent if these features were inherited from an ancestor in common with *T. floridus*. The appearance of scale-like spines late in the ontogeny of *P. manis* could signify that it is a recent, independent acquisition within *Ponticulocythereis* and similarities in spine type with *T. floridus* reflect convergence, nothing more. There is no fossil record of scale-like spines in *Ponticulocythereis*, whereas within *Trachyleberis*, scale-like spines are known to occur as far back as the mid Tertiary.

SYSTEMATIC PALAEOLOGY

- Subclass **Ostracoda** Latreille, 1806
- Order **Podocopida** G.W. Müller, 1894
- Suborder **Podocopa** Sars, 1866
- Superfamily **Cytheracea** Baird, 1850
- Family **Trachyleberididae** Sylvester-Bradley, 1948
- Genus **Trachyleberis** Brady, 1898
- Type species: *Cythere scabrocuneata* Brady, 1880.
- Trachyleberis scabrocuneata* (Brady, 1880) s.s.

1880 *Cythere scabrocuneata* Brady: 103, pl. 17, figs. 5a-f.
 1976 *Cythere scabrocuneata* Brady, 1880; Puri & Hulings: 289, pl. 26, figs 6 and 8.
Neotype. Adult, LV, BM 1974.324 (Station 233b of Brady, 1880); housed in British Museum (Natural History).
Remarks. As *Trachyleberis scabrocuneata* is the type species of the genus *Trachyleberis*, a stable understanding of this taxon is critical to the systematic classification of trachyleberid ostracods. Line drawings of *T. scabrocuneata* in Brady's (1880) monograph occur in pl. 17 (figs 5a-f) and pl. 23 (figs 2a-c). On the basis of differences in shape, the specimens illustrated in pl. 17 and pl. 23 cannot confidently be recognized as belonging to the same species. Harding & Sylvester-Bradley (1953) designated a lectotype for *Cythere scabrocuneata* (BM 1952.12.10, 1, 2 from station 233b of Brady, 1880). Unfortunately the lectotype specimen has been lost (Puri & Hulings, 1976). This fact in combination with uncertainties concerning the carapace shape arising from Brady's (1880) monograph plates, potentially destabilizes the morphological concept for *T. scabrocuneata* s.s. A concept for the carapace morphology of *T. scabrocuneata* s.l. appears to have become established around Brady's (1880) illustrations on pl. 17, figs 5a-f (Ishizaki, 1966, p. 156, pl. 18, fig. 9; Ishizaki, 1969, p. 221, pl. 26, fig. 8; Ishizaki, 1971, p. 91, pl. 4, fig. 16; Puri & Hulings, 1976, p. 289, pl. 26, figs 6 & 8; Malz & Ikeya, 1982, pl. 1, figs 4-5, Hu, 1986, p. 125, pl. 4, figs 9, 11, 21 and 26). However, within this rather loose concept there are some variations with respect to spine types, alignment and most importantly, the presence

of ribs. Hu (1986) made *Trachyleberis cuneatelles* Hu, 1984 a junior synonym of *T. scabrocuneata*. The holotype and paratypes of *T. cuneatelles* display a short, distinct longitudinal rib at about mid-height in the subanterior region of the carapace lateral surface. It also has a poorly defined longitudinal alignment of spines in the ventral region of the carapace lateral surface. A subanterior median rib is not apparent in the topotype of *T. scabrocuneata* figured by Puri & Hulings (1976) or in any of Brady's (1880) figures of this species. The absence of raised ribs in *Trachyleberis* species' is important with respect to their differentiation from *Actinocythereis* species'. Therefore, Hu's (1986) placement of *T. cuneatelles* as a junior synonym of the *Trachyleberis* type species diminishes the clarity of the differential diagnosis between *Trachyleberis* and *Actinocythereis*. The concept adopted here for *T. scabrocuneata* s.s. is based on the specimen of this species illustrated by Puri & Hulings (1976). This specimen does not have any raised longitudinal ribs although a very poorly defined longitudinal alignment of spines is apparent in the ventral region of the external lateral surface. The absence of obvious longitudinal lateral surface ribs (usually three) distinguishes *Trachyleberis* from *Actinocythereis*. In order to stabilize the concept of the carapace morphology of *T. scabrocuneata* and clarify the differential diagnosis between *Trachyleberis* and *Actinocythereis*, the topotype of *T. scabrocuneata* illustrated by Puri & Hulings (1976) is here designated as a neotype. This is a practical measure taken in order to stabilize the definition of *T. scabrocuneata* and the differential diagnosis between *Trachyleberis* and *Actinocythereis*. However, it is not here implied that this differential diagnosis always clusters species into phylogenetically consistent groupings.

Trachyleberis floridus sp. nov.
(Fig. 1C: Pl. 1, figs 7a&b, 9–12)

1987 *Trachyleberis* sp. 4 (in part) Warne: 442.

1994 ? *Ponticythereis* sp. aff. *P. manis* Whatley & Titterton, 1981 (in part): Neil: 5–6, pl. 2, figs 3–5.

Derivation of name. From the Latin, *floridus*, meaning flowery; a reference to the flower-like appearance of the serrated edged scale-like spines of this species.

Diagnosis. A subrectangular species of *Trachyleberis* with a broadly rounded posterior margin and scale-like spines. Individual spines consist of a stem on which sits a serrated edged disk. The lateral surface scale-like spines give the species an armoured appearance.

Holotype. Adult, RV, MV P122579 from the Fyansford Formation (early Middle Miocene) at Grice's (Gunyoung) Creek, Mornington, Victoria, Australia (near the Mouth of the Creek, 2 m vertically above the stream bed), 38°11'S, 145°03'E

Paratypes. MV P122580 (LV), MV P122581 (LV), MV P122589 (RV); all from type locality.

Additional material. 6 adult LV's, 1 adult RV and 1 juvenile valves from the Fyansford Formation in the Batesford Limestone Quarry, near the middle of the formation at this locality (top of middle quarry bench, above the upper limit of *Lepidocyclus* sp.), approximately 15 m above the contact with the Batesford Limestone, southeast face, near Fyansford, Victoria, 38°06'S, 144°17'E. Adults are stored on assemblage slide MV P122689. The juvenile is stored on the single fossil slide MVP 122590.

Description. Large, thick-shelled, opaque to semi-translucent; subrectangular in lateral view; subovate in dorsal view. Anterior margin evenly rounded with up to 13 blade-like spines; extremity at mid-height. Posterior margin gently rounded with up to 10, mostly blade-like spines (frequently abraded); extremity above mid-height. Dorsal margin with 10 scale-like spines; straight in RV; nearly straight in LV except for a slightly concave aspect just above and behind the terminal anterior hinge element. Ventral margin with numerous spines (blade-like in posterior) and with a slight medium concavity. Greatest length slightly above mid-height; greatest height at anterior cardinal angle; greatest width medianly. LV > RV. Surface of carapace primarily smooth but covered with

Explanation of Plate 1

Fig. 1. *Ponticythereis manis* Whatley & Titterton, female, left valve, holotype, OS11753, external lateral view, ×68. **Fig. 2.** *Ponticythereis manis* Whatley & Titterton, male, right valve, paratype, OS11759, internal view, ×65. **Fig. 3.** *Ponticythereis manis* Whatley & Titterton, female, carapace, paratype OS11754, dorsal view, ×67. **Fig. 5.** *Ponticythereis manis* Whatley & Titterton, male, carapace, paratype, OS11755, dorsal view, ×66. **Fig. 6a.** *Ponticythereis manis* Whatley & Titterton, male, left valve, paratype, OS11757, enlargement of lateral surface ornament immediately posterior of the anterior marginal depression and just below mid height. External lateral view showing minutely punctate scale-like spines. The upper margin of the figure is towards the anterior and the left hand margin is towards the venter, approximately ×344. **Fig. 6b.** *Ponticythereis manis* Whatley & Titterton, male, left valve, paratype, OS11757, enlargement of Plate 1, figure 6a and similarly orientated, showing an open normal pore canal situated between scale-like spines, approximately ×1060. **Fig. 7a.** *Trachyleberis floridus* sp. nov., female?, right valve, paratype, MV P122589, enlargement of lateral surface ornament towards the venter at about mid length showing an oblique view of minutely punctate and serrate scale-like spines. Ventral view, approximately ×580. **Fig. 7b.** *Trachyleberis floridus* sp. nov., female?, right valve, paratype, MV P122589, enlargement of ornament on the ventral margin one third of the carapace length from the posterior. Blade-like spines in the foreground and scale-like spines in the background, approximately ×792. **Fig. 8a.** *Ponticythereis manis* Whatley & Titterton, female, left valve, paratype, OS11758, enlargement of anterior hinge element, approximately ×191. **Fig. 8b.** *Ponticythereis manis* Whatley & Titterton, female, left valve, paratype, OS11758, enlargement of posterior hinge element, approximately ×191. **Fig. 9.** *Trachyleberis floridus* sp. nov., late stage juvenile (overall length of specimen = 0.72 mm), left valve, MV P122590, enlargement of a lateral surface spine in the postero-ventral region. The upper margin of the figure is towards the posterior and the right hand margin is towards the venter, approximately ×920. **Fig. 10.** *Trachyleberis floridus* sp. nov., female? left valve, paratype, MV P122580, external lateral view, ×53. (ct = abraded spine with clustered tubes; st = abraded spine with single tube). **Fig. 11.** *Trachyleberis floridus* sp. nov., male? left valve, paratype, MV P122581, internal view, ×45. **Fig. 12.** *Trachyleberis floridus* sp. nov., male?, right valve, holotype, MV P122579, external view, ×52.

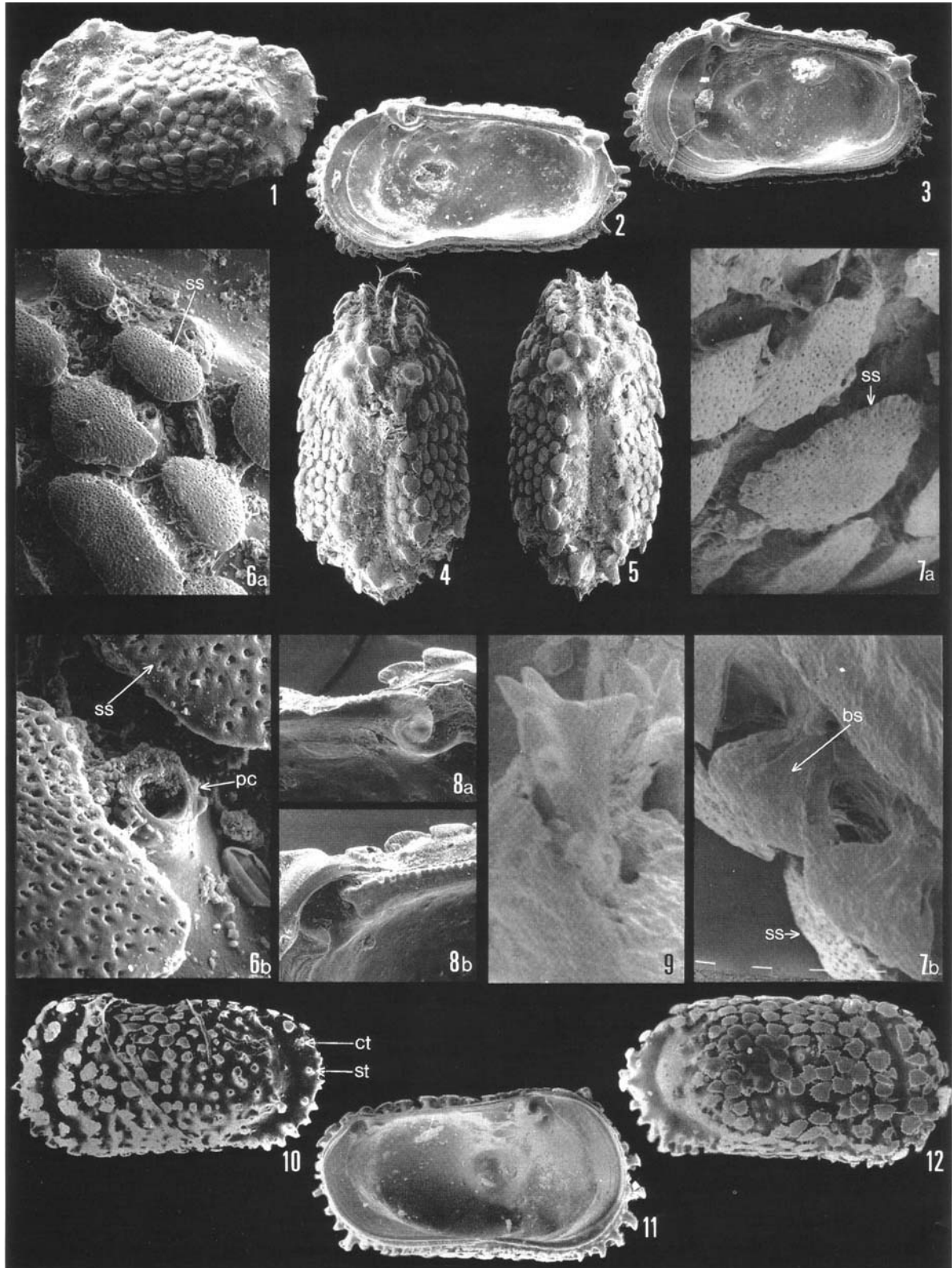


Plate 1

serrated edged scale-like spines which are minutely punctate. These are absent in the anterior and posterior marginal depressions. Subcentral tubercle is not visible externally, eye tubercle usually obscure, but in some specimens is prominent due to a glassy appearance. Marginal pore canals straight and numerous in both the anterior and posterior. Hinge amphidont. A snap knob and pit structure is weakly developed on the posterior inner lamellae. Adductor muscle scar pattern comprises 4 elliptical scars in a subcentral column. The frontal muscle scar is 'V'-shaped. Sexual dimorphism not obvious, with males having only a slightly greater length to height ratio than females.

Dimensions (mm).

			L	H
Holotype,	MV P122579,	RV, male?,	1.03	0.36
Paratype,	MV P122580,	LV, female?,	0.99	0.36
Paratype,	MV P122581,	LV, male?,	1.18	0.44
Paratype,	MV P122589,	RV, female?	0.90	0.42

Remarks. The late stage juvenile specimen possesses well developed scale-like spines in the vicinity of the dorsal margin. Elsewhere on the lateral surface of this juvenile specimen, scale-like spines are poorly developed or undeveloped. These undeveloped spines possess a relatively long stem on which a very small spherical ball sits and from which a number of delicate minute spines extend resembling a mace with its spherical spiked head. In adults the spherical ball appears to develop into a larger disk. The delicate minute spines extending from the ball do not appear to develop further in adults and may become the serrations on the edge of the scale-like disk. The overall effect of spines on the adult lateral surface is to give the species an armoured or scaly appearance. When spines are abraded in adults they usually appear as a single broken stem. Rarely, broken or undeveloped spines appear as a cluster of nodes on the carapace surface. Branching spines originating from a single stem, either as an originally preserved ornamental feature, or as an abraded feature have not been observed on the adult specimens examined in this study. They have, however, been observed in some of the *Trachyleberis* specimens illustrated by McKenzie *et al.* (1991). Adult specimens of *T. floridus* differ from other *Trachyleberis* species with scale or blade-like spines in being regularly subrectangular in shape, possessing a broadly rather than acutely rounded posterior and in having a different arrangement of spine positions. Some figured specimens designated as *Ponticythereis* sp. aff. *P. manis* Whatley & Titterton by Neil (1994, pl. 2, figs 3 & 5) are here considered to belong to *T. floridus*.

Age and stratigraphical range. Specimens examined for this study were collected from the latest Lower to earliest Middle Miocene marl, silt and clay lithologies of the Fyansford Formation, Victoria, Australia.

Genus *Actinocythereis* Puri, 1953

Type species: *Cythere exanthemata* Ulrich & Bassler, 1904.

Actinocythereis tetrica (Brady, 1880)

1880 *Cythere tetrica* Brady: 104, pl.23, figs 5a–d.

1976 *Cythere tetrica* Brady, 1880; Puri & Hulings: 29, pl.27, figs 4–6.

1978 *Actinocythereis dampierensis* Hartmann: 89, text-figs 165–174; pl. 5, figs 10–16.

1984 *Trachyleberis dampierensis* (Hartmann, 1978); McKenzie & Pickett: 230–232, figs 4BB, 4CC, 4DD, 4EE, 4FF, 5A.

Neotype. Adult, carapace, BM 1974.338 from sediment sample M-242 (Station 187 of Brady, 1880); housed in British Museum (Natural History).

Remarks. Puri & Hulings (1976) designated a number of lectotypes for species named by Brady (1880). The specimen designated as the lectotype for *Cythere tetrica* Brady, 1880 was lost during Puri & Hulings' study. There are no SEM photographs of this specimen. Instead, Puri & Hulings (1976) illustrated, with SEM photographs, one topotype (a carapace). Even though the lectotype has been lost, the citation of Brady's (1880) name for this species by Puri & Hulings (1976) means that it is still valid and has precedence over other names subsequently created for this species. In order to stabilize the relationship Brady's species has to other taxa, the topotype of *Cythere tetrica* illustrated by Puri & Hulings (1976) and housed in the British Museum is here designated as a neotype. This neotype is recognizable as belonging to the same species as the specimens of *C. tetrica* illustrated in Brady's (1880) monograph and is the same taxon as that designated by Hartmann, 1978 as *Actinocythereis dampierensis*. *Actinocythereis dampierensis* Hartmann, 1978 is therefore a junior synonym of *Cythere tetrica* Brady, 1880. The designation of a neotype for *Cythere tetrica* stabilizes the junior synonym status of *Actinocythereis dampierensis*. The specimens of this species illustrated by Brady (1880), Puri & Hulings (1976), Hartmann (1978) and McKenzie & Pickett (1984) are similar in size and have almost identical spine positions on the lateral surface of the carapace. This species is placed within *Actinocythereis s.l.* on the basis that some of the lateral surface spines are aligned along slightly raised longitudinal ribs. These ribs are not very prominent. As previously remarked, the differential diagnosis between *Trachyleberis* and *Actinocythereis* is based on character associations that are possibly a less than exact reflection of phylogenetic groupings of species within these genera. Figured specimens designated as *Actinocythereis tetrica* (Brady) by Yassini *et al.* (1993) vary slightly from the illustrated specimens within works here referred to in the synonymy list for *A. tetrica* by being less elongate, more rounded posteriorly and by possessing a higher anterior half of the carapace relative to posterior half of carapace in lateral view. Hornibrook (1952) has recorded this species from the Oligocene of New Zealand.

Actinocythereis rugibrevis (Hornibrook, 1952) n. comb.

1952 *Trachyleberis rugibrevis* Hornibrook: 34, pl.4, figs 52–54.

1993 *Trachyleberis rugibrevis* Hornibrook, 1952; Ayress: 140, fig. 10F.

Remarks. From the illustrations in Hornibrook's (1952) monograph and from the inspection of subfossil material from New Zealand it is apparent that some of the spines on this species are aligned along longitudinal ribs. As a consequence it is here placed in the genus *Actinocythereis* s.l. although a close affinity to some larger Indo/Pacific species such as *T. thomsoni* is probable. *A. rugibrevis* possesses a small tooth anterior to the left valve terminal hinge socket like larger Indo/Pacific *Trachyleberis* species (*T. tridens*, *T. thomsoni* and *T. careyi*). Generally this feature is poorly developed in these *Actinocythereis* and *Trachyleberis* species in comparison with *Ponticythereis* species. *A. rugibrevis* occurs in one of two Recent New Zealand ostracod collections housed at La Trobe University, Bundoora, Victoria, Australia. It is abundantly represented in a collection from offshore of Little Barrier Island, Hauratui Gulf, NZ at 77 m water depth (slide LTU 12465) and completely absent from a collection from offshore off Three Kings Island, NZ at 183 m water depth (slide LTU 12466). It is presumably a shallow neritic (inner to mid. shelf) species. Hornibrook (1952) records this species ranging back to the Late Oligocene of New Zealand.

Genus *Ponticythereis* McKenzie, 1967

Type species, *Ponticythereis militaris* McKenzie, 1967.

Ponticythereis manis Whatley & Titterton, 1981

(Figs 1A&B; Pl. 1, figs 1–5, 6a&b, 8a&b)

(SEM illustrations same as in Whatley & Titterton, 1981)

1981 (May) *Ponticythereis manis* Whatley & Titterton: 162–164, pl. 2, figs 1–12.

1981 (November) *Actinocythereis verrucifera* Hartmann: 104–105; text-figs 6–12, pl. 4, figs 6–12.

Remarks. Unlike *T. floridus*, *P. manis* does not, as far as is known, exhibit serrations on the periphery of the scale-like spines. The posteriorly pointing aspect of the blade or scale-like spines on this and other *Ponticythereis* species is often only conspicuous on the longitudinal lateral surface ribs towards their posterior terminations. The abraded specimen of this species illustrated by Hartmann (1981, pl. 6, fig. 12) has had the scale-like spines completely eroded off the carapace leaving only stumpy nodes. It is not possible to see the posterior pointing aspect of any carapace lateral surface spines on this specimen, although the longitudinal ribs and all spine positions are still evident. As a consequence, and without consideration of internal features, biostratonomical influences have caused this specimen to superficially resemble *Actinocythereis* species.

Ponticythereis labiata (Brady, 1890) is very similar in size and shape to *P. manis*. McKenzie's (1986) illustration of the holotype of *P. labiata* indicates that it has fewer spines. As some of these spines are scale-like it is presumed that spine development was sufficient for all spine positions to be apparent on the carapace. *P. labiata* therefore appears to be a discrete species from *P. manis*.

All juveniles of both *P. manis* and the Recent Papua New Guinea species *Ponticythereis laingensis* (Wouters, 1981)

are very similar in external ornament and shape although not in size. Scale-like spines are not apparent on these specimens and only go on to develop in the adult stage of *P. manis*.

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