EOCENE-OLIGOCENE OSTRACODA FROM SOUTH AUSTRALIA AND VICTORIA, AUSTRALIA

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ABSTRACT

Australian Eocene-Oligocene Ostracoda have been little reported hitherto, this paper representing the first substantial taxonomic study. The 89 species which we identified came from the late Eocene Gulf Rock Member of the Blanche Point Formation in the Willunga Embayment, South Australia (16 species) and the lower fossiliferous bed of the late Oligocene Angahook Formation at Bells Headland, Victoria (70 species); only 6 species are common to both formations. We describe 4 new genera, 38 new species and 2 new subspecies. The new genera are: Geelongella gen. nov. (type species G. antium sp. nov.); Margoclythea gen. nov. (type species M. aspera sp. nov.); Spinobradleya gen. nov. (type species S. acantha sp. nov.); Deitaleberis gen. nov. (type species D. rugosaptya sp. nov.). New species are: Cytherella gullrockensis sp. nov.; Cytherella belli sp. nov.; Platella victoriae sp. nov.; Geelongella antium sp. nov.; Cytherelloidea jugifera sp. nov.; Cytherelloidea marginoprypa sp. nov.; Bairdippilata torquayensis sp. nov.; Bythocypris sudaustrias sp. nov.; Tasmanocypris euryplamella sp. nov.; Saida bellensis sp. nov.; Schizocythere inexpecta sp. nov.; Cytheralison corrugata sp. nov.; Hanaiceratina primitiva sp. nov.; Rotundocythere fragilis sp. nov.; Loxocochea punctabella sp. nov.; Loxocochea macgowrani sp. nov.; Mylena lindsayi sp. nov.; Oculocythereperon australopunctatae sp. nov.; Aversovalva cooperi sp. nov.; Hemicytherura reeeckmanni sp. nov.; Pokornylla australis sp. nov.; Hornbrookerella aggregata sp. nov.; Quadracythere singletoni sp. nov.; Neobrontonia ariella sp. nov.; Bradleya langalata sp. nov.; Bradleya dickhensoni sp. nov.; Bradleypa regularis sp. nov.; Tenedocythere auriculata sp. nov.; Tenedocythere muda sp. nov.; Quasibradleya janjukiana sp. nov.; Margoclythea aspera sp. nov.; Spinobradleya acantha sp. nov.; Trachyleberis careyi sp. nov.; Acanthocythereis incerta sp. nov.; Rocaeeleberis' soumræialis sp. nov.; Idocythere thalassea sp. nov.; Deitaleberis rugosaptya sp. nov. and Arculacythereis thomasi sp. nov. The new subspecies are Trachyleberis brevicosta Hornbrook, 1952 australis subsp. nov. and T. brevicosta major subsp. nov. In the Late Eocene Gulf Rock Member the most commonly occurring families are Cytherellidae, Bythocyprididae, Pontocypridiidae, Paracyprididae, Krithidae and Trachyleberididae; at Bells Headland (late Oligocene) the most commonly represented families are Cytherellidae, Bairdiidae, Paracyprididae, Cytheruridae, Thaerocyprididae, Trachyleberididae and Hemicytheridae.

Both assemblages are interpreted as indicating offshore facies, of which the Gulf Rock Member was deposited in deeper water than the Bells Headland facies which, however, indicates (large count of Hemicytheridae) cooler seawater palaeotemperatures in the Late Oligocene than during the Late Eocene. Some Early-Middle Miocene records, from the Gellibrand Marl and the Fishing Point Marl (Victoria), are also incorporated for biostratigraphical and palaeobiographical reasons.

Keywords: Ostracoda, gen. nov., spp. nov., Eocene, Oligocene, S. Australia, Victoria, Australia.

RESUMEN

Los ostrácodos del Eoceno-Oligoceno de Australia son poco conocidos; este trabajo representa el primer estudio taxonómico sustancial. De las 89 especies identificadas, 16 de ellas provienen del Miembro Gulf Rock de la Fm. Blythe Point, de edad Eoceno Superior, en Willunga Embayment, South Australia y 70 especies lo son de las capas fosilíferas inferiores de la Fm. Angahook de edad Oligoceno Superior, en Bells Headland, Victoria; sólo 6 especies son comunes a ambas formaciones. Describimos 4 nuevos géneros, 38 nuevas especies y 2 nuevas subspecies. Los nuevos géneros son: Geelongella gen. nov. (especie tipo: G. antium sp. nov.); Margoclythea gen. nov. (especie tipo M. aspera sp. nov.); Spinobradleya gen. nov. (especie tipo S. acantha sp. nov.); Deitaleberis gen. nov. (especie tipo D. rugosaptya sp. nov.). Las nuevas especies son: Cytherella gullrockensis sp. nov.; Cytherella belli sp. nov.; Platella victoriae sp. nov.; Geelongella antium sp. nov.; Cytherelloidea jugifera sp. nov.; Cytherelloidea marginoprypa sp. nov.; Bairdippilata torquayensis sp. nov.; Bythocypris sudaustrias sp. nov.; Tasmanocypris euryplamella sp. nov.; Saida bellensis sp. nov.; Schizocythere inexpecta sp. nov.; Cytheralison corrugata sp. nov.; Hanaiceratina primitiva sp. nov.; Rotundocythere fragilis sp. nov.; Loxocochea punctabella sp. nov.; Loxocochea macgowrani sp. nov.; Mylena lindsayi sp. nov.; Oculocythereperon australopunctatae sp. nov.; Aversovalva cooperi sp. nov.; Hemicytherura reeeckmanni sp. nov.; Pokornylla australis sp. nov.; Hornbrookerella aggregata sp. nov.; Quadracythere singletoni sp. nov.; Neobrontonia ariella sp. nov.; Bradleya langalata sp. nov.; Bradleya dickhensoni sp. nov.; Bradleypa regularis sp. nov.; Tenedocythere auriculata sp. nov.; Tenedocythere muda sp. nov.; Quasibradleya janjukiana sp. nov.; Margoclythea aspera sp. nov.; Spinobradleya acantha sp. nov.; Trachyleberis careyi sp. nov.; Acanthocythereis incerta sp. nov.; Rocaeeleberis' soumræialis sp. nov.; Idocythere thalassea sp. nov.; Deitaleberis rugosaptya sp. nov. and Arculacythereis thomasi sp. nov. Los nuevos subespecies son Trachyleberis brevicosta Hornbrook, 1952 australis subsp. nov. y T. brevicosta major subsp. nov. En el Eoceno Geológico se reportaba la mayor frecuencia de los géneros Cytherellidae, Bythocyprididae, Pontocypridiidae, Paracyprididae, Krithidae y Trachyleberididae; en Bells Headland (Oligoceno) se registran principalmente las familias Cytherellidae, Bairdiidae, Paracyprididae, Cytheruridae, Thaerocyprididae, Trachyleberididae y Hemicytheridae.

Todas las asociaciones se interpretan como indicando facies oceánicas, de la que el Member Gulf Rock se depositó en aguas más profundas que las de Bells Headland las que, sin embargo, indican (mayor número de Hemicytheridae) temperaturas de agua más frías en el Oligoceno Medio que durante el Eoceno. Algunos registros Mioceno Temprano-Medio, de los Márines de Gellibrand y el de Fishing Point (Victoria), también son incorporados para la interpretación bioestratigráfica y paleobiográfica.
INTRODUCTION

Until recently, the Palaeogene Ostracoda of Australia were virtually unknown. The first reference to them is in a Tethyan biogeographic paper (McKenzie, 1967); the next is biostratigraphical and palaeoecological in its bias but incorporates several SEM plates which indicate both the richness of the fauna and the excellence of its preservation (McKenzie, 1974). The subsequent literature is likewise impoverished, McKenzie (1979) gave generic determinations for the faunas of three boreholes which penetrated the Eocene-Oligocene section of the Willunga Embayment, South Australia (S.A.); McKenzie and Guha (1986) compared the South Australian and Indian Eocene-Oligocene boundary zones with regard to their respective petroleum potentials, based on Ostracoda and some other (geochemical, sedimentary) parameters; and McKenzie and Warne (1986) dealt with the biostratigraphy of Alataleberis, including description of Eocene and Oligocene species. This paper, therefore, is the first substantial taxonomic contribution on Palaeogene Australian ostracods.

Nonetheless, we have benefited considerably from other taxonomic work in which some of the species treated here are recorded. This includes the monograph by Hornibrook (1952) on Tertiary and Recent marine Ostracoda of New Zealand; Benson (1972) on the Bradileya problem—which includes description of a Tasmanian Oligo-Miocene species of Quasibradileya; the well-illustrated study by Whatley and Downing (1983) on Middle Miocene Ostracoda from Victoria; papers on the Miocene Bairdiiidae of Victoria by Warne (1986, 1988, 1990); a major series on Recent Australian marine Ostracoda by Hartmann (1978, 1979, 1980, 1981); and well-illustrated papers on Recent faunas by Yassini and Jones (1987) and Yassini and Wright (1988). The latest regional taxonomic contribution is Howe and McKenzie (1989) which lists many useful Indopacific taxonomic papers.

On the other hand, there is a rich non-ostracod literature for the Tertiary of southern Australia, including the classic Eocene-Oligocene section from Maslin and Aldinga Bays, near Port Willunga, S.A. and the equally well-known Oligo-Miocene section from Bells Headland to Bird Rock, near Torquay, Victoria which we have collected for their Ostracoda. Our collecting began in September 1964 (K.G.M.) and continued through many subsequent visits (K.G.M.) up to the latest samplings in September 1986 and January 1989 (R.A.R., E.R.). The localities are indicated in Fig. 1.

This rich literature, in the main, is stratigraphic and sedimentologic in emphasis. For the Eocene-Oligocene of South Australia the principal papers are by Lindsay (1969, 1985), Cooper (1979, 1985) and Lindsay and McGowran (1986). In Victoria, the relevant Oligocene-Miocene papers are Singleton (1941), Raggatt and Crespin (1955), Reecommann (1974, unpublished) and Abele (1976). In general, the stratigraphy is based on foraminifers (Carter, 1958, 1959, Ludbrook and Lindsay, 1969, McGowran, 1979, Lindsay, 1985, Chaproniere, 1980) and Mollusca (Ludbrook, 1973, Darragh, 1985), although palyngnological, dinoflagellate and nannofossil biostratigraphy (Harris, 1973, Shafik, 1981) are also considered reliable. We believe that ostracod-based biostratigraphic and palaeoecologic interpretation is equally valid for the South Australian and Victorian sections and that its implementation awaits only the impetus of a dependable taxonomy.

Much of the above data was abstracted and compiled into the Tertiary Field Excursion Booklet for the 1986 ‘Shallow Tethys’ symposium (McKenzie compiler), 1986. Additionally, southeastern Australian Tertiary climates, based on oxygen-isotope-derived palaeotemperatures, have been interpreted by Dorman (1966) and Gill (1968); regional tectonic,
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<td>Jan Juc Marl</td>
<td>Molluscan rich carbonate sand, burrows, bryozoans</td>
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<td>Angahook Fm.</td>
<td>Molluscan rich quartz-carbonate sand, in parts with burrows</td>
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<td>Anglesea Sand</td>
<td>Carbonaceous sand, with burrows</td>
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Table 1. Stratigraphical sequence of the Paleogene in the Willunga Embayment, South Australia.

Table 2. Stratigraphical sequence at Bells Headland, Torquay, Victoria.

structural and depositional histories are provided in Cooper (1979, 1985) and Abele (1976); and the relevant sea-level changes can be obtained from Loutit and Kennett (1981).

The stratigraphical sequences at the two collecting sites are summarized in Tables 1 and 2.

SYSTEMATIC PALAEONTOLOGY

Family *Polycopidae* Sars, 1866
Genus *Polycop* Sars, 1866

*Polycop* sp.
Pl. I, fig. 1

Remarks: As noted by McKenzie (1967, 1974) polyco-
pids are rare in Australian Tertiary assemblages. This form appears to be faintly reticulate over much of its surface and to have an anteromarginal ridge. It bears little resemblance to any of the polycopids recently described by Warne (1990). The length is 0.49 mm; the height is 0.42 mm.

**Material Studied:** Single mature LV, PM Au 200.

**Occurrence and Age:** Angahook Formation at Bells Headland, near Torquay, Victoria; Late Oligocene (Janu-
kian).

Family *Cytherellidae* Sars, 1866
Genus *Cytherella* Jones, 1849

*Cytherella gullrockensis* sp. nov.
Pl. I, figs. 2, 4

1979 *Cytherella* sp., McKenzie, 96, pl. 1, figs. 3-4.
Holotypus: The specimen PAM Au 201, figured in Pl. I, fig. 4 from the Gull Rock Member, Blanche Point Formation (BPF), Aldinga Bay, South Australia. Figured paratype PM Au 202.

Derivatio Nominis: From the type locality (see above).

Diagnosis: A completely smooth and polished cytherellid with pronounced sexual dimorphism in shape; males more elongate, females more rounded.

Description: A large species (about 1 mm) with an elongate ovate shape in males, regularly rounded ovate in females; moderately compressed. Surface completely smooth and polished, slightly depressed in the muscle scar region and slightly inflated posteriorly in both sexes. Dorsal outline trends obliquely posteriorly, venter weakly inflated medially, anterior and posterior broadly rounded.

Internally, the selvage is distinct and the inner lamella is narrow without any marginal pore canals; normal pore canals small, simple and scattered, hinge adont; central muscle scars, located supramedially, comprise the characteristic feather-like cytherellid cluster. Sexual dimorphism distinct, as indicated above.

Measurements: The length of the carapace ranges in mature males from 0.89-0.9 mm, in mature females from 0.92-1.00 mm; the height in mature males is 0.50 mm, in mature females it ranges from 0.55-0.60 mm.

Remarks: The large smooth cytherellids tend to typify outer shelf or deepwater assemblages, e.g. Cytberella convoluta Deltel, 1963 in the Paleogene of Aquitaine. McKenzie (1979) interprets the Gull Rock Member equivalent in Willunga Embayment boreholes as indicating an outer shelf environment with depths around 75-100 m.

Material Studied: Forty two specimens, including fragments; juveniles, and adults of both sexes.

Occurrence and Age: Gull Rock Member, Blanche Point Formation (BPF), South Australia; Late Eocene (Aldingan).

Cytherella bellsi sp. nov.

Pl. I, figs. 3, 14

Holotypus: The specimen PAM Au203, a right female valve, figured in Plate I, Fig. 14 from Bells Headland, near Torquay, Victoria. Figured paratype PM Au 204.

Derivatio Nominis: From the type locality.

Diagnosis: A cytherellid characterised by a generally smooth shell with the indication of a posteromarginal inflation and well expressed sex dimorphism; males more elongate than females.

Description: A large species (about 1 mm) with an elongate subovate shape in males, more rounded subovate in females; moderately inflated. Surface generally smooth, depressed slightly in the muscle scar region and inflated posteriorly in both sexes. Dorsum straight, becomes oblique posterodorsally in males, convex in females, weakly convex in juveniles; venter nearly straight in mature males, convex in females, weakly inflated medially in juveniles; anterior broadly rounded; posterior characterised by the suggestion of marginal inflation and a transverse ridge in both sexes.

Internal characters as for the previous species; the feather-like central muscle scar cluster in C. bellsi is relatively elongate in mature individuals, more compact in juveniles.

Sexual dimorphism distinct, as noted above.

Measurements: The length of the carapace in mature males is 0.92 mm, it ranges in mature females from 0.87-1.03 mm; the height in mature males is 0.47 mm, it ranges in mature females from 0.50-0.58 mm.

Remarks: Distinguished readily from C. gallowayi by its posteromarginal ridge, which that species lacks.

Material Studied: One hundred and seventy seven specimens; juveniles, and adults of both sexes.

Occurrence and Age: Bells Headland, near Torquay, Victoria; Late Oligocene (Janukian).

Cytherella sp.

Pl. I, fig. 8

Remarks: A large cytherellid, distinguished by its convex dorsal outline and compact muscle-scar cluster.

Measurements: The length of the mature specimen is 1.16 mm; its height is 0.63 mm.

Material Studied: Two valves, one juvenile the other adult, both males.

Occurrence and Age: Bells Headland, near Torquay, Victoria; Late Oligocene (Janukian).

Genus Platella Coryell and Fields, 1937

Platella victoriae sp. nov.

Pl. I, fig. 6; Pl. XI, fig. 1

1979 Platella sp., McKenzie, 90, 93, pl. 1, fig. 5.

Holotypus: The specimen PAM Au 206, a female, figured in Pl. I, fig. 6, from Bells Headland, Victoria. Figured paratype PM Au 342.

Derivatio Nominis: From the state of Victoria, in which the type locality occurs.

Diagnosis: An elongate cytherellid with well marked surface punctuation and a posterior inflation in females that slightly overtops the posterior valve margin.

Description: A moderately large cytherellid (about 0.80 mm) with an elongate shape; moderately inflated. Surface punctate all over, except in the muscle scar depression. Anterior and posterior broadly rounded, in females the posterior inflation slightly overlaps the valve margin; dorum nearly straight; venter weakly inflated medially.

Internal features as for the Cytherella species; central muscle scar cluster relatively compact.

Sexual dimorphism distinct; males relatively more elongate, females more inflated posteriorly.

Measurements: The length of a mature male is 0.79 mm, in mature females it ranges from 0.79-0.82 mm; the height of a mature male is 0.40 mm, in mature females it ranges from 0.42-0.47 mm.

Remarks: Most ostracod specialists do not accept Platella as a valid genus, synonymising it with Cytherella. We choose to retain it as ecologically useful since the characteristic surface punctuation indicates relatively warm ambient temperatures. This species seems identical to Platella sp. McKenzie (1979, pl. 1, fig. 5).

Material Studied: Forty seven specimens all entire valves; juveniles, and adults of both sexes.

Occurrence and Age: Bells Headland, near Torquay, Victoria; Late Oligocene (Janukian). In Bore WLG 38 of the Willunga Embayment, South Australia, the species occurs in the latest Oligocene to earliest Miocene part of the section (McKenzie, 1979, p. 93).
**Platella parapunctata**
(Whatley and Downing, 1983)
Pl. X, fig. 4

1983 *Platella parapunctata* Whatley and Downing, 386, pl. 8, figs. 9-11.

**Remarks:** This species was originally described from the Miocene of Victoria by Whatley and Downing (1983). The present occurrence extends its range down into the Late Oligocene. Our material agrees in all respects with the figured specimens of Whatley and Downing.

**Material Studied:** Three valves, all mature.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjkukian).

**Genus Geelonella gen. nov.**

**Type Species:** *Geelonella antyx* sp. nov.

**Diagnosis:** A cytherellid genus characterised by a compressed shell and, above all, by a very wide marginal flange which extends from the anterodorsal region completely around the anterior, ventral and posterior margins, narrowing towards the postero-dorsal corner, where it terminates. There is no flange along the dorsal margin, behind the anterior- dorsal part. Inside this flange, the valves are subrectangular with rounded corners. The muscle scar depression is located submediodorsally, anterior of the valve mid-line. Other features resemble those of cytherellids.

**Remarks:** This genus, because of the wide and distinctive flange, cannot be confused with any other cytherellid taxon. We debated a resemblance to *Ankumia* Van Veen, but her figures illustrate forms which lack the *Geelonella* flange and, also, are not as compressed as our taxon. Within the Cytherellidae, the relationships of *Geelonella* lie clearly with *Cythereilla* and *Ankumia*, rather than with *Cytherelloidea* and *Keijyoidea*. At present, the new genus is monotypic.

**Derivatio Nominis:** From Geelong, the largest town of the region.

**Occurrence and Age:** Restricted, thus far, to the fossiliferous beds at Bells Headland, near Torquay, Victoria, in the Angahook Formation, having a Late Oligocene age.

**Geelonella antyx sp. nov.**
Pl. I, fig. 7; Pl. X, fig. 1

**Holotype:** The specimen PAMAu 207 figured in Pl. I, fig. 7 from Bells Headland. Figured paratype PM Au 323.

**Derivatio Nominis:** *Anyx* (GK.) = a rim or flange (feminine).

**Diagnosis:** A *Geelonella* with a well marked flange, especially in juveniles.

**Description:** A large cytherellid (about 1.00 mm) with a broadly subrectangular shell and well marked anterior flange that produces into a characteristic anterodorsal 'ear'; compressed. Surface mostly smooth, but finely reticulate along the anterior margin and also posteroventrally; muscle scar depression indistinct. Anterior very broadly rounded; dorsal outline straight behind the anterodorsal 'ear' then sloping steeply posteriorwards; posteroventral margin rounded; venter inflexed slightly postero- medially.

Internal features as for cytherellids generally, except that in this species the flange is an atypical and prominent feature, especially in juveniles; also the central muscle scars cluster postero-medially.

Sexual dimorphism could not be determined.

**Measurements:** The length of a mature male is 0.99 mm; its height is 0.61 mm.

**Remarks:** The well developed flange is sufficient to distinguish this species from other Australian cytherellids. Furthermore, the length/height ratio is less than for most members of the genus. For these very cogent reasons, we have elected to erect a new species, despite the relative small sample at hand.

**Material Studied:** Six valves embracing juvenile and mature specimens, plus one incomplete specimen.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjkukian).

**Genus Cytherelloidea Alexander, 1929**

**Cytherelloidea jugifera sp. nov.**
Pl. I, figs. 10-12

1979 *Cytherelloidea* sp., McKenzie: 96, pl. 1, fig. 7.

**Holotype:** The specimen PAMAu 208 figured in Pl. I, fig. 10 from the Gull Rock Member (BPF), South Australia, an adult male LV. Figured paratypes PMAu 209, PM Au 308.

**Derivatio Nominis:** *Jugum* (L.) = a yoke; and suffix - *fera* (L.) = bearing; for the yoke-like ridge on each valve.

**Diagnosis:** A *Cytherelloidea* characterised by a yoke-like medial ridge on each valve within a thickened marginal ridge.

**Description:** A large species (to 1.00 mm) with a broadly subrectangular shell ornamented by a thickened marginal ridge and within its periphery a yoke-like medial ridge, that almost completely encloses the muscle scar depression in some individuals; anterior and posterior indistinctly reticulate over and within the thickened marginal rim. Anterior very broadly rounded; dorsal outline nearly straight, trends obliquely postero-dorsally; posterior broadly rounded; ventral outline very weakly inflexed medially and just overlapped by the marginal rim postero-ventrally.

Internal features typical for the cytherellids generally; muscle scar cluster subcarinate.

Sexual dimorphism distinct; males relatively more elongate than females, which are further distinguished by possession of an indistinctly divided brood-chamber.

**Measurements:** The length of mature males ranges from 0.89-0.95 mm, and of mature females from 0.95-1.00 mm; the height of mature males is 0.58 mm, and in mature females it ranges from 0.57-0.60 mm.

**Remarks:** Like the previous species this species has a lesser length/height ratio than is typical in *Cytherelloidea*. It belongs with a group of species related to *Cytherelloidea intermedia* (Chapman, Crespin, and Keeble, 1928) which is considered next and was also illustrated in McKenzie (1974, pl. 1, fig. 2), but is distinguished from these others by its characteristic yoke-like inner ridge, although it shares with them a thickened marginal ridge.
Material Studied: Sixty five specimens, including several fragments of valves; juveniles, and adults of both sexes.

Occurrence and Age: Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan).

**Cythereilloidea cf. intermedia**
(Chapman, Crespin and Keeble, 1928)
Pl. I, fig. 9

1928 *Cytherella intermedia* Chapman, Crespin and Keeble, 129, figs. 69a, b.
1943 *Cythereilloidea intermedia* (Chapman, Crespin and Keeble); Crespin, 100.
1974 *Cythereilloidea intermedia* (Chapman, Crespin and Keeble); McKenzie, 166, pl. 1, fig. 2.
1983 *Cythereilloidea intermedia* (Chapman, Crespin and Keeble); Whatley and Downing, 386, pl. 8, figs. 12-15.

**Remarks:** In our material, the medial ridge is not as prominent as in *C. intermedia* s.s. but otherwise this taxon closely resembles that species. McKenzie (1974, p. 166) notes that the lineage ranges from the Late Eocene, possibly with *Cythereilloidea auricula* (Chapman, 1914) as a Miocene end member. These specimens range in length from 0.89-0.91 mm; their height is about 0.53 mm.

**Material Studied:** Twenty two valves; juveniles, and adult females.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

**Cythereilloidea marginopygta** sp. nov.
Plate II, fig. 1; Pl. X, figs. 2, 3

**Holotypus:** The specimen PAMAU 213 figured in Pl. II, fig. 1 from Bells Headland, Victoria, a female RV. Figured paratypes PM Au 324, Pm Au 325.

**Derivatio Nominis:** *Margo* (L.) = a margin or border, and *pygta* (AS) = a pig, for the pitted marginal areas of this species.

**Diagnosis:** A *Cythereilloidea* with pitted marginal areas and well defined anteromarginal ridge.

**Description:** A moderately large *Cythereilloidea* (about 0.80 mm) with an elongate rectangular shape ornamented by close-set shallow pits dorsally, ventrally and posteriorly which, in females, outline the two-embryon broodchamber; such pits less numerous anteriorly and scattered irregularly over the medial valve surface. Anterior broadly rounded and marked by an anteromarginal ridge, posterior truncate, dorsal and ventral outlines both slightly inflected medially. Valves swollen ventrally and posteriorly, flattening anteriorly to the marginal ridge.

**Internal features** typical for cythereilloids; the muscle scar cluster is compact and lies in a depression. Sex dimorphism likely but not confirmed from our material.

**Measurements:** The length ranges from 0.76-0.82 mm; the height ranges from 0.42-0.45 mm.

**Remarks:** This species may be part of the same lineage as the Late Eocene taxon illustrated by McKenzie (1979, pl. 1, fig. 6); which, however, is more uniformly pitted and has a well-defined ventral ridge, unlike our species.

**Material Studied:** Seventeen valves; juveniles and adult females; three growth stages in all.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

Family Bairdiidae Sars, 1888
Genus *Neonesidea* Maddocks, 1969

**Neonesidea sp.**
Pl. I, fig. 13

1979 *Neonesidea* sp., McKenzie, 90, pl. 1, fig. 1.

**Remarks:** Our collection from the Gull Rock Member contains a few juveniles possibly attributable to this as yet undescribed taxon, the description of which must await better material.

**Material Studied:** Six specimens, including fragments; all but one juveniles.

**Occurrence and Age:** Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan).

**Neonesidea australis** (Chapman, 1914)
Pl. I, fig. 5

1914 *Bairdia australis* Chapman, 31, 32, pl. 6, fig. 7.
1983 *Neonesidea australis* (Chapman); Whatley and Downing, 351, pl. 1, figs. 5-6 (with synonymy).
1987 *Neonesidea australis* (Chapman); Warne, 441.
1988 *Neonesidea australis* (Chapman); Warne, 16, figs. 9A-B.

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Plate 1

2. *Cytherella gulgrockensis* sp. nov. Female RV, PM Au 202. Gull Rock Member, Blanche Point Formation, Aldinga Bay (AB), South Australia (AB). Late Eocene. x 65.
3. *Cythereella bellis* sp. nov., Bells Headland, Late Oligocene. Male RV, PM Au 204. x 65.
5. *Neonesidea australis* (Chapman). Female LV, PM Au 212. BH. Late Oligocene. x 50.
6. *Platella victoriae* sp. nov. Female RV, Holotypy, PM Au 206. BH. Late Oligocene. x 75.
7. *Geelongella antox* sp. nov. Male LV, Holotypy, PM Au 207. BH. Late Oligocene. x 50.
8. *Cytherella* sp. Male LV, PM Au 205. BH. Late Oligocene. x 50.
10. *Cythereilloidea juggera* sp. nov. Male LV, Holotypus, PM Au 208. AB. Late Eocene. x 50.
11. Same species and provenance. Female RV, PM Au 209. x 50.
12. Same species and provenance. Female LV, PM Au 308. x 75.
13. *Neonesidea* sp. Male interior LV, PM Au 211. AB. Late Oligocene. x 50.
14. *Cythereella bellis* sp. nov. Female RV, Holotypus, PM Au 203. (BH). Late Oligocene. x 55.
Remarks: Our record takes the time-range of this distinctive species back to the Late Oligocene. Warne (1988, p. 17) notes that it ranges from late Early Miocene to late Middle or early Late Miocene in his samples. The maximal adult size of our specimens is 1.21 mm not much less than the 1.25 mm recorded by Warne (cit., p. 16).

Material Studied: Forty eight valves, including a few broken ones; juveniles, and adults of both sexes.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjan).

Genus Bairdopilata Coryell, Sample and Jennings, 1935

Bairdopilata torquayensis sp. nov.
Pl. III, fig. 1; Pl. XI, fig. 3

Holotypus: The specimen PAMAU 214 figured in Pl. III, fig. 1; a female RV from Bells Headland, near Torquay, Victoria. Figured para- type PMAu 344.

Derivatio Nominis: From the nearest town to the type locality.

Diagnosis: A very large species which is proportionately less high with respect to its length than the other known Australian species.

Description: A very large Bairdopilata (about 1.20 mm) with a trapezoidal shape, and considerable valve asymmetry, the left valve (LV) higher than and overlapping the right valve (RV); surface smooth, ornamented with an irregular patch over the muscle scar rossette. Dorsum convex, venter inflexed medially, anteroventral margin broadly rounded, posterosternal part subacuminate.

Internal characters include broad inner lamellae with distinct selvage and numerous marginal pore canals; simple, rimmed normal pore canals; a relatively short adont hinge, with terminal (anterior and posterior) auxiliary dentitions as typical for the genus; central muscle scars clustered in a rosette of 8-9 scars, with a small frontal scar separate from and slightly above this group.

Internal dimorphism not confirmed from our material.

Measurements: The length ranges from 1.20-1.40 mm; the height ranges from 0.78-0.80 mm.

Remarks: The closest species to our taxon is Bairdopilata sp. A of Warne (1988, p. 22, figs. 8C, D, I, J; 10 A-G) but that species is relatively higher with respect to its length.

Material Studied: Seven valves, two broken, two juveniles, and 5 adult females.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjan).

Genus Paranesidea Maddocks, 1969

Paranesidea? sp.
Pl. III, fig. 2

Remarks: The single mature individual of this taxon is finely punctate not unlike Neonesidea species but the juveniles are all clearly pitted as typifies Paranesidea, hence the doubtful generic citation. The specimen figured in Pl. III, fig. 2 is eroded (PMAu 215).

Material Studied: Five valves, 4 of them juvenile. The mature valve has a length of 0.87 mm and a height of 0.51 mm.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjan).

Paranesidea cf. vadum Warne, 1986
Pl. III, figs. 3, 4

1986 Paranesidea vadum Warne, 45, figs. 3 N-S, 4 E-F, H-M.
1987 Paranesidea vadum Warne; Warne, 441, pl. 2, fig. A.

Remarks: The single mature individual of this species is finely pitted and ventrally inflated, in this resembling some Triebelina species, but it lacks the ridges which are considered diagnostic for that genus.

Material Studied: Two valves, one of them juvenile. The mature right valve has a length of 0.82 mm and is 0.42 mm in height.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjan).

Family Bythocyprididae Maddocks, 1969
Genus Bythocypris Brady, 1880

Bythocypris sudaustralis sp. nov.
Pl. II, figs. 2, 3

Holotypus: The specimen PAMAU 218 figured in Pl. II, fig. 2 from the Gull Rock Member (BPF), South Australia, a female LV. Figured paratype PMAu 219.

Derivatio Nominis: For the southern Australian provenance.

Plate II

1. Cytherelloidea marginopyna sp. nov. Female RV, Holotypus, PM Au 213. (BH). Late Oligocene. x 70.
2. Bythocypris sudaustralis sp. nov. Female LV, Holotypus, PM Au 218. (AB). Late Eocene. x 45.
4. Orloviabidula (?) sp. Fragment of anterior LV, PM Au 221. (BH). Late Oligocene. x 80.
6. Same species and provenance. Female RV, PM Au 223. x 45.
7. Paracypris sp. aff. bradyi McKenzie. Female RV, PM Au 224. (AB). Late Eocene. x 50.
8. Tasmanocypris eurylamella sp. nov. Female RV, Holotypus, PM Au 226. (BH). Late Oligocene. x 50.
9. Same species and provenance. Female interior LV showing muscle scars, PM Au 225. x 50.
10. Cytheridion cf. pravocauda Hornbrook. Female LV, PM Au 236. (BH). Late Oligocene. x 75.
11. Cytheridion corrugata sp. nov. Male RV, Holotypus, PM Au 238. (BH). Late Oligocene. x 85.
12. Hanaciceratina primitiva sp. nov. Female RV, Holotypus, PM Au 239. (BH). Late Oligocene. x 75.
13. Same species and provenance. Male interior RV showing muscle scars, PM Au 240. x 75.
15. Cytheridion corrugata sp. nov. Female RV, PM Au 239. (BH). Late Oligocene. x 50.
Diagnosis: A smooth shelled relatively elongate *Bythocypris* with asymmetrical valves.

Description: A large species (about 1.00 mm) with an elongate bean shape and smooth, polished shell surface in mature individuals. Anterior more broadly rounded than the posterior; dorsal outline gently convex; ventral inflated medially. Relatively thin-shelled. Valves asymmetrical.

Internal characters include well developed inner lamellae which are broadest anteroventrally, with elongate vestibules and many short marginal pore canals; simple, rimmed normal pore canals; hinge adoint; muscle scar cluster located medially, comprises four large adductors.

Sexual dimorphism weak, males relatively more elongate than females.

Measurements: The length of a nature female paratype is 1.00 mm, its height is 0.50 mm. A mature male from Bells Headland has a length of 0.89 mm and a height of 0.42 mm.

Remarks: This species is presumably the same as the *Bythocypris* cited by McKenzie (1979, pp. 95-96) from several borings in the Willunga Embayment, South Australia which, however, was never figured. It differs from *Bythocypris* sp. of Whatley and Downing (1983, pl. 1, fig. 9) by being more elongate. The genus is regarded as an offshore, deeper water index.

Material Studied: Eighteen specimens, including fragments, from the Gull Rock Member (type locality) and 9 specimens, one broken, from Bells Headland; mostly juveniles but including adults of both sexes.

Occurrence and Age: Gull Rock Member (BPF), South Australia, Late Eocene (Aldingan); and Bells Headland, Victoria, Late Oligocene (Janjkian).

Genus *Orolobaibardia* McKenzie, 1978

*Orolobaibardia* sp.

Pl. III, fig. 5

Remarks: This is a relatively large *Orolobaibardia* with a length of 0.87 mm and a height of 0.50 mm. It is like the type species, *Orolobaibardia angulata* (Brady, 1870) in that the surface is smooth but is higher with respect to its length than that species as well as being larger.

Material Studied: Single mature LV, presumably a female.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjkian).

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*Remarks: Both the available specimens of this taxon are fragments, otherwise it would certainly be described as a new species and, probably, a new genus. Unlike typical *Orolobaibardia* it is neither smooth-surfaced nor pit ted; instead, the surface ornament consists of numerous small spinules densely clustered around the lower, anterior and posterior part of each valve but absent or more sparsely distributed medially. There is also a thickened marginal rim anteriorly and posteriorly which again differs from *Orolobaibardia* s.s. and the marginal valve spines are stout and more prominent than in typical *Orolobaibardia*. The preserved fragments make it clear that a complete adult carapace would be rather compressed; and the muscle scars appear similar to *Bythocyprididae*. The more complete fragment (a LV) has a length of 0.76 mm; its estimated height would be about 0.42 mm.*

*Material Studied:* Two fragments from different valves; one RV, the other LV both either mature or A-1.

*Occurrence and Age:* Bells Headland, Victoria; Late Oligocene (Janjkian).

**Family Macrocyprididae** Müller, 1912

**Genus Macromonckieza** Maddocks, 1990

*Macromonckieza porcelanica* (Whatley and Downing, 1983)

Pl. II, figs. 5, 6

1983 *Macrocypris porcelanica* Whatley and Downing, 353, pl. 1, figs. 11-13.

Remarks: At the 10th International Symposium on Ostracoda, at Aberystwyth, Wales, U.K., Maddocks displayed the completed manuscript of her revision of the Macrocyprididae. It has just been published. She suggests in this that the Australian species referred to either *Macrocypris* or *Macrocypris* by various authors probably belong either in *Macromonckieza* or another new genus established by her. The characters of Whatley's and Downing's species *porcelanica* as confirmed by our good series of specimens seem to place it in *Macromonckieza*. At a length of 1.54 mm, our largest specimens are larger than the type series but we have no doubt that they are conspecific with it. Since several growth stages are represented, the taxon is likely to have been autochthonous.
Plate III

Material Studied: Eight specimens, including 2 adult valve which are probably females.

Occurrence and Age: Lochard Gorge, near Port Campbell, Victoria, collected near the base of the coastal cliffs; Middle Miocene.

Family Paracyprididae Sars, 1923
Genus Paracypris Sars, 1866

Paracypris sp. aff. bradyi McKenzie, 1967
Pl. II, fig. 7
1967 Paracypris bradyi McKenzie, p. 64, 65, fig. 2d.
1974 Paracypris bradyi McKenzie; McKenzie, 166.

Remarks: Our specimens include many fragments and most of the complete valves are sediment-inflected and fragile. We believe that they represent the ancestral lineage of the Recent species P. bradyi described by McKenzie (1967) from Port Phillip Bay, Victoria. It is worth noting, however, that our specimens are rather larger (length about 0.85 mm, height about 0.35 mm) than the types.

Material Studied: Nineteen specimens, including 6 fragments; juveniles and adults of females.

Occurrence and Age: Gulf Rock Member (BPF), South Australia; Late Eocene (Aldingan).

Genus Tasmanocypris McKenzie, 1979

Tasmanocypris eurylamella sp. nov.
Pl. II, figs. 8, 9; Pl. XI, fig. 2

Holotype: The specimen PAMaU 226 figured in Pl. II, fig. 8 from Bells Headland, Victoria, a right valve. Figured paratypes PM Au 225, PM Au 343.

Derivatio Nominis: Eury (Gk.) = broad and lamella (L.) = lamella; for the diagnostic broad inner lamella.

Diagnosis: A Tasmanocypris species characterised by large size, and a broad inner lamella, especially in the ventral region.

Description: A large species (around 1.00 mm) with a smooth elongate subtriangular shell. Dorsum regularly convex, except anterodorsally in the RV where it is slightly inflexed—an accommodation to overlap by the larger LV—, venter inflexed medially; anterior rounded; posterior subabuminate. Elliptical in dorsal view; the greatest breadth medial.

Internally, characterised by a broad inner lamella which is unusually broad in the ventral region; large anterior and a smaller posterior vestibule; branched radial pore canals; normal pore canals simple and rimmed; hinge adont; muscle scar cluster prominent, consisting of 4 large scars in an anterior series and 2 scars behind these, i.e. 6 in the cluster, plus 2 small mandibulars in front of and below the main group.

Sexual dimorphism not apparent in the large series of specimens available to us.

Measurements: The length ranges from 0.97–1.05 mm; the height ranges from 0.45–0.47 mm.

Remarks: The size of this species is such as to invite comparisons with Macrocyprisidae but although it is similar in shape to Macrocyprisina and other macrocyprid genera it is easily distinguished from them by the paracypridid muscle scars and the adont hinge. While all paracypridid species have broad inner lamellae, this characteristic is more developed than usual in T. eurylamella enabling it to be readily differentiated from the other Australian species T. setigera (Brady, 1880), T. darnalli McKenzie, 1979 and T. dietmarkeiseri (Hartmann, 1979).

Material Studied: Fifty one specimens, one of them broken; all adult females.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukan).

Family Pontocyprididae Muller, 1894

Genus Argilloecia Sars, 1866

Argilloecia sp.
Pl. III, fig. 6

Remarks: The poor specimens at hand warrant only a record of the occurrence of the genus in these assemblages.

It is likely allochthonous at Bells Headland, but may be autochthonous in the Gulf Rock Member.

Material Studied: A broken A-1 right valve (Victoria); 3 A-1 specimens (2 carapaces, 1 LV) including both sexes (South Australia).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukan); the Gulf Rock Member (BPF), South Australia, Late Eocene (Aldingan).

Genus Maddocksella McKenzie, 1981

Maddocksella obscura
(Whatley and Downing, 1983)
Pl. III, fig. 7

1983 A. obscura Whatley and Downing, 362-363, pl. 3, figs. 5-7.

Plate IV
1. Saida bellensis sp. nov. Detail of a lateral sieve-type pore canal, x 4000.
2. Hanaicera littoralis sp. nov. Central muscle scar field of female interior RV figured in Plate II, fig. 10-5 adductors, gap between 3 and 4, 2 frontals. x 400.
3. Loxoconcha punctatella sp. nov. Central muscle scar field of female interior RV figured in Plate V, fig. 5. x 500.
4. Myrena lindseyi sp. nov. Detail of surface texture and of lateral sieve-type pore canals. x 1000.
5. Hemicytherura reeckmannii sp. nov. Detail of anterolateral ornament of female RV figured in Plate VI, fig. 4. x 500.
6. Bradleya regularis sp. nov. Detail of a lateral sieve-type pore canal of male RV figured in Plate VI, fig. 11. x 4000.
7. Spinobradleya acantha sp. nov. Central muscle scar field of male interior RV figured in Plate VIII, fig. 10-note divided adductor 2 and 2 frontal scars (one open v-shaped). x 400.
8. Spinobradleya acantha sp. nov. Detail of a lateral sieve-type pore canal. x 3200.
9. Deltaiceras rugosagutta sp. nov. Catspaw pattern of surface ornament. x 1300.
10. Alatalesbeira ornithoptera ornithoptera McKenzie and Warne. Detail of a lateral sieve-type pore canal. x 4000.
Remarks: Recently, one of us (K.G.M.) had the opportunity to compare Maddocksella specimens against the types and other specimens of the genus Proaplysocypris Pokorný, 1979. The shell features which differentiate these genera are, first, the shape in dorsal view which is regularly elliptical in Proaplysocypris but box-like (with flattened ends) in Maddocksella; and secondly, the marginal pore canals which are straight in Proaplysocypris but flexuous in Maddocksella. In the second feature particularly, Proaplysocypris resembles closely the genus Abyssocypris van den Bold, 1974. There is also a difference between Proaplysocypris and Maddocksella in environmental preferences. The former, like Abyssocypris, is indicative of deepwater facies, around 1000 m depth or deeper. Maddocksella, on the other hand, is typical of shelf deposits from inshore to the uppermost part of the slope, i.e. it indicates palaeodepths of around 250 m or less.

Material Studied: 4 specimens; 3 juvenile valves and a mature female LV.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

**Maddocksella argilloeaformis**
(Whatley and Downing, 1983)
Pl. III, figs. 8, 9

1983 *Australocypris argilloeaformis* Whatley and Downing, 361-362, pl. 3, figs. 2-4.

Remarks: The relatively more elongate shape clearly distinguishes this species from *M. obscura*, *M. mackenziei* and *M. tumeaica* (the type species). As Australian Tertiary Maddocksella species become better known they should begin to demonstrate some biostratigraphic utility since the adults of species are easily identified and the genus occurs across the whole gamut of marginal and shelf marine environments.

Material Studied: Twenty three specimens, including fragments; mostly juveniles, but adults of both sexes also occur.

Occurrence and Age: The Gulf Rock Member (BPF), South Australia; Late Eocene (Aldingan) and Bells Headland, Late Oligocene.

**Maddocksella tumeaica** (Chapman, 1914)
Pl. III, fig. 10

1914 *Bythocypris tumeaica* Chapman, p. 30.
1974 *Australocypris tumeaica* (Chapman); McKenzie, 158, text-fig. 3g.
1981 *Maddocksella tumeaica* (Chapman); McKenzie, 105-107, fig. 1a-c.
1987 *Maddocksella tumeaica* (Chapman); Warne, 445.

Remarks: This large form (length about 1.10 mm) is the type species of Maddocksella and readily differentiated on size alone. Females tend to be fatter than males which are relatively more elongate.

Material Studied: Five specimens; 2 of them adult RV (one male, one female), the others juveniles. Three growth stages are represented in this small collection.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Genus *Propontocypris* Sylvester Bradley, 1948

**Propontocypris** sp.
Pl. III, fig. 11

Remarks: The single mature LV indicates usefully that the range of Propontocypris in Australia extends back at least to the Late Eocene. The length of our specimen is about 0.80 mm, its height is about 0.40 mm.

Material Studied: A mature LV, probably female.

Occurrence and Age: Gulf Rock Member (BPF); Late Eocene (Aldingan).

Family *Cytheridae* Baird, 1850
Genus *Saida* Hornibrook, 1952

**Saida bellensis** sp. nov.
Pl. III, fig. 12; Pl. IV, fig. 1; Pl. XI, fig. 6

1974 *Saida* sp., McKenzie, 161, pl. 2, fig. 13.

Holotype: The specimen PAMAu 233, figured in Pl. III, Fig. 12 from Bells Headland, Victoria. Figured paratype PM Au 347.

Derivation Nominis: From the type locality.

Diagnosis: A *Saida* with a keeled ventral ridge and posterodorsal rib; microreticulate anteriorly and posteriorly but not medially.

Description: Shell small (about 0.35-0.40 mm in length), subquadrate; ornamented with a distinctly keeled ventral ridge and posterodorsal rib, otherwise reticulate over the entire surface. The reticulation is most coarse in the medial region of each valve and becomes microreticulate towards the anterior and posterior. Several minor ribs occur anteriorly, and there is a narrow marginal rim which is irregular in its outline anteriorly and posteriorly. Dorsal outline nearly straight; ventral margin inflexed anteromeditally; anterior and posterior both broadly rounded, carrying marginal denticles in well preserved specimens. The keeled ventral ridge comes to its apex posteroventrally. A lateral pore-canal is shown in Pl. IV, Fig. 1.

Internally, with relatively broad inner lamellae and well defined inner and outer selvage lines; no vestibules; marginal pore canals few and straight, both anteriorly and posteriorly; normal pore canals sieve type; hinge modified merodont, consisting in the RV of a medial furrow and small, smooth terminal tooth-like elements, LV complementary; muscle scars comprise 4 subvertical adductors with a heart-shaped frontal scar, mandibular scars probably present but could not be confirmed.

Sexual dimorphism distinct, males relatively more elongate than females.

Measurements: The length ranges from 0.35-0.39 mm, the height ranges from 0.25-0.28 mm.

Remarks: McKenzie (1979) records two lineages of *Saida* from the Janukian type section near Torquay. This collection did not recover the other (smaller and more elongate-shaped) lineage. In our measurements we cite the observations of a larger series collected at the same locality about 25 years ago by one of us (K.G.M.). *Saida* is one of a number of small ornamental genera - others include *Kangarina*, *Homicytherura* and *Euicytherura* - these have definite biostratigraphic potential in the Tertiary deposits of southeastern Australia (cf. McKenzie, 1974, pl. 5).

Material Studied: Two mature valves. Additionally one specimen in McKenzie's deposition in the British Museum of Natural History (McKenzie, 1974), five in McKenzie's personal collection, one in the Berlin Museum of Natural History and two in the Geological Museum, University of Melbourne.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).
Genus *Schizocythere* Triebel, 1950

*Schizocythere* *inexpecta* sp. nov.

**Holotype:** The specimen PAMAU 234, figured in Pl. III, fig. 13 from Bells Headland, Victoria.

**Derivatio Nominis:** *Inexpecta* (L.) = unexpected; since we had not expected to encounter the genus.

**Diagnosis:** A *Schizocythere* characterised by a ventral ridge projecting terminally and a minor posterodorsal projection; both much more distinct in A-1 juveniles.

**Description:** A small medium-sized species (length about 0.50-0.55 mm), with an overall reticulate surface and well marked ventral ridge which terminates abruptly posteroventrally; there is also a weakly developed posterodorsal projection, very prominent in A-1 juveniles; shape subquadrat, with a small posterodorsal cauda. There is a small anterodorsal eye tubercle. In dorsal view rather stout, subcunulate anteriorly, broadest posteriorly. Finally, our best preserved specimen displays an unusual posterodorsal lug projecting outwards just above the margin.

Internally, with moderately broad inner lamella and a well defined outer selvage line anteriorly that merges with the margin ventrally and posteriorly; marginal pore canals few and straight anteriorly, while in the rear two of them are produced towards the cauda; normal pore canals numerous, sieve-type; hinge schizodont in the LV of a socket followed by a schizodont tooth and erenate median element then a terminal (posterior) socket, RV complementary; muscle scars comprising at least 4 subvertical adductors and an obscure frontal scar.

Sexual dimorphism not established in our material.

**Measurements:** The length of our mature specimens is 0.53 mm; their height is 0.34 mm; and the breadth (based on 2 carapaces) is 0.34 mm.

**Remarks:** This is the first record of *Schizocythere* from Australia. Previously, Keij (1966) had identified the schizocytherine *Pajenborchella*, and McKenzie (1974) had recorded *Amphicytherura*, from the Tertiary; while another schizocytherine genus *Neomosoceratina* is known from the Australian Quaternary. *Schizocythere* can be a good biostratigraphic index elsewhere, but is too little known as yet in Australia for this purpose.

**Material Studied:** Eight specimens; 4 juveniles and 4 adult females (2 carapaces, 2 LV).

**Occurrence and Age:** Bells Headland, Victoria. Late Oligocene (Janjukian).

Genus *Microcytherea* Müller, 1894

*Microcytherea* sp.

**Pl. III, fig. 14**

**Remarks:** The relationship between *Microcytherea* and *Laxocythere* Hornbrook, 1952 is discussed in Howe and McKenzie (1989). Our single valve clearly belongs to the *Microcytherea* part of this apparent continuum. Its dimensions are: length 0.32 mm; height 0.18 mm.

**Material Studied:** Single mature LV, possibly a female.

**Occurrence and Age:** Bells Headland, Victoria. Late Oligocene (Janjukian).

Family *Bythocytheridae* Sars, 1926

Genus *Cythermalon* Hornbrook, 1952

*Cythermalon* cf. *pravacuda*

Hornbrook, 1952

**Pl. II, fig. 10**

1952 *Cythermalon pravacuda* Hornbrook, 66-67, pl. 18, figs. 285, 286, 288.


**Remarks:** Hornbrook (1952) notes that this species ranges in New Zealand from the Eocene-Recent. In our material, the reticulation is particularly deep-set but otherwise the form is not unlike Hornbrook's species, and of a similar size (our largest specimen has a length of 0.89 mm). A closely similar form is *Cythermalon* sp. McKenzie (1979, pl. 1, fig. 8 - male LV illustrated) from bore WLG 40 in the Willunga Embayment, South Australia.

**Material Studied:** Twenty six specimens all valves; juveniles and adults of both sexes.

**Occurrence and Age:** Bells Headland, Victoria. Late Oligocene (Janjukian). In Bore WLG 40 of the Willunga Embayment, S.A., a similar species occurs in the Oligocene part of the section (McKenzie, 1979, p. 90, 94).

*Cythermalon* *corrugata* sp. nov.

**Pl. II, figs. 11, 15; Pl. III, fig. 15**

**Holotype:** The specimen PAMAU 237 a LV, figured in Pl. II, fig. 11, from Bells Headland, Victoria. Figured paratypes PM 234, PM Au 312.

**Derivatio Nominis:** *Corrugata* (L.) = corrugated; for the principal feature of the valve ornament.

**Diagnosis:** A *Cythermalon* with a corrugated surface ornament.

**Description:** A moderately large species (length about 0.75-0.80 mm) with a subquadrat shape and a weak posterior caudal lamella. There is no eye tubercle. The surface ornament is very striking and is best appreciated when the valves are viewed dorsally. It is then seen to consist of a series of ridges (corrugations) that trend transversely across the valve from the dorsal region, swing rearwards as they reach the venter, run parallel to the ventral margin, then sweep up posteriorly, i.e. they are concentric. Seen laterally, these ridges are connected by many small ribslet creating an overall reticulate appearance in lateral view. Dorsal margin straight; venter nearly so; anterior broadly rounded; posterior also rounded but still by virtue of the weak subposterodorsal caudal lamella. Shell thick, as is typical for the genus. External muscle-scar pit obscured on most specimens.

Internally, there are moderately broad inner lamellae, without vestibules and with well marked selvages; marginal pore canals numerous, tending to be straight; normal pore canals simple, rimmed; hinge modified lophodont, RV with terminal smooth tooth-like elements separated by a median groove, LV complementary; muscle scars characteristic for the genus consisting of 5 large alternately placed adductors in a subvertical series plus minor frontal scars.

Sexual dimorphism weak, presumed males relatively more elongate than presumed females.

**Measurements:** The length ranges from 0.71-0.76 mm; the height ranges from 0.38-0.42 mm.

**Remarks:** Hornbrook (1952, p. 66) noted the occurrence of several undescribed species of *Cythermalon* in the New Zealand Tertiary; *C. corrugata* is an Australian example of this diversity, as is *Cythermalon* sp. 1 of Warne (1987, p. 445). Some specimens of *C. corrugata* while retaining the overall aspect of transverse ridges becoming concentric have gradated to the point where the corrugate nature of the valve ornament is obscured.
Material Studied: Ten valves; some juvenile but most adult, probably including both sexes.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Genus *Hanaiceratina* McKenzie, 1974

*Hanaiceratina primitiva* sp. nov.

Pl. II, figs. 12, 13; Pl. IV, fig. 2

Holotype: The specimen PAMAu 239, figured in Pl. II, fig. 12 from Bells Headland, Victoria. Figured Paratype PM Au 240.

Derivatio Nominis: Primitiva (L.) — first, early; to mark the fact that this is the oldest known member of the genus.

Diagnosis: A *Hanaiceratina* characterised by a reticulate shell and subhomboidal outline.

Description: A large species (about 1.00 mm) with a subhomboidal shape and lacking an eye tubercle. The surface ornament over the inflated main part of each valve consists of reticulations, the network clearly formed by longitudinal riblets with interconnecting ridges. The muscle scar region is depressed, as are the anterior and posterior marginal areas; these latter bear scattered normal pore canal pits. Dorsum and venter nearly straight; anterior rounded anteroventrally but tending backwards more dorsally; posterior parallel to it and forming a subdorsal cauda. The valves are inflated on either side of a weak dorsomarginal depression. Subhastate in dorsal view.

Internal features include moderately broad inner lamellae, with moderate-sized anterior and posteroventral vesitbules; marginal pore canals fairly numerous and straight; normal pore canals scattered, simple and rimmed; hinge with the diagnostic terminal dentitions of *Hanaiceratina* s.s.; central muscle scars comprise 5 adductors in a subvertical series and two mandibular scars in front (Pl. IV, Fig. 2). They lie just below an internal dorsomarginal ridge, which is the internal trace of the weak external dorsomarginal depression.

Sexual dimorphism apparent, males longer than females.

Measurements: Length of a mature female is 0.95 mm, and its height is 0.53 mm; length of a mature male is 1.05 mm and its height is 0.51 mm.

Remarks: Initially it seemed as if this species represented a new generic category but under the scanning electron microscope the hinge was seen to correspond with *Hanaiceratina* s.s. The reticulation, made up of interconnected longitudinal riblets, and the more obviously subhomboidal shape suffice to distinguish *H. primitiva* from *H. arenacea* (2 subspecies), *H. posterospinoso* and *H. henryhowei* which are the other described Australian species in this genus and have a spiky overall appearance (see McKenzie, 1974, pl. 4, figs. 1-7). *H. primitiva* is the oldest known *Hanaiceratina* species. Further, apart from its quite different (reticulate) ornament, our new species lacks the prominent anterodorsal flange 'ear' of *H. henryhowei*, the posteroventral spine of *H. posterospinoso*, and the regularly rectangular shape of the 2 *H. arenacea* subspecies; nor is a dorsomarginal depression discernible in these other species, apart from being weakly present in *H. arenacea arenacea* females. The phylogenetic importance of this fact has led us to erect a new species despite the relatively small sample available.

Material Studied: Four adult valves, one male and two female. Additional material from the Point Addis Limestone (Miocene), Victoria.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Family *Krithiidae* Mandelshtam, 1960

Genus *Krithi* Brady, Crosskey and Robertson, 1874

*Krithi nitida* Whatley and Downing, 1983

Pl. II, fig. 14; Pl. III, fig. 16

1974 *Krithi* sp., McKenzie, 158, fig. 36.
1983 *Krithi nitida* Whatley and Downing, 368-369, pl. 4, figs. 7-13.
1984 *Krithi C* 22 to 24, McKenzie and Peyrouquet, 293.

Remarks: This form seems to be long-ranging geologically in Australian Tertiary marine environments, now being known from Late Eocene to Middle Miocene. Some specimens show a variation in the vestibule which differs from McKenzie's original illustration (cf. Synonymy above). McKenzie and Peyrouquet (1984) used such variation to postulate upwelling during the Middle Miocene off the southern coastline of Australia. The size of our specimens, which ranges from 0.63-0.71 mm, is close to the size range of the *K. nitida* type series (Whatley and Downing, 1983, p. 369).

Material Studied: Fifty seven specimens, including fragments; juveniles, and adults of both sexes from the Gull Rock Member (BPF), South Australia; plus 3 specimens; one juvenile, the others mature female and mature male valves from Bells Headland, Victoria.

Occurrence and Age: Gull Rock Member (BPF), South Australia, Late Eocene (Aldingan); Bells Headland, Victoria, Late Oligocene (Janukian).

Family *Eucytheridae* Puri, 1954

Genus *Pseudocythere* Hartmann, 1989

*Pseudocythere pseudosubovalis* (Whatley and Downing, 1983)

Pl. V, figs. 1-3; Pl. XI, fig. 7

1983 *Eucythere (Rotundacythere) pseudosubovalis* Whatley and Downing, 368, pl. 4, figs. 4-6.

Remarks: The species belongs in *Pseudocythere* because it has a subcuminate, not a rounded, posterior. At a maximal size of 0.58 mm (range in length 0.53-0.58 mm), our specimens are considerably larger than those of the type series. Since the Late Oligocene was cooler (Gill, 1968) than the Middle Miocene—the age of Whatley’s and Downing’s species—we believe this to be a temperature-related size difference.

Material Studied: Four specimens, all mature, 3 female (2 LV, 1 RV) and a male LV. An additional specimen from the Point Addis limestone (Miocene).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Genus *Rotundacythere* Mandelshtam, 1958

*Rotundacythere fragilis* sp. nov.

Pl. V, fig. 4; Pl. XI, fig. 5

Holotype: The specimen PAMAu 246, figured in Pl. V, Fig. 4 from Bells Headland, Victoria. Figured paratype PM Au 346.
Derivatio Nominis: Fragilis (L.) = fragile, for the relatively thin shell.

Diagnosis: A thin-shelled Rotundaclythere with an elongate shape and no discernible ornament.

Description: Shell medium-sized (length about 0.55-0.60 mm); bean-shaped; relatively fragile; without discernible ornament, apart from the normal pore canal pittings; dorso-ventral margin nearly straight in LV, inflected medially in RV; valves asymmetrical, the LV larger; greatest height a little anterior of the mid-length.

Internal characters include a moderately broad inner lamella; narrow anterior vestibule; few marginal pore canals; normal pore canals sieve type and scattered; hingel weakly anisomeric; muscle scars comprising 4 adductors in a subvertical series and a heart-shaped frontal scar, plus 2 small mandibulars.

Sexual dimorphism present, males smaller than females and relatively less high.

Measurements: Length of a mature male ranges from 0.53-0.54 mm; its height is 0.32 mm. Length of a mature female ranges from 0.55-0.58 mm, its height ranges from 0.33-0.36 mm.

Remarks: The rather fragile shell and lack of any median sulcus differentiate this species from Rotundaclythere rotunda (Hornbrook, 1952). The broadly rounded posterior distinguishes it from Pseudolimacina (Whatley and Downing, 1983) which we have transferred to Pseudolimacina, as noted above. The figured specimen bears what seems to be a murcid drill-hole.

Material Studied: Six specimens all mature valves; 4 female (2 RV, 1 LV) and 2 male (1 RV, 1 LV). Additional material in McKenzie’s collection was consulted.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujanian).

Family Loxoconchidae Sars, 1925
Genus Loxoconcha G. Sars, 1866

Loxoconcha punctabella sp. nov.
Pl. IV, figs. 3; Pl. V, figs. 5, 6

Holotype: The specimen PAMAU 247, figured in Pl. V, fig. 6 from Bells Headland, Victoria. Figured paratype PM AU 248.

Derivatio Nominis: Puncta (L.) = a puncta, and bella (L.) = pretty; for the prettily punctate valves.

Diagnosis: An inflated Loxoconcha with a prettily punctate shell.

Description: A medium-sized species (length about 0.55-0.60 mm), with a subhomboidal shape —more regularly subhomboidal than in most Loxoconcha species— and a finely punctate shell ornament, the other ornamental feature being its large normal pores. Dorsum straight to weakly convex; venter sinuated antero-medially; anterior broadly rounded, trending anteroventrally; posterior also rounded ending in a subdorsal cauda. Rather flat in dorsal view, because of the inflated valves.

Internally, there are broad inner lamellae, with well marked inner and outer selvage lines, and narrow vestibules anteriorly and posteroventrally; the marginal pore canals are rather few (about 10 anteriorly and also posteroventrally); normal pore canals scattered, large, sieve type; hinge gongylodont; muscle scars consisting of 4 adductors in a subvertical series with a large V- or U-shaped frontal scar, plus 2 small mandibulars (Pl. IV, fig. 4).

Sexual dimorphism present but slight; males relatively more elongate than females.

Measurements: Length of a mature male is 0.48 mm; its height is 0.32 mm. The length of a mature female ranges from 0.50-0.53 mm; its height ranges from 0.33-0.34 mm.

Remarks: The shell is more inflated than in other Australian loxocondhids and the fine surface punctuation is also diagnostic for this species. It seems that loxocondhids are generally infrequent in Australian Tertiary environments although regularly encountered in Recent assemblages, a paradox that we cannot satisfactorily explain.

Material Studied: Eighteen valves and a carapace; only 2 valves are juvenile, of the remainder, one or two valves seem to be males, the others (including the carapace) are mature females.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujanian).

Loxoconcha macgowani sp. nov.
Pl. V, figs. 7, 8, a-b; Pl. VIII, figs. 1, a-b

Holotype: The specimen PAMAU 249, figured in Pl. V, fig. 7 from Bells Headland, Victoria. Figured paratype PM AU 250.

Derivatio Nominis: For Prof. B. McGowran, University of Adelaide, who has guided one of us (K.G.M.) around the South Australian Tertiary sections of the Willunga Embayment.

Diagnosis: A Loxoconcha with an inflated, reticulate carapace that is broadly sublate in dorsal view due to its prominent posteroventral alae.

Description: A medium-sized species (length about 0.55 mm) with a subquadrate shape and reticulate surface ornament, the walls of the muri not as strongly developed as in, say, Loxoconcha australis Brady, 1880. Carapace inflated and with well marked ventral alae that terminate abruptly in the posteroventral region of each valve and give this species a broadly sublate appearance in dorsal view. Dorsum straight, as in the venter; anterior broadly rounded; posterior margin evenly curved, sweeping upwards to the posterodorsal corner where it makes a small ‘ear’ behind the dorsal margin. This ‘ear’ presumably is equivalent to the posterior cauda of other species. Ornament and pore-structure illustrated in Pl. IV, fig. 4.

Internally, with moderately broad inner lamella; well defined selvages; elongate anterior and posteroventral vestibules; rather few, straight marginal pore canals; sieve type normal pore canals; a gongylodont hinge; and muscle scars comprising a subquadrate series of 4 adductors, plus a V-shaped frontal scar and 2 small mandibulars.

Sexual dimorphism not confirmed from our material.

Measurements: The length of a mature female is 0.55 mm; its height is 0.32 mm.

Remarks: No previously described Australian species has the dorsal appearance of this taxon, although Warne (1987, pl. 4, fig. D) has figured a likely Middle Miocene descendant. The hinge line is relatively narrow, but typically like a Loxoconcha in its elements.

Material Studied: Ten valves; two of which are mature females (LV and RV of different individuals).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujanian); Lochard Gorge, Port Campbell; Early Miocene (Gellibrand Marl).
**Loxococoncha sp.**
Pl. V, fig. 9

**Remarks:** This is a characteristic Australian loxococonchid. It is not as inflated as *L. punctabella* and reticulate rather than punctate. The LV has a length of 0.55 mm and a height of 0.34 mm.

**Material Studied:** Single mature LV, possibly male.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

**Genus Myrena Neale, 1967**

**Myrena lindsayi** sp. nov.
Pl. IV, fig. 4; Pl. V, fig. 10

1979 *Myrena* sp., McKenzie, 91, pl. 1, fig. 10, p. 100, fig. 2.

**Holotype:** The specimen PAM 252, figured in Pl. V, Fig. 10 from the Gull Rock Member (BPF), South Australia, a male carapace.

**Derivatio Nominis:** For Dr. M. J. Lindsay, South Australian Geological Survey, who guided the 'Shallow Tethys 2' field-trip to the classic South Australian Tertiary sections of the Willunga Embayment.

**Diagnosis:** An inflated loxococonchid, more subrectangular than subbromboidal in shape and with a part-reticulate, part-pitted surface ornament.

**Description:** Shell small-medium sized (about 0.45-0.50 mm in length), subrectangular to elongate subbromboidal in shape; inflated; the inflated region of each valve is distinctly reticulate, but sometimes pitted medially, the valve margins are without such ornament. There is a poorly expressed subdorsal cauda, but no discernible eye tubercle. Dorsal margin straight; ventral margin inflected anteromedially; anterior broadly rounded; posteroventral margin broadly rounded, sweeping up posteriorly to the cauda; postero-dorsal margin (above the cauda) inflexed. Fat in dorsal view.

**Internal characters** (McKenzie, 1979, fig. 2) include moderately broad inner lamellae, with well marked inner and outer selvages; elongate anterior and posterior vestibules; about 10 marginal pore canals anteriorly and also posteriorly; normal pore canals scattered, large, sieve type; hinge modified gongylodont, with a partly crenulate posterior tooth on the RV; muscle scars comprising 4 subvertical adductors, a V-shaped frontal scar, plus 2 small mandibulars.

**Sexual dimorphism** distinct, males relatively more elongate than females.

**Measurements:** A mature male has a length of 0.47 mm; and a height of 0.26 mm. Females are known to reach 0.50 mm in length, from other collections.

**Remarks:** *Myrena* is nearly always rare in the Australian Tertiary. McKenzie (1974, p. 164) previously determined it as a *Loxococona*. Apart from our record, it occurs in the Castle Cove section, Victoria (McKenzie, 1974, p. 163 and Table 3) where it is more common than usual.

**Material Studied:** Single mature male LV; additional material, five specimens from the Late Eocene Castle Cove and Johanna River, Victoria and six specimens in bores WLG 38 and WLG 42 in the Late Eocene of South Australia (McKenzie, 1979).  

**Occurrence and Age:** Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan).

**Family Xestoleberididae** Sars, 1928

**Genus Xestoleberis** Sars, 1866

**Xestoleberis** sp.
Pl. V, fig. 11

1987 *Xestoleberis* sp. 5, Warne, 444, pl. 4, fig. G.

**Remarks:** Our few specimens seem closest to the taxon illustrated by Warne. Surprisingly, for such a small collection, 3 growth stages are represented. Length ranges from 0.50-0.51 mm; and height from 0.29-0.32 mm in mature individuals. The valves are asymmetrical, the LV being larger.

**Material Studied:** Four specimens; 2 juveniles, plus a mature female LV and RV.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

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**Plate V**

1. *Pseudocythere pseudosubovalis* (Whitney and Downing). Female RV, PM Au 240. (BH). Late Oligocene. x 75.
2. Same species and provenance. Juvenile LV (A-1), PM Au 244. x 100.
3. Same species and provenance. Female LV, PM Au 245. x 75.
4. *Rotundocythere fragilis* sp. nov. Female (?), Holotypus, PM Au 246. (BH). Late Oligocene. x 75.
5. *Loxococona punctabella* sp. nov. Female interior RV showing muscle scars, PM Au 247. BH. Late Oligocene. x 100.
6. Same species and provenance. Female LV, Holotypus, PM Au 248. x 100.
7. *Loxococona macgowiani* sp. nov. Male LV, Holotypus, PM Au 249. (BH). Late Oligocene. x 100.
8. a-b. Same species and provenance. RV and LV of same female, PM Au 250. x 75.
9. *Loxococona* sp. Female LV, PM Au 251. (BH). Late Oligocene. x 75.
10. *Myrena lindsayi* sp. nov. Male LV, Holotypus, PM Au 252. (AB). Late Eocene. x 100.
11. *Xestoleberis* sp. Female RV, PM Au 253. (BH). Late Oligocene. x 100.
12. *Foveoleberis minutissima* (Chapman). Female LV, PM Au 254. (BH). Late Oligocene. x 100.
14. Same species and provenance. Female RV, PM Au 256. x 100.
15. Same species and provenance. Male interior RV, PM Au 257. x 100.
16. Same species and provenance. Male interior LV, PM Au 258. x 100.
Genus *Foveoleberis* Malz, 1980

*Foveoleberis minutissima* (Chapman, 1926)

Pl. V, fig. 12

1926 *Bairdia minutissima* Chapman, 132, pl. 10, figs. 2 a, b.

1974 *Uroleberis minutissima* (Chapman); McKenzie, 163, pl. 1, fig. 14.

1983 *Uroleberis minutissima* (Chapman); Whatley and Downing, 384, pl. 7, fig. 20.

1987 *Foveoleberis minutissima* (Chapman); Warne, 444.

**Remarks:** There is now some uncertainty on the validity of *Foveoleberis*. Chapman's species has a finely pitted surface ornament and a crenulate median hinge element which places it in *Foveoleberis* according to the generic diagnosis for this taxon (Malz, 1980). Apparently, some foveolate species have a smooth median hinge element (like *Uroleberis* s.s.); and some smooth-surfaced species have a crenulate median hinge element (like *Foveoleberis* s.s.). Our only adult valve has length/height of 0.59/0.42 mm.

**Material Studied:** Sixteen valves, 15 juveniles, plus a mature female RV.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

Family *Cytheruridae* Müller, 1894

Genus *Oculocytheroperon* Bate, 1972

*Oculocytheroperon australopunctatarum* sp. nov.

Pl. VI, fig. 1; Pl. VII, figs. 1, 2

**Holotype:** The specimen PAMAU 255, a RV figured in Pl. VII, fig. 1 from the Gulf Rock Member (BPF), South Australia. Figured paratypes PM Au 260, PM Au 261.

**Derivatio Nominis:** *Auster* (L.) = south; *punctata* (L.) = punctate, for the main feature of its surface ornament. Note that the genus name *Oculocytheroperon* (meaning 'the winged cytheracean') is a plural form and feminine in gender, hence the -*anum* ending for the species name.

**Diagnosis:** A highly punctate *Oculocytheroperon* with a broad low ala in each valve.

**Description:** A medium-sized species (length 0.53 mm) with a broadly semicircular shape which features a distinct and broad posterior cauda and a broad low ala, which points posteriorly and laterally on each valve; also a weak submarginal dorsal riblet; inequivalent the RV overlapping, and higher, than the LV. Surface almost entirely punctate, except for the rim of each ala; slightly depressed medianally in the central muscle scars region. Dorsal margin broadly convex; anterior subrounded; posterior caudate; ventral margin inflected antero-medially and overlapped by the ventral ala. Subbasal and rather inflated in dorsal view with the greatest breadth well behind the middle.

Internally, with broad inner lamellae and a small anterior vestibule; anterior marginal pore canals are flexuous, few and grouped antero-ventrally, posterior marginal pore canals include 2 or 3 which traverse the caudal region; normal pore canals simple, rimmed and scattered; hinge in RV with dentate terminal elements and a connecting crenulate median groove, LV complementary; muscle scars comprise 4 adductors in a subvertical series, a broadly V-shaped frontal scar and several dorsal scars; mandibular scars not observed.

**Sexual dimorphism** distinct, males more elongate than females.

**Remarks:** Our specimens are intermediate in size (length 0.53 mm) between *Cytheroperon wellmani* Hornibrook, 1952 and *C. parawellmani* Whatley and Downing, 1983. They seem close to the latter in their surface punctuation but with a weaker dorsal submarginal rib and lacking the weak reticulate meshwork of that species.

**Material Studied:** Five valves, all adult including both sexes from the Gulf Rock Member (BPF), South Australia. Additional material; three specimens in the collections of the Geological Survey of South Australia (Willunga Embayment; boreholes WLG 40 and WLG 42).

**Occurrence and Age:** Gulf Rock Member (BPF), South Australia, Late Eocene (Aldingan).

*Oculocytheroperon parawellmani* Whatley and Downing, 1983

Pl. V, figs. 13-16

1983 *Cytheroperon parawellmani* Whatley and Downing, 371, pl. 4, figs. 20, 21, pl. 5, fig. 1.

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**Plate VI**

1. *Oculocytheroperon australopunctatarum* sp. nov. Male LV, PM Au 261. (AB). Late Eocene. x 100.

2. *Oculocytheroperon cf. microforinix* Whatley and Downing. Female LV interior, PM Au 263. (BH). Late Oligocene. x 100.

3. *Aversovalva cooperi* sp. nov. Male LV, Holotypus, PM Au 264. (BH). Late Oligocene. x 100.

4. *Hemiectythera reeckmani* sp. nov. Female RV, Holotypus, PM Au 265. (BH). Late Oligocene. x 180.


7. *Hornibrookella* sp. Female (?) LV, PM Au 270. (BH). Late Oligocene. x 75.

8. *Bradleya longulata* sp. nov. Female RV, Holotypus, PM Au 275. (BH). Late Oligocene. x 75.

9. *Bradleya dickbensonii* sp. nov. Female LV, Holotypus, PM Au 277. (BH). Late Oligocene. x 75.

10. Same species and provenance. Male RV, PM Au 276. x 65.

11. *Bradleya irregularis* sp. nov. Male RV, Holotypus, PM Au 278. (BH). Late Oligocene. x 75.

12. Same species. Male RV, PM Au 279. (AB). Late Eocene. x 75.

13. *Bradleya* sp. cf. *regularis* sp. nov. Male RV (AB), Early to Middle Miocene (Lohard Gorge). PM Au 280. x 75.

14. *Quasibradleya janiikatanai* sp. nov. Male LV, Holotypus, PM Au 281. BH. Late Oligocene. x 75.

15. Same species and provenance. Female RV, PM Au 310. x 75.

16. Same species and provenance. Male RV, PM Au 311. x 75.

17. *Ortolibaindia* (?) sp. Fragment of anterior LV, PM Au 312. BH. Late Oligocene. x 75.
1987 *Cytheropterus parawellmani* Whatley and Downing; Warne, 444.

**Remarks:** Our specimens seem identical with the referred species. The length of adults ranges from 0.50-0.53 mm; their height ranges from 0.32-0.33 mm. Males are more elongate than females. This records extends the species range into the Late Oligocene.

**Material Studied:** Sixty specimens, comprising one carapace, the remainder being valves—most are adults, with both sexes represented—from Bells Headland, Victoria.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

**Oculocytheropterus cf. microfornix**

Whatley and Downing, 1983
Pl. VI, fig. 2; Pl. VII, fig. 3

1983 *Oculocytheropterus microfornix* Whatley and Downing, 372-373, pl. 5, figs. 3-9.

**Remarks:** As with *Oculocytheropterus cf. parawellmani*, our specimens (length 0.47-0.50 mm) are intermediate in size between the referred species and a Hornbrook species, to wit, *Oculocytheropterus frondis* (Hornbrook, 1952). Again, we regard the size difference as a temperature-related effect. Certain slight, but persistent, differences prevent us from making a definite assignation to *O. frondis* despite the large sample available.

**Material Studied:** Forty six specimens, all valves; only 2 juveniles, the remainder mature and including both sexes, from Bells Headland, Victoria. Only 2 specimens, a mature female RV and a juvenile carapace, from the Gull Rock Member (BPF), South Australia.

**Occurrence and Age:** See above for occurrence; Late Eocene to Late Oligocene.

**Oculocytheropterus ? cf. albomaculata**

(Whatley and Downing, 1983)
Pl. X, fig. 12

1983 *Cytheropterus albomaculata* Whatley and Downing, 370, pl. 4, figs. 17-19.

**Remarks:** Two specimens of the form recorded here were obtained from Bells Headland. They agree in general features with *O. ? albomaculata* but differ in being appreciably smoother. It is possible that our material could be a smooth variant of the species.

**Material Studied:** Two specimens.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

**Genus Aversovalva** Hornbrook, 1952

*Aversovalva cooperi* sp. nov.
Pl. VI, fig. 3; Pl. XI, figs. 4A-B

**Holotypus:** The specimen PAMAu 264, figured in Pl. VI, Fig. 3 from Bells Headland, Victoria, male LV. Figured paratype PM Au 345.

**Derivatio Nominis:** For Dr. B. J. Cooper, South Australian Geological Survey who provided samples and advice on some Willunga Embayment boreholes to one of us (K.G.M.).

**Diagnosis:** An *Aversovalva* with spectacularly developed alae.

**Description:** A small species (length 0.35-0.40 mm), with smooth shell, and subrhomboidal lateral shape dominated by a very large, backswep tala with a pointed tip on each valve. Valves asymmetrical with RV larger than LV as characteristic for the genus. Dorsum gently convex; ventral margin slightly inflexed anteromedially; anterior rounded, trending anteroventrally; posterior evenly curved posteroventrally; produced posteroventrally into a distinct cauda. Eye tubercle absent. Wing-shaped in dorsal view.

Internal features include broad inner lamellae anteriorly and posteriorly, the inner margin of each lamella running from the anterior hinge element around anteriorly, ventrally and posteriorly to the posterior hinge element; a small anterior vestibule; and few, flexuous anterior marginal pore canals, several grouped closely in the anteroventral area of each inner lamella; normal pore canals simple and rimmed; hinge antimerodont, with small crenulate terminal teeth in the RV and a crenulate median furrow; LV complementary; muscle scars consist of 4 adductors in a subvertical series plus a frontal scar, mandibularis not observed (probably hidden within the holotype).

**Sexual dimorphism distinct, males less high than females.**

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**Plate VII**

1. *Oculocytheropterus australopunctatatum* sp. nov. Female RV, Holotypus, PM Au 259. (AB). Late Eocene. x 120.
2. Same species and provenance. Male RV, PM Au 260. x 120.
3. *Oculocytheropterus cf. microfornix* Whatley and Downing. Female LV, PM Au 262. (BH). Late Oligocene. x 120.
4. *Pokornyella australiae* sp. nov. Male RV, Holotypus, PM Au 268. (BH). Late Oligocene. x 90. Note naticid drill-hole at base of caudal process, an unusual site of attack.
5. *Hornbrookella aggrada* sp. nov. Female RV, Holotypus, PM Au 271. (BH). Late Oligocene. x 95.
6. *Quadracythere singletoni* sp. nov. Female RV, Holotypus, PM Au 271. (BH). Late Oligocene. x 85.
7. Same species and provenance. Dorsal view of female carapace, PM Au 272. x 90.
8. *Neobuntonia ariella* sp. nov. Female RV, Holotypus, PM Au 273. (BH). Late Oligocene. x 80.
11. *Trachyleberis careyi* sp. nov. Male RV, Holotypus, PM Au 290. (BH). Late Oligocene. x 60.
12. Same species and provenance. Female RV, PM Au 291. x 60.
14. *Trachyleberis brevicosta australis* subsp. nov. Female RV, Holotypus, PM Au 291. (BH). Late Oligocene. x 80.
15. *Quadracythere singletoni* sp. nov. Male RV, PM Au 340. (BH). Late Oligocene. x 80.
Measurements: A mature male RV has a length of 0.38 mm; and a height of 0.18 mm. In mature females, the length ranges from 0.36-0.39 mm; the height ranges from 0.21-0.24 mm. The breadth of a mature female carapace is 0.30 mm.

Remarks: One other Australian species of *Aversovalva* has been figured - but determined as *Cytheropteron sp.* (e.g. McKenzie, 1979, pl. 1, fig. 15). The very prominent alae easily distinguish *A. cooperi* from that species and from the type species, *A. aureum* Hornbrook, 1952.

Material Studied: Four specimens, all adult; one male RV, two female LV and a female carapace. In describing this species, we referred to more specimens in an earlier collection made by one of us McKenzie (1964). Additional material studied - 12 specimens from Bells Headland in McKenzie's private collection (McKenzie, 1974).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujkian).

Genus *Hemicytherura* Elufson, 1941

*Hemicytherura reekmani* sp. nov.
Pl. IV, fig. 5; Pl. VI, fig. 4; Pl. XI, figs. 12-14

1974 *Hemicytherura* sp., McKenzie, 176, pl. 3, figs. 4, 5.

Holotype: The specimen PAMAU 265, figured in Pl. VI, fig. 4 from Bells Headland, Victoria. Figured paratypes PM Au 353, PM Au 354.

Derivatio Nominis: For Anne Reecman, Esso Australia Ltd., whose thesis at Melbourne University has proved valuable to us on the Tertiary coastal section, near Torquay, Victoria. This work includes the type locality for our new species (Reecman, 1974 unpubl.).

Diagnosis: A *Hemicytherura* in which the surface ornament includes blebs of smooth calciite over the central muscle scars (cf. McKenzie, 1974, pl. 3, fig. 5).

Description: A small species (0.30-0.35 mm in length), subhemicircular in lateral view with a surface ornament consisting of large depressions with smooth muri but microreticulate within. In the second depression (of the lower tier) from the front the four adductor scars are delineated by blebs of smooth calciite while the frontal scar is similarly delineated in the upper left corner of the first depression from the front on the lower tier. Each valve terminates in a supraventral cauda; and there is an indication of anteroventral dentition on well preserved material. Valves asymmetrical, RV larger than LV, overlapping it in the dorsal region, more conspicuously in females than in males. The eye ridge, if present, is produced above the junction between the first and second depressions of the upper tier from the front, i.e. it is located anterodorsally. Dorsum convex, venter nearly straight; anterior produced anteroventrally; posterior ending in a cauda. Above the boundary of the upper tier of depressions is a rather wide marginal area (in female RV).

Internally, inner lamellae broad; marginal pore canals flexuous including a few grouped anteroventrally; normal pore canals simple and rimmed; hinge of the usual cytheopterontine merodont type; muscle scars comprising 4 adductors in a vertical series plus a U-shaped frontal scar, mandibularis were not observed.

Sexual dimorphism distinct, males less high and smaller than females.

Measurements: A mature male measures 0.26 mm in length; its height is 0.18 mm. From other collections (McKenzie, 1979) it is known that mature females approach 0.35 mm in length.

Remarks: *Hemicytherura pentagona minor* Whatley and Downing, 1983, has a similar kind of ornament but a completely different pattern of depressions (cf. Whatley and Downing, 1983, pl. 5, figs. 16, 17); the same applies to *H. pentagona pentagona* Hornbrook, 1952. Because of its striking and species-specific ornament which appears to vary markedly through time, *Hemicytherura* is probably a biostratigraphically useful genus, at least in the Australian Cainozoic.

Material Studied: Three valves; two males, one mature the other a A-1 juvenile and a female. We also had recourse to the large series of more than 20 specimens in collections made earlier by McKenzie (1974) at Bells Headland.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujkian).

Family *Pectocytheridae* Hanai, 1957

Genus *Arcacythere* Hornbrook, 1952

Arcacythere sp. aff. chapmani Hornbrook, 1952
Pl. VI, fig. 5

1952 *Arcacythere chapmani* Hornbrook, 31, 32, pl. 2, figs. 33-35.

Remarks: Our single mature valve seems close to Hornbrook's taxon, except that it lacks the heavy posterior rim which he illustrates (Hornbrook, 1952, fig. 33). In our form the posterior is inflated and completely reticulate; its length is 0.47 mm and the height is 0.22 mm.

Material Studied: Two valves; one juvenile, the other a mature female RV.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujkian).

Genus *Munseyella* van den Bold, 1957

*Munseyella* sp.
Pl. VI, fig. 6


Remarks: Our form is clearly identical with that figured previously by McKenzie (cf. Synonymy). The poor available material precludes description of a new species.

Material Studied: Single mature RV, probably a male (length 0.47 mm).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janujkian).

Family *Hemicytheridae* Puri, 1953

Genus *Pokornyella* Oertli, 1956

Pokornyella australiae sp. nov.
Pl. VII, fig. 4; Pl. X, figs. 5-8

1974 *Pokornyella s.l.* sp., McKenzie, 159, pl. 1, fig. 5.

Holotype: The specimen PAMAU 268, figured in Pl. VII, fig. 4 from Bells Headland, Victoria. Figured paratypes PM Au 327, PM Au 328, PM Au 329, PM Au 330.

Derivatio Nominis: For Australia.
Diagnosis: An auriform Pokornyella, with a reticulated surface formed by longitudinal ribs and transverse intercostal ribs.

Description: Carapace medium-sized (length about 0.65-0.75 mm), auriform, with a reticulate surface; the network is formed by strong longitudinal ribs and transverse intercostal ribs - the difference between ribs and ribs accentuated in aggraded specimens. Eye tubercle anterodorsal, circular and low-profiled. Dorsal outline straight along the hinge, sloping to the front and, more steeply, to the rear; anterior rounded, trending anteroventrally, ventral margin inflected anteromedially then convex; posterior evenly rounded to the small cauda, inflected between the postero dorsal angle and the cauda. In dorsal view, elliptical, with inflated middle and pointed extremities.

Internal features comprise moderately broad inner lamellae; with distinct ventral and posteroventral selvage; about 40 marginal pore canals and, in some specimens, a narrow anterior vestibule; normal pore canals both simple and sieve-type; hinge strongly holomphidont; with a weakly lobate posterior tooth in the RV and a crenulate median bar behind a strong tooth in the LV and without the small post in the LV posterior socket that typifies Austra Pokorny, 1955; muscle scars consist of 4 adductors, one divided, in a subventral series and 2 frontal scars, plus 2 small mandibulare.

Sexual dimorphism present, males relatively more elongate in lateral profile than females and usually smaller.

Measurements: Length of mature males ranges from 0.65-0.68 mm; the height ranges from 0.42-0.44 mm. The length of mature females ranges from 0.66-0.74 mm; their height ranges from 0.44-0.48 mm.

Remarks: McKenzie (1974, this volume) compared Australian species of Pokornyella with the type species, concluding that the Australian taxa should be regarded as Pokornyella s.l. Following a project in Aquitaine, where he worked with over 20 species of European Pokornyella (McKenzie et al., 1979), he now considers that the type species is exceptional in its low number of marginal pore canals and 3 frontal scars. Most Aquitaine Basin Pokornyella resemble the Australian species in these characters, i.e. have around 40 m.p.c. and only 2 frontal scars. There is no longer any necessity, therefore, to regard the Australian taxa as Pokornyella s.l. In southeastern Australia, Pokornyella ranges from the Late Oligocene to Middle Miocene (McKenzie, 1974; Warne, 1987). The species seems distinct from Pokornyella s.l. sp. McKenzie (1979, pl. 2, fig. 12) from Bore WLG 38, Willunga Embayment, S.A., which is punctate not reticulate.

Material Studied: Eighty three specimens mostly valve but including 5 carapaces, a few A-1 juveniles, the remainder adults with both sexes represented and females dominant numerically. Additional material from the Point Addis limestone (Miocene).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjian).

Genus Hornibrookella Moos, 1965

Hornibrookella aggradata sp. nov.

Pl. VII, fig. 5; Pl. XI, fig. 8

Holotype: The specimen PAMAU 269, figured in Pl. VII, fig. 5 from Bells Headland, Victoria. Figured paratype PM Au 352.

Derivatio Nominis: Aggradata (L.) = aggraded; for the thickened muri of the surface ornament which give an impression that the shells have been aggraded.

Diagnosis: A Hornibrookella in which the muri of the surface ornament are thickened.

Description: Shell subrectangular and medium sized (about 0.65-0.75 mm in length); surface ornament reticulate, characterised by grossly thickened muri and relatively elongate, deep intermural pits; plus minor ventral and posterodorsal ridges; somewhat inflated. Dorsal outline straight, slopes slightly rearwards in females; ventral margin inflected anteromedially; anterior broadly rounded; posterior curved below and dentate, forming a cauda, inflexed between the upper cauda and the posterodorsal angle. In dorsal view subelliptical with thickened extremities.

Internally, with moderately broad inner lamellae; distinct marginal selvage, numerous marginal pore canals; normal pore canals both simple and sieve type; hinge holomphidont but not as strong as in Pokornyella australiae; muscle scars comprising a subventral series of 4 adductors, one of these divided, plus 2 round frontal scars and 2 small mandibulare (not always distinct).

Sexual dimorphism marked; males more elongate than females and usually larger.

Measurements: The length of mature males ranges from 0.70-0.75 mm; the height ranges from 0.37-0.38 mm. The length of mature females ranges from 0.63-0.71 mm; their height ranges from 0.37-0.38 mm.

Remarks: Hornibrookella seems to lie between Quadracrythis Hornibrook, 1952 and Mutillus Neviani, 1928 in its characteristics. It seems to one of us (K.G.M.) that Recent Mutillus species in Australia, e.g. Mutillus punula (Brady, 1866), may be regarded as descendants of Oligo-Miocene Hornibrookella.

In what we regard as Quadracrythis species, the rear of the valve is more expanded than in Hornibrookella (see next description) and the size is usually larger - although not in the type species Quadracrythis truncula (Brady, 1889) which is about the same size as H. aggradata.

Material Studied: One hundred and seventy nine specimens, mostly valves but including 17 carapaces; about 30 juveniles, the remainder adults of both sexes - females: males ratio about 5:2.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjian).

Hornibrookella sp. 

Pl. VI, fig. 7; Pl. X, fig. 15

Measurements: The length of a mature male is 0.66 mm; its height is 0.31 mm. The length of mature females is 0.65 mm; their height ranges from 0.32-0.33 mm.

Remarks: The reticulation pattern of Hornibrookella sp. differs from that of H. aggradata because it does not have thickened ribs; it differs from H. flexicostata (Chapman, 1914) because in that species the ribs are flexuous as well as thickened, totally obscuring any reticulations. Our form seems to be a new species.

Material Studied: Three mature valves; 2 female LV, 1 male RV.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukjian).

Hornibrookella flexicostata (Chapman, 1914)

Pl. X, fig. 11

1914 Cythere flexicostata Chapman, 35-36, Pl. VII, figs. 14a, b.

Remarks: A few specimens of this easily recognizable form.
species were obtained from Bells Headland. These agree closely with material before us from the Miocene of Lochard Gorge, Port Campbell, Victoria.

**Material Studied:** Four adult valves. In addition, material from the Lochard Gorge and the Point Addis limestone.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukan). Lochard Gorge, Port Campbell, Victoria; Gellibrand Marl, Early to Middle Miocene.

**Genus Quadracythere Hornbrook, 1952**

**Quadracythere singletoni** sp. nov.

**Pl. VII,** figs. 6, 7, 15

**Holotype:** The specimen PAMaU 271, figured in Pl. VII, fig. 6 from Bells Headland, Victoria, female RV. Figured paratypes PM Au 272, PM Au 316.

**Derivatio Nominis:** For Dr. O. P. (Ops) Singleton, Geology Department, University of Melbourne, mentor on the Tertiary of Victoria to many generations of students, including R.A.R.

**Diagnosis:** A *Quadracythere* with a large shell and reticulate surface ornament, expanded in the rear; unlike any known Australian hemicystherid.

**Description:** Shell moderately large to large (length about 0.85-1.00 mm) subrectangular in shape; surface ornament of reticulations, plus a narrow anteromarginal ridge, expanded rearwards into ventral and posterodorsal ridges, the reticulate pattern also indicating this. Eye tubercle distinct; posterior cauda likewise well defined. Dorsum straight, slightly overlapped posterodorsally; anterior broadly rounded; venter inflexed anteromedially and gently convex behind the influxure, the ventral ridge expands medially to nearly reach the margin; posterior curved evenly to the cauda, not obviously dentate, inflexed between the upper cauda and the posterodorsal angle. In dorsal view, subelliptical, showing the rear expansion with thickened extremities (due to thick margins).

Internal features rather similar to *Hornibrookella aggradata* except that the marginal selage is much more prominent and the hinge tending towards hemiaphilodont with a distinctly bilobed posterior tooth and crenulate median furrow in the LV.

Sexual dimorphism distinct; males larger than females and relatively more elongate in shape.

**Measurements:** The length of mature males ranges from 0.89-1.00 mm; their height ranges from 0.50-0.53 mm. The length of mature females ranges from 0.82-0.88 mm; their height ranges from 0.47-0.53 mm.

**Remarks:** *Quadracythere* and *Hornibrookella* are alike in that males are larger than females but can be distinguished, at least in Australia, by the more prominent marginal selage and distinctly bilobed posterior LV tooth of the former versus the latter (in which these features do not occur). *Q. singletoni* is differentiated from New Zealand species (Hornbrook, 1952) by its more rounded ventral ridge. Note that we regard *Quadracythere* as having hemicystherid, rather than bradleyine (Benson, 1972) affinities.

**Material Studied:** Two hundred and twenty two specimens, mostly valves but including 16 carapaces; many juveniles, also many adults of both sexes; females; males ratio about 3:1.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukan).

**Genus Neobuntonia Hartmann, 1981**

**Neobuntonia airenla** sp. nov.

**Pl. VII,** figs. 8, 9; **Pl. X,** figs. 16, 17

1974 *Trachyleberidae* sp. 2, McKenzie, Pl. I, fig. 7.

**Holotype:** The PAMaU 273 RV, figured in Pl. VII, fig. 8 from Bells Headland, Victoria, a male RV. Figured paratypes PM Au 274, PM Au 338, PM Au 339.

**Derivatio Nominis:** From the Aire River district, coastal Victoria (and west of Bells Headland), where this species also occurs abundantly.

**Diagnosis:** A *Neobuntonia* with denser punctuation than the type species, and also finer punctae posteriorly.

**Description:** Shell moderately large (length about 0.80-0.85 mm); subtrapezoidal; inflated ventrally with a broad ventrolateral keel; distinct eye tubercle; surface densely punctate, with larger punctae centrally and finer punctae posteriorly; pattern apparently concentric about the median area of the valve; LV slightly overlaps RV anterodorsally. Dorsal margin highest above the eye tubercle, gently convex and sloping backwards; ventral margin inflexed anteromedially but usually obscured in lateral view by the broadly concave ventrolateral keel; anterior rounded, trending anteroventrally; posterior triangular, with a small but distinct posteroventral cauda. Subelliptical in dorsal view, greatest breadth posteriorly.

Internally, with moderately broad inner lamellae; no

Plate VIII

1. a-b. *Loxoconcha macgrounri* sp. nov. Stereomicrographs of a female interior RV, PM Au 282. (BH). Late Oligocene. x 75.

2. *Quinabradleya janjukania* sp. nov. Female LV, PM Au 283. (BH). Late Oligocene. x 75.

3. *Spinobradleya acantha* sp. nov. Female RV, PM Au 318. (BH). Late Oligocene. x 75.

4. *Tenedocythere auriculata* sp. nov. Male LV, Holotypus, PM Au 284. (BH). Late Oligocene. x 75.

5. *Tenedocythere nuda* sp. nov. Male LV, Holotypus, PM Au 285. (BH). Late Oligocene. x 75.

6. a-b. *Spinobradleya acantha* sp. nov. Stereomicrographs of a male LV, Holotypus, PM Au 287. (BH). Late Oligocene. x 75.

7. a-b. Same species and provenance. Stereomicrographs of a juvenile (A-1) interior LV, PM Au 288. x 75.


9. "*Roeoebertis* "sudauritralis* sp. nov. Female LV of spinose morph, Holotypus, PM Au 296. (BH). Late Oligocene. x 60.

10. *Spinobradleya acantha* sp. nov. Male interior RV, PM Au 296. (BH). Late Oligocene. x 55.

11. *Trachyleberis brevicosta major* subsp. nov. Male RV, PM Au 297. (BH). Late Oligocene. x 55.


vestibules; strong marginal selvage; many relatively straight marginal pore canals; simple, rimmed normal pore canals; hinge holambhindont, anterior tooth in RV not stepped, median element smooth or only indistinctly crenulate, posterior tooth low, broad and strong; LV complementarily; muscle scars sit on a slight, vertical internal ridge; they comprise 4 adductors in a subvertical series, the 2 lowest virtually coalesced, plus 2 round frontal scars.

Sexual dimorphism distinct; males larger than females and relatively more elongate.

**Measurements:** Length of mature males ranges from 0.82-0.84 mm; their height ranges from 0.42-0.44 mm. Length of mature females ranges from 0.79-0.82 mm; their height ranges from 0.43-0.47 mm.

**Remarks:** *Neobuntonia* is close in surface morphology to *Incongruella* Ruggieri, 1958 and *Carinovaba* Sissingh, 1973. But both these genera are smooth whereas *Neobuntonia* is always punctate; punctuation in the type species *N. siebertorum* Hartmann, 1981 is more open than in *N. airella* and not as fine posteriorly. The genus also occurs in the Pleistocene of Victoria and the Recent of South Australia. The soft anatomy (Hartmann, 1981) indicates a relationship with *Hemicytheridae* (cf. Howe and McKenzie, 1989).

**Material Studied:** One hundred and three specimens, several carapaces the rest valves of which 41 are juveniles. Additional material from the Point Addis limestone (Miocene).

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janukian).

**Family Thaerocytheridae** Hazel, 1967
**Subfamily Bradleyinae** Benson, 1972
**Genus Bradleya** Hornibrook, 1952

*Bradleya lunalata* sp. nov.

Pl. VI, fig. 8, Pl. X, figs. 9, 10

**Holotypus:** The specimen PAMAu 275 RV, figured in Pl. VI, fig. 8 from Bells Headland, Victoria. Figured paratypes PM Au 331, PM Au 332 (Lochard Gorge, Early to Middle Miocene).

**Diversio Noninta:** Lunga (L.) = long, and alata (L.) = alate; for the long wing-like ventral ridge.

**Diagnosis:** A reticulate *Bradleya* with a long, alate ventral ridge, that is highest posteriorly and a reduced dorsal ridge.

**Description:** Shell moderately large (length about 0.85-0.90 mm) subrectangular in lateral view; surface reticulate overall (individual reticules subquadrate or wedge-shaped) except along the thickened valve periphery; subcentrally tubercle low and rounded (with indistinct reticulation); eye tubercle spherical, distinct. The main feature of each valve is a long, alate ventral ridge that is highest posteriorly; by comparison the dorsal ridge is reduced. The edge of this ventral ridge is thickened similarly to the valve periphery. Dorsum straight, ventral margin also straight, obscured in lateral view by the thickened edge of the ventral ridge; anterior broadly rounded; posterior characterised by a large cauda which is strongly dentate. Substantate in dorsal view.

Internally, inner lamella broad with a marked submarginal selvage; marginal pore canals numerous, usually straight; normal pore canals both simple, rimmed and sieve type; hinge holambhindont; muscle scars consisting of 4 adductors in a subvertical series, the second from the top attenuated, plus 2 round frontal scars and indistinct mandibular.

Sexual dimorphism not confirmed from our material.

**Measurements:** In mature females length ranges from 0.86-0.89 mm; the height is about 0.45 mm.

**Remarks:** The New Zealand species of *Bradleya* (Hornibrook, 1952) and species described by Benson (1972) mostly fall within the *arata* and *dictyon* groups. This species, however, is clearly distinct from both groups because of its reduced dorsal ridge. The only New Zealand species with similar features is *Quadracythere quadrazza* Hornibrook (1952) (Mungoarpan - Duntroonian) but that taxon is smaller and also has a more prominent posteroventral spine than our species.

**Material Studied:** Fourteen valves, 2 broken, 5 juveniles.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janukian); and Early to Middle Miocene (Lochard Gorge).

*Bradleya dickbensonii* sp. nov.

Pl. VI, figs. 9, 10

**Holotypus:** The specimen PAMAu 277, figured in Pl. VI,

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**Plate IX**

1. *Acanthocythereis incerta* sp. nov. Male LV, Holotypus, PM Au 295. (BH). Late Oligocene. x 60.
4. Same species and provenance. Male interior RV, PM Au 308. x 60.
5. Same species and provenance. Male RV, PM Au 309. x 60.
8. *Idioctythere thalassea* sp. nov. Female LV, Holotypus, PM Au 303. (BH). Late Oligocene. x 75.
9. Same species and provenance. Male LV, PM Au 304. x 75.
10. *Acanthocythereis thomasi* sp. nov. Female RV, Holotypus, PM Au 307. (BH). Late Oligocene. x 50.
11. *Deltaleberis rugosapica* sp. nov. L. view of female carapace, PM Au 306. (BH). Late Oligocene. x 75.
14. Same species. Female RV, PM Au 319. (BH). Late Oligocene. x 100.
15. *Acanthocythereis thomasi* sp. nov. L. view of female carapace, PM Au 340. (BH). Late Oligocene. x 50.
16. Same species and provenance. Female interior LV, PM Au 320. x 50.
17. *Mangocythere aspetra* sp. nov. Female LV, PM Au 321. (BH). Late Oligocene. x 75. Aggraded specimen.
18. *Tenedocythere nuda* sp. nov. Female RV, PM Au 322. (BH). Late Oligocene. x 75.
fig. 10 from Bells Headland, Victoria, male RV. Figured paratype PM Au 276.

**Derivatio Nominis:** For Dr. R. H. Benson, Department of Paleobiology, United States National Museum of Natural History: Smithsonian Institution in recognition of his contribution on the Bradleya problem.

**Diagnosis:** A *Bradleya* with larger reticules and higher (more raised) muri than other Australasian species in the genus.

**Description:** Shell moderately large (length about 0.75-0.85 mm), subquadrate; ornamented by large reticules with raised muri in a pattern that mostly radiates from the subcentral tubercle region, the tubercle itself somewhat obscured by this meshwork; with a strong ventral ridge, highest posteriorly, and a well defined but lower dorsal ridge. Eye-tubercle distinct, posterior cauda marked in the RV but not in the overlapping LV. Dorsal margin straight, ventral outline nearly so; anterior broadly rounded and marginally denticate; posterior rounded in the LV but caudate in the RV, both valves being dentate posteriorly. In dorsal view, broadly subhastate, broadest at the end of the ventral ridge.

Internal features as for *B. lunata*.

Sexual dimorphism present, males relatively more elongate than females.

**Measurements:** The length of mature males ranges from 0.76-0.86 mm; their height ranges from 0.39-0.45 mm. The length of mature females ranges from 0.74-0.82 mm; their height ranges from 0.45-0.47 mm.

**Remarks:** Other *Bradleya* species, such as *B. japonica* Benson, 1972 and *B. antdamanae* Benson, 1972 have large reticules but the meshwork pattern in these taxa does not radiate from the subcentral tubercle region. Our new species may be an ancestral form to such species as *B. praemackenziei* Whatley and Downing, 1983 and *B. mackenziei* Benson, 1983. Of these two, the latter (Recent) species resembles it more closely but has more reticulations, the former (Miocene) species has microspinose and micropunctate mural walls, unlike *B. dickbensonii* in which these are smooth.

**Material Studied:** Two hundred and seventy seven specimens, all valves except for 2 mature carapaces; numerous juveniles and many adults with both sexes represented. The 2 mature carapaces are females.

**Occurrence and Age:** Bells Headland, Late Oligocene (Janjukan).

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**Plate X**

1. Geelongella arctis sp. nov. Female LV, PM Au 323. (BH). Late Oligocene. x 75.
2. Cythereoides marginopicta sp. nov. Female LV, PM Au 324. (BH). Late Oligocene. x 75.
3. Same specimen. Detail of depressed central muscle scar depression cluster, PM Au 325, x 360.
4. Plateella parapunctata (Whatley and Downing). Female RV, PM Au 326. (BH). Late Oligocene. x 75.
5. Pokornyella australiae sp. nov. Female LV, PM Au 327. (BH). Late Oligocene. x 110.
7. Same species and provenance. Female interior RV, PM Au 329. x 75.
8. Same species and provenance. Female interior LV, PM Au 330. x 75.
9. Bradleya lunata sp. nov. Female RV, PM Au 331. (BH). Late Oligocene. x 75.
10. Same species. Female LV, PM Au 332. Locharb Gorge, near Port Campbell, Victoria. Early-Middle Miocene. x 75.
12. Oculeothoraxopener cf. albonuculata (Whatley and Downing). Male LV, PM Au 337. (BH). Late Oligocene. x 100.
13. Trachyleberis caragi sp. nov. Male RV, PM Au 333. (BH). Late Oligocene. x 50.
15. Hornbrookella sp. Female LV, PM Au 335. BH. Late Oligocene. x 100.
16. Neobuntonia airella sp. nov. Male interior LV, PM Au 338. (BH). Late Oligocene. x 75.
17. Same species and provenance. Male LV, PM Au 339. x 75.

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**Bradleya regularis** sp. nov.

Pl. VI, figs. 11-13

1979 Quasibradleya sp., McKenzie, 93, pl. 2, figs. 6, 7.

**Holotop:** The specimen PAMAu 278 RV, figured in Pl. VI, fig. 11 from Bells Headland, Victoria, a male RV. Figured paratypes PM Au 279; PM Au 280 is cf. *regularis*.

**Derivatio Nominis:** Regularis (L.) = regular; for the meshwork of regular reticulations in the upper rows.

**Diagnosis:** A *Bradleya* in which the reticulate meshwork is more regular than in such species as *B. dickbensonii* and *B. dictyon* Brady, 1880. Further, the lower row of reticulations consists of larger reticules than the upper rows.

**Description:** Shell moderately large (length 0.75-0.80 mm), subrectangular; ornamented by a regularly patterned meshwork of reticulations in which the lower row consists of larger reticules than the upper rows. Ventral ridge prominent, its edge marked by a rib that continues as a submarginal anterior ridge; dorsal ridge reduced. Behind the anterior ridge are 2 very large transverse reticules about equally sized behind which the regular meshwork commences. Dividing these large reticules is a short rib, connecting the subcentral tubercle region to the anterior ridge (this rib led to the earlier assignment to *Quasibradleya*). Eye tubercle distinct; posterior cauda much the same in both LV and RV, not prominent. Subhastate in dorsal view (not as broad as *B. dickbensonii*).

Internal features typical for the genus.

Sexual dimorphism present, males less than females.

**Measurements:** The length of a mature male is 0.80 mm; its height is 0.37 mm. The length of mature females ranges from 0.76-0.80 mm; their height ranges from 0.39-0.42 mm.

**Remarks:** The reticulation pattern; comprising 2 large, transverse anterior reticules, a regular meshwork behind with a lower row of larger reticules and upper rows of smaller reticules is not matched by any previously described species.

**Material Studied:** Seventeen specimens, 1 carapace and 16 valves; 6 juveniles and 11 adults, the latter comprising a male RV, 3 female RV, 6 female LV and a female carapace from Bells Headland, Victoria.
Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukian). The species also occurs in the Early Miocene of Bore WLG 38, Willunga Embayment, South Australia, also Early to Middle Miocene (Lochard Gorge). (cf. McKenzie, 1979, pl. 2, figs. 6, 7).

Genus Quasibradleya Benson, 1972

Quasibradleya janjukiana sp. nov.
Pl. VI, figs. 14-16, Pl. VIII, fig. 2

Holotypus: The specimen PAMAU 281. LV, figured in Pl. VI, fig. 14 from Bells Headland, Victoria. Figured paratypes PM Au 282, PM Au 283, PM Au 313.

Derivatio Nominis: from the Victorian Stage name.

Diagnosis: A Quasibradleya with a blunted mediiodorsal spine and curved ventral ridge ending in a short thick spine; and an ornament of large deep reticules.

Description: Shell moderately large (length about 0.75 mm) subrectangular to subquadrate in lateral view; surface reticulate overall (individual reticules are large, rectangular to subcircular, and deep) with thick micropunctate muri. The ornament also includes a regularly and gently curved ventral ridge that rises posteriorly where it terminates in a short thick spine, a central somewhat irregular ridge (genus character), and a short oblique mediiodorsal ridge which breaks the dorsal outline as a blunted mediiodorsal spine. The eye tubercle is moderately-sized, spherical and distinct. Dorsal margin irregular; ventral margin almost straight; anterior broadly rounded and multisemose; posterior subcuculate, armed with several short, thick, caudal spines. Subhastate in dorsal view.

Internally, the inner lamella is broad and has a distinct submarginal selvage; marginal pore canals are numerous, and usually straight; normal pore canals comprise both single rimmed and sieve type; hinge hemisphondont; central muscle scars comprise 4 adductors in a subvertical series, plus 2 rounded frontal scars and 1 or 2 indistinct mammillar scars.

Sexual dimorphism slight but consistent, with females relatively higher (less elongate) than males.

Measurements: In mature specimens length ranges from 0.70-0.80 mm; the height ranges from 0.37-0.41 mm.

Remarks: Benson (1972) described the nearly related Quasibradleya paradigynonis species from the Oligo-Miocene of Fossil Bluff, near Wynyard, Tasmania which is directly opposite the Oligo-Miocene section (Bird Rock to Bells Headland) near Torquay, on the other side of Bass Strait. The size of our specimens (length ranges from 0.70-0.80 mm) is somewhat less than Benson's holotype (length 0.86 mm).

Material Studied: Seventy specimens, all adult valves; 23 females and 36 males. Several specimens from the Gellibrand Marl were also examined.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukian); Lochard Gorge, Port Campbell, Victoria, Early-Middle Miocene (Gellibrand Marl).

Genus Tenedocythere Sissingham, 1972

Tenedocythere auriculata sp. nov.
Pl. VIII, fig. 4

Holotypus: The specimen PAMAU 284, figured in Pl. VIII, fig. 4 from Bells Headland, Victoria, a male LV.

Derivatio Nominis: Auriculata (L.) = eared; for the posterior dorsal and ventral ridge-‘ears’.

Diagnosis: A Tenedocythere having dorsal and ventral ridges which are produced terminally into ‘ears’.

Description: A medium-sized reticulate species (length about 0.65 mm) that is subquadrate in shape with a distinct posteroventral cauda. Eye-tubercle spherical and also distinct; subcentral tubercle with an anteroventral-trending ridge, connecting it with the anteromarginal ridge; there are also distinctive dorsal and ventral ridges which rise rearwards and are produced terminally into ‘ears’. Dorsal margin straight, overlapped posterodorsally by the dorsal ridge-‘ear’; ventral margin inflexed anteromedially, otherwise straight; anterior broadly rounded, margin thickened but not denticulate; posterior produced into an indistinct dentate but definite cauda. Broadly subhastate in dorsal view, both ‘ears’ of each valve visible in the dorsal profile.

Internal features comprise moderately broad inner lamellae with well defined marginal selvages; no vestibules; marginal pore canals numerous and straight to flexuous; normal pore canals simple, rimmed and sieve-type; hinge hemisphondont; muscle scars consisting of 4 adductors in a subvertical series plus 2 frontal scars, mammillars not observed.

Sex dimorphism distinct; males longer, and relatively less high, than females.

Measurements: The length of a mature male is 0.66 mm; its height is 0.34 mm. The length of mature females is 0.62-0.63 mm; their height is 0.34 mm.

Plate XI

1. Platella victoriae sp. nov. L view of male carapace, PM Au 342. (BH). Late Oligocene. x 75.
2. Tasmanocypris euryamella sp. nov. Female RV, internal. (BH). PM Au 343. Late Oligocene. x 50.
4. Aversovalva cooperi sp. nov. Female LV, stereopair (A and B), PM Au 345. (BH). Late Oligocene. x 100.
5. Rotundocythere fragilis sp. nov. Female carapace, PM Au 346. (BH). Late Oligocene. x 100.
7. Pseudocythere pseudobubalina (Whateley and Downing). Male LV. PM Au 351. (BH). Late Oligocene. x 100.
8. Hornibrookella aggregata sp. nov. Female LV, PM Au 352. (BH). Late Oligocene. x 75.
9. Margocythere asprea sp. nov. Male RV, PM Au 348. (BH). Late Oligocene. x 75.
10. Same species and provenance. Female LV, PM Au 349. x 75.
11. Same species and provenance. R view of female carapace, PM Au 350. x 75.
12. Henicythera reuckmanni sp. nov. Male RV showing muscle field, PM Au 353. (BH). Late Oligocene. x 180.
13. Same species and provenance. Male LV, PM Au 354. Late Oligocene. x 180.
Remarks: Tenedocythe, like Yugoslocytheis Puri, 1957, has ridges over the subcentral tubercle but is not as heavy-shelled as the Gulf Coast genus. It is becoming used more regularly for Indopacific taxa that previously might have been referred to Yugoslocytheis or even to Hernanites Puri, 1955. The type locality for the genus is Tenedos, in the Mediterranean so, presumably, the Indo-Pacific and Australian species assigned to it represent its distribution limits before the Tethys occluded in the Neogene. No other described species in this genus has such well-developed ridge ears.

Material Studied: Seven specimens, 6 valves and a carapace; including 3 juveniles, a female mature carapace, female RV, and male LV.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukian).

Tenedocythe nuda sp. nov.
Pl. VIII, fig. 5; Pl. IX, fig. 18.

Holotypus: The specimen PAM Au 255, a male LV, figured in Plate VIII, fig. 5 from Bells Headland, Victoria. Figured paratype PM Au 322.

Derivatio Nominis: Nuda (L.) = smooth, nude; for the smooth, non-reticulate valves.

Diagnosis: A non-reticulate species referred to Tenedocythe because of similarities in general shape and internal features.

Description: A moderately-large species (length about 0.75-0.80 mm) with a subquadrate shape and smooth, non-reticulate, surface; however, traces of ridges in the subcentral tubercle region can be seen in juveniles; dorsal and ventral ridges present and produced into rounded, short, terminal ridge 'ears'; apart from these, the main feature of the shell is a slight depression behind the anteromarginal rim on each valve. Eye tubercle present, but low. Outline characters as for T. auriculata, including the dorsal profile. Internal features as reported for T. auriculata.

Sexual dimorphism distinct, males longer than females.

Measurements: The length of a mature male is 0.79 mm; its height is 0.39 mm. The length of mature females ranges from 0.74-0.77 mm; their height is about 0.39 mm.

Remarks: It is conceivable that these specimens represent a further molt of T. auriculata but this seems most unlikely because the specimens of that species are clearly mature in their internal characters. Alternatively, T. nuda might represent some heavily degraded specimens of T. auriculata or a smooth morph of that species.

Material Studied: Eight specimens, 6 valves and 2 carapaces; one juvenile LV, 2 female carapaces, 2 female RV, 2 female LV and a male LV, all mature. Additional material from the Point Addis limestone (Miocene).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukian).

Genus Margocythere gen. nov.

Type Species: Margocythere aspreta sp. nov.

Diagnosis: A Bradleyinae genus with a moderately large, subrectangular shell (length about 0.80 mm); characterised by a broad margin in each valve that extends from in front of the prominent eye tubercle around the anterior, ventral and posterior outline to the posterodorsal angle, but does not occur dorsally; surface of the type species rugosely reticulate; with ventral and dorsal ridges, the former low (unlike Bradleya and Quasibradleya) the latter produced terminally into a low 'ridge ear'; posterior cauda distinct in RV less so in the slightly larger LV; subcentral tubercle weakly expressed. Internal features bradleyine, including a strong marginal selve in both valves; hemiamphidont hinge; and 2 frontal scars in the central muscle scar complex. Parallel-sided in dorsal view, greatest width considerably less than the valve height; extremities thickened. Males relatively more elongate than females.

Remarks: The genus characters of low ridges (giving it a parallel-sided dorsal aspect) and the broad margin, distinguish it from typical Bradleyinae (Bradleya, Quasibradleya), while the hemiamphidont hinge and 2 frontal scars justify its placement in the subfamily. It seems too large for a hemicytherid; but we note that for fossil taxa, at least, the relationships between Hemicytheridae and Thaerocytheridae have yet to be fully defined. Unlike most hemicytherids, however, the 4 subvertical adductor muscle scars in this genus do not include a divided second or third scar which is some confirmation for our familial/subfamilial placement. Thaerocythere Hazel, 1967 lacks the broad marginal rim of Margocythere and has a different hinge.

Derivatio Nominis: Margo (L.) = a border; for the diagnostic thickened marginal rim; and suffix -cythere. The gender is feminine.

Occurrence and Age: So far, only known from the Oligocene of Victoria.

Margocythere aspreta sp. nov.
Pl. VII, fig. 10; Pl. IX, fig. 17; Pl. XI, figs. 9-11.

Holotypus: The specimen PAM Au 285, figured in Pl. VII, fig. 10 from Bells Headland, Victoria, a female RV. Figured paratypes PM Au 321, PM Au 348, 349, 350.

Derivatio Nominis: Aspreta (L.) = a rough place; for the rugosely reticulate surface of each valve.

Diagnosis: A ruggedly reticulate Margocythere, with a low posterodorsal 'ridge ear' and low ventral ridge.

Description: Shell subrectangular and moderately large (length about 0.80 mm) with a ruggedly reticulate surface that obscures the weak subcentral tubercle. Eye tubercle large. Valves broadly emarginate, small ribs (3-6) run across the anterior margin from the reticulate area and meet a minor marginal riblet, there is the suggestion of a similar marginal riblet posteriorly. Other features as for the generic diagnosis.

Internally, there are no vestibules, and many marginal pore canals (but not as many as in typical Hemicytheridae); the flange area, outside the well defined marginal selve is quite broad; normal pore canals are both simple, rimmed and sieve type. Other features as for the generic diagnosis.

Sexual dimorphism distinct; males relatively more elongate, and less broad, than females.

Measurements: Length of mature males ranges from 0.80-0.83 mm; their height ranges from 0.39-0.42 mm. Length of mature females ranges from 0.79-0.80 mm; their height ranges from 0.41-0.46 mm.
Remarks: See generic diagnosis.
Material Studied: Twenty five specimens, 2 carapaces and 23 valves; 1 juvenile RV, the remainder adults including both sexes. Of the 2 (adult) carapaces, one is female, the other male.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Genus Spinobradleya gen. nov.
Type Species: Spinobradleya acantha sp. nov.

Diagnosis: A Bradleyinae genus with the typical size and shape of the subfamily, i.e. subquadrate with well defined ventral ridge and moderately large (0.75-0.80 mm in length); but differentiated by its surface ornament of many, usually flat-topped, thick spines. Muscle scars also atypical; in good specimens they are seen to comprise a subvertical series of 4 adductor muscle scars, plus a large scar immediately alongside and in front of the lower 2 of the adductors; and 2 frontal scars, the upper small and subcircular, the lower larger and arcuate. Subcentral tubercle large and well-defined. Internal features, apart from the muscle scars, include strong marginal selvages and normal pore canals that are both simple, rimmed and sieve-type; hinge hemiambident.

Remarks: Unlike any other bradleyine, as indicated in the diagnosis above. In the Trachyleberididae, genera only have a single V-shaped frontal scar; further a ridged genus such as Carnocyctheres Ruggieri, 1956, has more ridges than Spinobradleya.

Derivatio Nominis: Spina (L.) = a spine, for the spine ornament; and - bradleya from the genus Bradleya.

Occurrence and Age: As yet only known from the Late Oligocene of Victoria.

Spinobradleya acantha sp. nov.
Pl. IV, figs. 7, 8; Pl. VIII, figs. 3, 6, a-b, 7, a-b, 10

Holotypus: The specimen PAMAU 287 LV, figured in Pl. VIII, figs. 6, a-b from Bells Headland, Victoria, a female LV. Figured paratypes PM Au 288, PM Au 317.

Derivatio Nominis: Acantha (GK.) = a thorn; for the spine ornament carapace.

Diagnosis: A Spinobradleya with a frill-like ventral ridge separated by a distinct gap from a large terminal posteroventral spine.

Description: Shape subquadrate, moderately large-sized (length 0.75-0.80 mm); surface ornament of thick spines, including several flat-topped spines along the dorsal margin and others over the well-developed subcentral tubercle; ventral ridge frill-like separated by a distinct gap from a large terminal posteroventral spine (the largest spine on each valve). Eye tubercle distinct and spherical to conical in shape. Dorsum straight; venter inflexed anteromedially; anterior broadly rounded and denticulate marginally; posterior not as high as the anterior, rounded in LV, weakly subcuate in RV - as is typical, the LV overlaps the RV posteriorly. In dorsal view moderately inflated and spino-se, with spines, thickened extremities.

Internally, having moderately broad inner lamellae; no vestigules; prominent marginal selvages, weak inner selvages; numerous straight to flexuous marginal pore canals; normal pore canals simple rimmed and sieve type; hinge hemiambident; muscle scars as described for the generic diagnosis.

Sexual dimorphism weak, males less high than females.

Measurements: The length of mature males ranges from 0.74-0.77 mm; their height ranges from 0.39-0.40 mm. The length of mature females ranges from 0.76-0.80 mm; their height ranges from 0.40-0.43 mm.

The breadth (2 females) ranges from 0.45-0.47 mm.

Remarks: See generic diagnosis.
Material Studied: Forty one specimens, including 2 mature female carapaces; 25 juvenile valves; 14 mature valves, 2 carapaces (only 2 of the valves are males).

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Family Trachyleberididae Sylvester Bradley, 1948
Subfamily Trachyleberidinae Sylvester Bradley, 1948
Genus Trachyleberis Brady, 1898

Trachyleberis cf. prosobioides Hornibrook, 1952
Pl. VIII, fig. 8

1952 Trachyleberis prosobioides Hornibrook, 34, pl. 4, figs. 50, 51, 55.

Remarks: Our large series contains many individuals which are better preserved than the forms illustrated by Hornibrook. These show that the surface spines usually have polyfucate or fucate tips; nevertheless their positions match those figured by Hornibrook (1952) as flattened spines. Further, the size range of our specimens (length ranges from 0.70-0.74 mm) is close to that of Hornibrook’s taxon (cited length range 0.69-0.76 mm).

Material Studied: One hundred and forty eight specimens, all valves except for 3 carapaces; one RV juvenile, the remaining adults representing both sexes.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janukian).

Trachyleberis careyi sp. nov.
Pl. VII, figs. 11, 12; Pl. X, figs. 13-14

Holotypus: The specimen PAMAU 290 a RV, figured in Pl. VII, fig. 11 from Bells Headland, Victoria, a male RV. Figured paratypes PM Au 291, PM Au 333, PM Au 334.

Derivatio Nominis: For Prof. Emer. S. Warren Carey to whom the ‘Shallow Tethys’ 2’ volume (McKenzie (Ed.), 1987) was dedicated.

Diagnosis: A large Trachyleberis with thickened periphery, especially anteriorly and posteriorly and spine ornament - easily distinguished by the size of mature forms.

Description: A large species (length about 1.10-1.25 mm) with a subrectangular shape in the overlapping, larger LV but tending to be elongate-subovate in the RV due to the slightly produced posterior. Surface covered with spines; in juveniles there is a fine inter-spine reticulation; the spines may be single, bi-fucate, tri-fucate or poly-fucate, they tend to be stout at the circular base; the largest spine-cluster is near the anteroventral corner, a feature common to all species of this group — see also
Hornibrook (1952, pls. 3, 4); anterior and posterior margins thickened, spinose, with depressions behind them; medial surface inflated. Eye-tubercle spherical and distinct; subcentral tubercle prominent, domeshaped carrying several spines. In dorsal view, moderately inflated with flattened ends.

Internal characters comprise a moderately broad inner lamella, with well defined inner and outer selvages; no vestibule; marginal pore canals numerous, straight to flexuous; normal pore canals simple, rimmed; hinge hemiapihodont, with a crenulate median furrow and a broad, flat posterior tooth in the RV, the anterior tooth stepped, LV complementary; main muscle scars, lying within the subcentral tubercle, consist of 4 adductors in a subvertical series, plus a large V-shaped frontal scar, outside the subcentral tubercle periphery (also below and slightly in front) are 2 small mandibulars.

Sexual dimorphism distinct, males relatively more elongate than females.

**Measurements:** The length of a mature male is 1.11 mm; its height is 0.66 mm. The lengths of mature females range from 1.15-1.26 mm; their heights range from 0.68-0.72 mm.

**Remarks:** Of the 3 large New Zealand species, our taxon is most like *Trachyleberis tridens* Hornibrook, 1952 but that species has far fewer spines and is distinctly smaller (length 1.00 mm).

**Material Studied:** Forty six specimens, all valves; 37 juveniles and 9 adults (8 female, 1 male). Additional material from the Point Addis Limestone (Miocene).

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janujkian).

*Trachyleberis brevicosta* Hornibrook, 1952

**australis** subsp. nov.

Pl. VII, fig. 14

1952 *Trachyleberis brevicosta* Hornibrook, 33-34, pl. 3, figs. 44-46.

1979 *Trachyleberis* sp., McKenzie, 94, pl. 1, fig. 16.

**Holotypus:** The specimen PAMAu 292, figured in Pl. VII, fig. 14 from Bells Headland, Victoria, a female RV.

**Derivatio Nominis:** Australis (L.) = southern; for the southern Australian provenance.

**Diagnosis:** Like *T. brevicosta brevicosta* but with a more spinose surface.

**Description:** Agreeing in all characters with *T. brevicosta brevicosta* except its greater spinoity; also having a more distinct subcentral tubercle (observed on specimens abraded of their spines) and well defined sex dimorphism. Males are relatively more elongate than females.

**Measurements:** The length of a mature male ranges from 0.79-0.87 mm; its height ranges from 0.38-0.40 mm. The length of a mature female ranges from 0.80-0.90 mm; its height ranges from 0.39-0.45 mm.

**Remarks:** The spines in this group of subspecies are flat-topped, looking rather like studs. When 2 or 3 of these studs come off the same base the effect is rather like a coralline efflorescence. The illustration of *T. brevicosta brevicosta* by Hornibrook (1952, pl. 3, fig. 44) conveys this well. When photographed by SEM a weakly-raised inter-spine meshwork is evident.

**Material Studied:** One hundred and twenty one specimens, including 3 fragments and 2 carapaces the remainder valves; 5 adult males plus an adult male carapace 39 adult females, plus an adult female carapace, 77 juvenile valves.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janujkian). The taxon also occurs in the Oligocene section of Bore WLG 40, Willunga Embayment, S.A. (McKenzie, 1979, cf. Synonymy - male LV illustrated).

*Trachyleberis brevicosta* Hornibrook, 1952

**major** subsp. nov.

Pl. VII, fig. 13; Pl. VIII, fig. 11

1952 *Trachyleberis brevicosta* Hornibrook, 33-34, pl. 3, figs. 44-46.

**Holotypus:** The specimen PAMAu 293, figured in Pl. VII, fig. 13 from Bells Headland, Victoria, a male LV.

**Derivatio Nominis:** Major (L.) = greater; for its larger size than both the typical subspecies and *T. brevicosta australis*.

**Diagnosis:** A subspecies of *T. brevicosta* that is distinctly larger than the other known subspecies.

**Description:** Very like *T. brevicosta australis* in all characters but distinctly larger, and more elongate in shape.

**Measurements:** The length ranges from 0.95-1.00 mm; the height ranges from 0.46-0.50 mm.

**Remarks:** Since the difference between these subspecies *T. brevicosta australis* and *T. brevicosta major* is apparently only one of size the possibility exists that they may represent distinct clones of a single taxon. There is as yet no formal recognition of clones in zoological taxonomy unless the use of the informal term ‘form’ is meant to cover this as well as other local variations. We suggest that the formalization of clone as a separate category –of the same rank as the subspecies— is overdue especially since electrophoretic studies have demonstrated the existence of several distinct clones of species in numerous groups of organisms, including ostracods (Rossi and Menozzi, 1990).

**Material Studied:** Eighteen specimens, adult LV and RV.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janujkian); Gull Rock Member, Blanche Point Formation, South Australia, Late Eocene.

**Genus Acanthocythereis** Howe, 1963

Acanthocythereis incerta** sp. nov.

Pl. IX, fig. 1

**Holotypus:** The specimen PAMAu 295, figured in Pl. IX, fig. 1 from Bells Headland, Victoria, a male LV.

**Derivatio Nominis:** Incerta (L.) = uncertain, to record our uncertainty that the generic assignment is appropriate.

**Diagnosis:** A *Acanthocythereis* with a surface ornamentation of scattered large polyfurcated spines and numerous interspersed spines.

**Description:** Shell large (length 0.90-0.95 mm) and oblong; surface ornamented with two distinct types of spines; one type is large and polyfurcated near its tip and scattered over the valve surface; the other type is a spine-like, usually occurring in clumps of two or three and thickly interspersed between the large spines; additionally there are numerous, simple, marginal spines, including double rows anteriorly and ventrally. Eye-tubercle distinct, and
spherical to conical in shape; subcentral tubercle less distinct and low but bearing a large spine at its centre. Dorsal margin straight, highest anteriorly; ventral margin nearly straight; anterior broadly rounded; posterior rounded (but less high than the anterior) in the LV, more subtriangular in the smaller RV. Relatively compressed in dorsal view. The interspine reticulation that is diagnostic for Acanthocythereis is evident in juveniles, especially the A-2 and A-1, but apparently does not occur in adults.

Sexual dimorphism distinct, males longer than females.

**Measurements:** The length of a mature male is 0.95 mm; its height is 0.46 mm. The length of mature females ranges from 0.90-0.93 mm; their heights range from 0.47-0.49 mm.

**Remarks:** The lack of surface reticulation in the adults of this species has already been noted and was the reason for our choice of name. Nevertheless, the habitus of this species is closer to such well-accepted Acanthocythereis species as *A. hystric* (Reuss, 1850) than it is to *Trachyleberis scabrocuneata*. Generally, *Trachyleberis* is thicker-shelled than *Acanthocythereis*, and also more inflated in dorsal view.

**Material Studied:** Fifty specimens, all valves; 3 adult females, 1 adult male, the rest juveniles from Bells Headland, Victoria.

**Occurrence and Age:** Bells Headland, Victoria, Late Oligocene (Janjukian).

**Genus Rocaeleberis** Bertels 1969

*“Rocaeleberis” sudaustralis* sp. nov.

Pl. VIII, fig. 9.

1979 *Rocaeleberis* sp., McKenzie, 91, 93, 94, fig. 6.

**Holotype:** The specimen PAMAu, 296, figured in Pl. VIII, fig. 9 from Bells Headland, Victoria.

**Derivatio Nominis:** Sudaustrialis (*L.*) = south-austrial; for the southern Australian provenance.

**Diagnosis:** A spine-nosed *“Rocaeleberis”*, many of the spines having furcate tips.

**Description:** Shell medium sized length about 0.70 mm, inflated, subrectangular in shape; surface ornamented all over with spines, usually with bi-furcate or trifurcate tips; these spines also differ in size and there are numerous spinules along the dorsal and ventral perimeter of each valve. Seems to possess eye-tubercles; there is almost no expression of a subcentral tubercle. Dorsal and ventral margins straight, subparallel; anterior broadly rounded; posterior broadly rounded in the slightly larger LV, but produced into a tiny medial cauda in the RV. Dorsal outline subelliptical, with flattened extremities because of the thickened valve margins.

Internally, the inner lamellae are moderately broad; with well-defined marginal selvages and showing a weak inner selvage line when viewed microscopically and immersed in water; no vestibules; marginal pore-canals numerous, and straight to flexuous; normal pore-canals simple, rimmed; hinge modified amphid, comprising in the RV a weakly crenulate rather broad anterior tooth, followed by a relatively shallow socket then a crenulate median groove and, finally, a crenulate posterior tooth, similar in size and shape to the anterior tooth, LV complementary; muscle scars consist of 4 adductors in a subvertical series plus a V-shaped frontal scar, mandibularis not observed. Sexual dimorphism could not be determined.

**Measurements:** The length ranges from 0.68-0.74 mm; the height ranges from 0.37-0.39 mm.

**Remarks:** The shape, ornament, poorly expressed subcentral tubercle and hingement all conform to *Rocaeleberis* (Bertels, 1969). On the other hand, our species is distinctly smaller, lacks a vestibule (described as always present in *Rocaeleberis*) and has more marginal pore canals, all of which are non-branching (*Rocaeleberis* has branched n.d.c. anteroventrally). In view of these differences, we have left our taxon in Trachyleberidinae rather than cte it in Bertels’ subfamily Rocaeleberidinae (Bertels, 1969).

**Material Studied:** Eight valves all mature females (3 LV, 5 RV) from Bells Headland (Victoria). In addition, a mature female RV from the Gulf Rock Member (BPF), South Australia was found.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian). The species is also known from the Gulf Rock Member (BPF), South Australia in borings (McKenzie, 1979, cf. Synonymy). Its age range is in southern Australia, therefore, is Late Eocene to Late Oligocene.

**Genus Cletocythereis** Swain, 1963

*Cletocythereis* cf. *rastromarginata* (Brady, 1880)

Pl. VIII, fig. 13; Pl. IX, fig. 2

1880 *Cythere rastromarginata* Brady, 83, pl. 16, figs. 1-a-d.
1952 *Bradelea rastromarginata* (Brady); Hornibrook, 17.
1963 *Cletocythereis rastromarginata* (Brady); Swain, 823.
1967 *Cletocythereis rastromarginata* (Brady); McKenzie, 95, text-figs. 6b, 10a-b, pl. 13, figs. 1, 2.
1978 *Cletocythereis rastromarginata* (Brady); Hartmann, 97, pl. 6, fig. 16.
1979 *Cletocythereis* cf. *rastromarginata* (Brady); Hartmann, 234, pl. 6, figs. 5-7.
1979 *Cletocythereis* sp., McKenzie, 91, pl. 2, figs. 4, 5.
1981 *Cletocythereis* rastromarginata (Brady); Hartmann, 108, pl. 5, figs. 15, 16.
1987 *Cletocythereis* cf. *rastromarginata* (Brady); Warne, 442.

**Remarks:** This is a characteristic Australian Caimanoidei species complex that ranges in age from Eocene-Recent. The various morphotypes are closely similar apart from size variations. Our specimens have a length of 0.79 mm; and a height which ranges from 0.37-0.39 mm; the Recent specimens recorded by McKenzie (1967) ranged in length from 0.75-0.80 mm with a height of 0.38 mm.

**Material Studied:** Three adult female RV.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian). The taxon also occurs in the Oligocene section of Bore WLG 40, Wilunga Embayment, S.A. (McKenzie, 1979, cf. Synonymy).

*Cletocythereis* cf. *curta* McKenzie, 1967

Pl. IX, fig. 7

1967 *Cletocythereis curta* McKenzie, 95, 96, Fig. 5g, 5a.

**Remarks:** Our specimens are close to *C. curta* in size, but differ slightly in the anterior, being relatively higher than that species. Length range of our material is 0.66-0.71 mm, the height range is 0.35-0.37 mm. The types of *C. curta* are 0.63-0.64 mm in length and 0.34-0.35 mm in height.

**Material Studied:** Six adult female valves (4 LV, 2 RV).
Occurrence and Age: Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan).

*Cletocythereis* cf. *caudispinosa* (Chapman, Crespin and Keeble, 1928)
Pl. VIII, fig. 14; Pl. IX, fig. 6

1928 *Cythere caudispinosa* Chapman, Crespin and Keeble, 125, pl. 9, figs. 64a, b.
1974 *Cythere caudispinosa* Chapman, Crespin and Keeble; McKenzie, 160, pl. 1, fig. 4.
1979 *Oerteliiella* sp., McKenzie, 98, pl. 2, fig. 1.
1983 *Cletocythereis caudispinosa* (Chapman, Crespin and Keeble); Whately and Downing, 382, pl. 7, figs. 10, 11.
1987 *Cletocythereis caudispinosa* (Chapman, Crespin and Keeble); Warne, 442, pl. 2, fig. J.

Remarks: The characteristic spines off the dorsal margin of this species are reminiscent of some *Oerteliiella*, but we no longer doubt that the taxon belongs in *Cletocythereis*. Our specimens, all of which are heavily aggraded, range in length from 0.63-0.66 mm and in height from 0.33-0.37 mm. The specimens reported by Whately and Downing (1983) have a length of 0.68 mm and a range in height from 0.33-0.34 mm.

Material Studied: Seven specimens; 1 juvenile carapace, 1 male carapace, 1 female carapace, 4 female valves (3 RV, 1 LV).

Occurrence and Age: The Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan).

Genus *Idiocycthere* Triebel, 1958

*Idiocycthere thalassea* sp. nov.
Pl. IX, figs. 8, 9

1974 *Idiocycthere* sp., McKenzie, 158, text-fig. 3d, pl. 1, figs. 12, 13.

Holotype: The specimen PAMaU 303, figured in Pl. IX, fig. 8 from Bells Headland, Victoria, a female LV. Figured paratype PM Au 304.

Derivatio Nominis: *Thalasseus* (Gr.) = fisherman; for the Fishing Point Marl where this species was first collected (McKenzie, 1974).

Diagnosis: An *Idiocycthere* with a punctate surface ornament but no surface reticulation, and marginal pore canals not clustered as in the type species.

Description: Shell medium to moderately large in size (length 0.78 mm), elongate; surface ornamented by punctations; ventral ridge prominent; dorsal ridge less prominent; anterior and posterior margins thickened and dentate anteromarginally and posteroventrally. Eye-tubercle absent or weak; subcentral tubercle weak but present in all known specimens. Subhastate in dorsal view. Dorsal margin straight, trending backwards; ventral margin inflexed anteromedially then overlapped by the ventral ridge; anterior broadly rounded, inflexed anterodorsally in the RV to accommodate the anterior rim tooth; posterior caudate and inflexed above the upper cauda.

Internally, with broad inner lamellae; well-defined inner and outer selvages; no vestibules; fairly numerous, flexuous to straight, marginal pore canals; simple, rimmed normal pore-canals; hinge amphidont with a crenulate median element, strengthened by an anterior 'rim tooth' in the LV; muscle scars comprising 4 adductors in a subvertical series, plus a V-shaped frontal scar.

Sexual dimorphism distinct, females shorter and broader than males.

Measurements: The length of a mature female is 0.78 mm; its height is 0.39 mm.

Remarks: *Idiocycthere* appears to be related to *Cletocythereis* which has a similar overall shape, and an anterior 'rim tooth' in the LV. Our species differs from the type species in that it has no surface reticulation only punctation, and in that the marginal pore canals are not clustered anteriorly and posteroventrally as in the type species. The taxon is always rare in Australian Tertiary assemblages.

Material Studied: Eight mature valves.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukan). Also consulted in material from the Early Miocene Fishing Point Marl (McKenzie, 1974).

Genus *Delaleberis* gen. nov.

Type Species: *Delaleberis rugosapyyta* sp. nov.

Diagnosis: A trachyleberidid genus characterised by medium size (about 0.60 mm) and a triangular (delta-shaped) posterior; with thickened margins, three irregular obliquely-transverse ridges having dense pitting between them and around them to the valve margins; denticulate anteromarginally; eye tubercle round and flat, located at the upper end of the anteromarginal rim; elongate-subhastate in dorsal view; greatest breadth postero-median. Internally, with moderately broad inner lamellae; no vestibules; strong marginal selvage; numerous, nearly straight, marginal pore canals; simple, rimmed normal pore canals; holamphidont hinge with a crenulate median element; central muscle scar cluster of 3-4 compact adductors in an inclined series plus a V-shaped frontal scar and 1-2 small mandibulars.

Remarks: No other trachyleberidid genus has such a strikingly triangular posteroventral profile, and the combination of irregular oblique ridges and intervening dense pitting is also unique.

Derivatio Nominis: *Delta* (Gr.) = letter D, shaped like a triangle; and suffix - *beris* (Gr.) = sloughed skin - ostracods regularly moult. The gender is feminine.

Occurrence and Age: According to McKenzie (1974), this taxon ranges in the Victorian Tertiary from Late Eocene (Aldingan) to Late Miocene (Bairnsdalean).

*Delaleberis rugosapyyta* sp. nov.
Pl. IV, fig. 9; Pl. IX, figs. 11-14

1974 Trachyleberidinae sp. 1, McKenzie, 159, pl. 1, fig. 6.

Holotype: The specimen PAMaU 305, figured in Pl. IX, fig. 12 from Bells Headland, Victoria. Figured paratypes PM Au 306, PM Au 318, PM Au 319.

Derivatio Nominis: *Rugosa* (L.) = ridged; *pyty* (AS) = a pit; for the species ornament.

Diagnosis: A *Delaleberis* with an ornament of irregu-
lar, obliquely transverse ridges and intervening dense, fine, pitting.

**Description:** Shell medium-sized (length about 0.60 mm), elongate and with a triangular posterior, but not caudate; entire periphery of each valve thickened; surface ornamented with obliquely transverse, irregular ridges and fine, dense intervening and surrounding pitting; subcentral tubercle weak, masked by a ridge. Eye tubercle flat, round and located at the anterodorsal end of the anteromarginal rim. Dorsal and ventral margins subparallel, the latter inflexed medially; posterior triangular; anterior broadly rounded and marginally denticate. In dorsal view, elongate-subhastate, broadest behind the middle.

Internal features as in the generic diagnosis. Note also the occurrence of a small ocular sinus. Sexual dimorphism present, males more elongate than females.

**Measurements:** Length of mature male 0.61 mm; its height is 0.26 mm. Length of a mature female is 0.58 mm; its height is 0.29 mm.

**Remarks:** McKenzie (1974) considers Delaleberis to be endemic to Australia.

**Material Studied:** Fourteen valves and carapaces; all mature, both female and male. We had recourse also to earlier collections at Bells Headland by McKenzie (1974) comprising more than 20 specimens and several specimens in E.R.R.'s collection from the Miocene of the Lochard Gorge, Victoria.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

Subfamily Pterygothyereidae Puri, 1957
Genus Alataleberis McKenzie and Warne, 1986

*A. orinthope tra orinthope tra*

McKenzie and Warne, 1986

Pl. IV, fig. 10; Pl. IX, figs. 3-5

**1974 Alatacithere sp.,** McKenzie, 138, pl. 2, fig. 7.

**1986 Alataleberis orinthope tra orinthope tra** McKenzie and Warne, 38, figs. 2F, G, 3G, H, I, J.

**Remarks:** McKenzie and Warne (1986) showed that this easily recognizable genus has biostratigraphical utility in the Australian Tertiary where it ranges from Late Eocene - Middle Miocene. A. orinthope tra orinthope tra is an index for the Late Oligocene - Early Miocene in Victoria. The length of our specimens ranges from 0.87-0.95 mm.

**Material Studied:** Twenty three specimens, all valves; 9 juveniles and 14 adults representing both sexes.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian).

Family Campanylytheridae Puri, 1960
Subfamily Arculacythereinae Hartmann, 1981
Genus Arculacythereis Hartmann, 1981

*Arculacythereis thomasi* sp. nov.

Pl. IX, figs. 10, 13, 16

**Holotype:** The specimen PAMAu 310, figured in Pl. IX, fig. 10 from Bells Headland, Victoria. Figured paratypes PMAu 320, PMAu 340.

**Derivatio Nominis:** For Dr. G. Thomas, Geology Department, University of Melbourne who has supervised several theses on the Tertiary of Victoria.

**Diagnosis:** An *Arculacythereis* with a more close-set surface reticulation than in the type species.

**Description:** Shell elongate-subrectangular and large (length about 0.90-0.95 mm) with a vertical depression in the muscle scars region; surface reticulate with close-set relatively small reticulae. Dorsum straight; venter sinuated anteromedially; anterior broadly rounded; posterior subtruncate. In dorsal view, elongate-ovate, with greatest breadth behind the middle.

Internally, inner lamellae broad; no vestibules; marginal slavage of RV strong, accommodated by a RV groove; inner slavage less distinct; marginal pore canals long and flexuous, not numerous (about 15 anteriorly); normal pore canals simple, rimmed and sieve type; hinge modified amphidont, characterised by a broad, low anterior 'tooth' in the RV and similarly formed posterior tooth, with a crenulate groove between them, LV complementary; the most characteristic feature of the internal shell surface is a very strong anterodorsal muscle platform, below the hinge but above and in front of the central muscle scars, the muscle scars consist of 4 relatively small adductors in an inclined series, plus a V-shaped frontal scar, and well defined mandibular scars, also a large round scar not much above the central cluster.

Sexual dimorphism present, males smaller than females.

**Measurements:** Length of a mature male is 0.89 mm; its height is 0.39 mm. Length of mature females ranges from 0.90-0.95 mm; their height ranges from 0.40-0.43 mm.

**Remarks:** The powerful dorsal muscle platform is a diagnostic feature of campanylytherids; in their soft anatomy, however arculacythereines differ from typical campanylytherids (Hartmann, 1981) justifying the new subfamily. This is the geologically oldest arculacythereine species known to us, but it is possible that the group goes back to the Late Eocene.

**Material Studied:** Five valves; one juvenile LV, one male LV, 3 females (2 LV, 1 RV). Several specimens in John V. Neil's collection from the Middle Miocene (N8) of the Hamilton district, Victoria and a juvenile from Bells Headland in McKenzie's private collection.

**Occurrence and Age:** Bells Headland, Victoria; Late Oligocene (Janjukian). Hamilton district, Victoria; Middle Miocene.

**CONCLUSIONS**

This taxonomic contribution has considered 80 species; of which several are left open for lack of adequate material, 24 were described previously, and 38 are described as new, plus 2 new subspecies. The species are contained in 50 genera of which 4 are new.

Most of the species came from the Late Oligocene collection made at Bells Headland. Of the 16 species collected from the Late Eocene Gull Rock Member (BPF), South Australia, 6 were also found at Bells Headland. The only new species which are as yet exclusive to the Gull Rock Member are Cythereis gullrockensis, Cythereideoida jugfiera, Cythereideon australopunctataram and Myrena lindsayi. Thus, the Late Oligocene assemblage is much more diverse, 70 species, versus 16 for the Late Eocene fauna. Additionally, some Miocene records from Lochard Gorge (Gellibrand Marl) the Point Addis Limestone and the Fishing Point Marl have been incorporated.
It seems clear that the assemblages represent two different facies. The occurrence of numerous bythocypridids in the Gulf Rock Member and the many bythocytherids in the Bells Headland assemblage indicate that both the facies are offshore in type. Of the two, the Gulf Rock Member with its many Krithiidae, Cypriidae, and large cytherellids seems to have been deposited in deeper water than the Bells Headland unit, which is characterized by numerous hemicytherids, thacocytherids (bradleyi- nes), trachyleberidids, cytherurids and shallower water cytherellids.

On the other hand, the Late Oligocene Angahook Formation beds at Bells Headland, represent the earliest occurrence in the Tertiary of southeastern Australia of large numbers of hemicytherids—Polonormyella, Hornibrookella, Quadracythera, Neobun- tonia—which may be interpreted by analogy with offshore and shoreline assemblages from southern Africa (McKenzie unpublished) as indicating cooler sea-water palaeotemperatures during the Late Oligocene probably due to the influence of circum-Antarctic currents (which began to affect the coastline of southern Australia as the Australian Block drifted northwards and away from Antarctica) as well as to a general, global, Late Oligocene cooling.

ACKNOWLEDGEMENTS

We are grateful to grants from the Swedish Natural Science Research Council for financing this research, including an extended stay for K.G. McKenzie in Uppsala 1988 and a short visit in October 1990.

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*Manuscrito recibido: 5 de noviembre, 1990.*


La Paleontologiska Institutionen ha contribuido con 1750 $ a la publicación de este trabajo.