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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 80 species which we identified came from the Late Eocene Gull 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. antyx* sp. nov.); *Margocythere* gen. nov. (type species *M. aspreta* sp. nov.); *Spinobradleya* gen. nov. (type species *S. acantha* sp. nov.); *Deltaleberis* gen. nov. (type species *D. rugosapytta* sp. nov.). New species are: *Cytherella gullrockensis.* sp. nov.; *Cytherella bellsi* sp. nov.; *Platella victoriae* sp. nov.; *Geelongella antyx* sp. nov.; *Cytherelloidea jugifera* sp. nov.; *Cytherelloidea marginopytta* sp. nov.; *Bairdoppilata torquayensis* sp. nov.; *Bythocypris sudaustralis* sp. nov.; *Tasmanocypris eurylamella* sp. nov.; *Saida bellsensis* sp. nov.; *Schizocythere inexpecta* sp. nov.; *Cytheralison corrugata* sp. nov.; *Hanaiceratina primitiva* sp. nov.; *Rotundracythere fragilis* sp. nov.; *Loxoconcha punctabella* sp. nov.; *Loxoconcha macgowrani* sp. nov.; *Myrena lindsayi* sp. nov., *Oculocytheropteron australopunctatae* sp. nov. *Aversovalva cooperi* sp. nov.; *Hemicytherura reeckmanni* sp. nov.; *Pokornyella australiae* sp. nov.; *Hornibrookella aggradata* sp. nov.; *Quadracythere singletoni* sp. nov.; *Neobuntonia airella* sp. nov.; *Bradleya lungalata* sp. nov.; *Bradleya dickbensoni* sp. nov.; *Bradleya regularis* sp. nov.; *Tenedocythere auriculata* sp. nov.; *Tenedocythere nuda* sp. nov.; *Quasibradleya janjukiana* sp. nov.; *Margocythere aspreta* sp. nov.; *Spinobradleya acantha* sp. nov.; *Trachyleberis careyi* sp. nov.; *Acanthocythereis incerta* sp. nov.; *'Rocaeleberis' sudaustralis* sp. nov.; *Idiocythere thalassea* sp. nov.; *Deltaleberis rugosapytta* sp. nov. and *Arculacythereis thomasi* sp. nov. The new subspecies are *Trachyleberis brevicosta* Hornibrook, 1952 *australis* subsp. nov. and *T. brevicosta major* subsp. nov. In the Late Eocene Gull Rock Member the most commonly occurring families are Cytherellidae, Bythocyprididae, Pontocyprididae, Paracyprididae, Krithiidae and Trachyleberididae; at Bells Headland (Late Oligocene) the most commonly represented families are Cytherellidae, Bairdiidae, Paracyprididae, Cytheruridae, Thaerocytheridae, Trachyleberididae and Hemicytheridae.

Both assemblages are interpreted as indicating offshore facies, of which the Gull 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 80 especies identificadas, 16 de ellas provienen del Miembro Gull Rock de la Fm. Blanche 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 especies nuevas y 2 nuevas subespecies. Los nuevos géneros son: *Geelongella* gen. nov. (especie tipo: *G. antyx* sp. nov.); *Margocythere* gen. nov. (especie tipo *M. aspreta* sp. nov.); *Spinobradleya* gen. nov. (especie tipo *S. acantha* sp. nov.); *Deltaleberis* gen. nov. (especie tipo *D. rugosapytta* sp. nov.). Las especies nuevas son: *Cytherella gullrockensis* sp. nov.; *Cytherella bellsi* sp. nov.; *Platella victoriae* sp. nov.; *Geelongella antyx* sp. nov.; *Cytherelloidea jugifera* sp. nov.; *Cytherelloidea marginopytta* sp. nov.; *Bairdoppilata torquayensis* sp. nov.; *Bythocypris sudaustralis* sp. nov.; *Tasmanocypris eurylamella* sp. nov.; *Saida bellsensis* sp. nov.; *Schizocythere inexpecta* sp. nov.; *Cytheralison corrugata* sp. nov.; *Hanaiceratina primitiva* sp. nov.; *Rotundracythere fragilis* sp. nov.; *Loxoconcha punctabella* sp. nov.; *Loxoconcha macgowrani* sp. nov.; *Myrena lindsayi* sp. nov.; *Oculocytheropteron australopunctatae* sp. nov. *Aversovalva cooperi* sp. nov.; *Hemicytherura reeckmanni* sp. nov.; *Pokornyella australiae* sp. nov.; *Hornibrookella aggradata* sp. nov.; *Quadracythere singletoni* sp. nov.; *Neobuntonia airella* sp. nov.; *Bradleya lungalata* sp. nov.; *Bradleya dickbensoni* sp. nov.; *Bradleya regularis* sp. nov.; *Tenedocythere auriculata* sp. nov.; *Tenedocythere nuda* sp. nov.; *Quasibradleya janjukiana* sp. nov.; *Margocythere aspreta* sp. nov.; *Spinobradleya acantha* sp. nov.; *Trachyleberis careyi* sp. nov.; *Acanthocythereis incerta* sp. nov.; *'Rocaelebe-*

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ris' sudaustralis sp. nov.; *Idiocythere thalassea* sp. nov.; *Deltaleberis rugosapytta* sp. nov. y *Arculacythereis thomasi* sp. nov. Las nuevas subespecies son: *Trachyleberis brevicosta* Hornibrook, 1952 *australis* subsp. nov. y *T. brevicosta major* subsp. nov. En el Miembro Gull Rock las familias más comunes son Cytherellidae, Bythocyprididae, Pontocyprididae, Paracyprididae, Krithiidae y Trachyleberididae; mientras que en Bells Headland lo son Cytherellidae, Bairdiidae, Paracyprididae, Cytheruridae, Thaerocytheridae, Trachyleberididae y Hemicytheridae.

Ambas asociaciones se interpretan como indicadoras de facies de mar abierto; las del Miembro Gull Rock de aguas más profundas que las de Bells Headland, aunque éstas indican aguas más frías (major proporción de Hemicytheridae). También se incluyen algunos datos del Mioceno Medio inferior de las Gellibrand Marl, Fishing Point Marl, por razones bioestratigráficas y paleobiogeográficas.

Palabras clave: Ostracodos, nov. gen., nov. spp., Eoceno, Oligoceno, S. Australia, Victoria, Australia.

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 *Bradleya* problem —which includes description of a Tasmanian Oligo-Miocene species of *Quasibradleya;* the well-illustrated study by Whatley and Downing (1983) on Middle Miocene Ostracoda from Victoria; papers on the Miocene Bairdiidae 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), Reeckmann (1974, unpublished) and Abele (1976). In general, the stratigraphy is based on foraminifers (Carter, 1958, 1959, Ludbrook and Lindsay, 1969, McGowran, 1979, Lindsay, 1985, Chapronière, 1980) and Mollusca (Ludbrook, 1973, Darragh, 1985), although palynological, dinoflagellate and nannofossil biostratigraphies (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 2' 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,

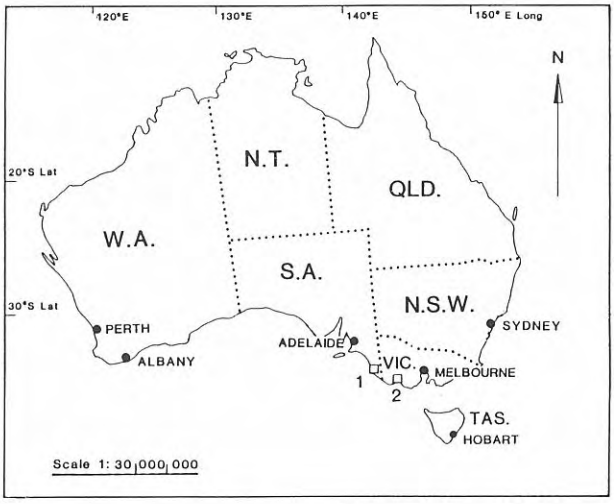

Figure 1. Sketch map showing the localities (1) Willunga Embayment in South Australia and (2) Bells Headland, Victoria.

	Formations	Dominant lithology
OLIGOCENE	*Port Willunga Fm.*	
	Ruwarung member	Bryozoal limestone
	Aldinga member	Bryozoal sandstone and limestone
----------	*Chinaman Gully Fm.*	
	Blanche Point Fm.	
	Tuit member	Banded calcareous clay; glauconitic
LATE	Perkana member	Calcareous clay
EOCENE	Gulf Rock member	Banded calcareous clay
	Tuketja member	Glauconitic clay and limestone
	Tortachilla limestone	Cream goethitic limestone

MIDDLE TO	*Maslin Sands*	
LATE EOCENE	South Maslin sand	Quartz sand
MIDDLE EOCENE	North Maslin sand	Cross-bedded sands

Table 1. Stratigraphical sequence of the Paleogene in the Willunga Embayment, South Australia.

	Formations	Dominant lithology
	Point Addis Limestone	
MIOCENE	*Jan Juc Marl*	Molluscan rich carbonate sand, burrows, bryozoans
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	Angahook Fm.	Molluscan rich quartz-carbonate
OLIGOCENE		sand, in parts with burrows
	Anglesea Sand	Carbonaceous sand, with burrows

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 *Polycope* Sars, 1866

Polycope sp.
Pl. I, fig. 1

Remarks: As noted by McKenzie (1967, 1974) polycopids 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 (Janjukian).

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 PAMAu 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 posterodorsally, venter weakly inflexed 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. *Cytherella consueta* 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 inflexed 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. gullrockensis* 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 (Janjukian).

Cytherella sp.
P. 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 (Janjukian).

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 PAMAu 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 punctation and a posterior inflation in females that slightly overlaps 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; dorsum nearly straight; venter weakly inflexed 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 punctation 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.

Ocurrence and Age: Bells Headland, near Torquay, Victoria; Late Oligocene (Janjukian). 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 *Cytherella 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 (Janjukian).

Genus *Geelongella* gen. nov.

Type Species: *Geelongella 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 posterodorsal corner, where it terminates. There is no flange along the dorsal margin, behind the anterodorsal 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 *Geelongella* flange and, also, are not as compressed as our taxon. Within the Cytherellidae, the relationships of *Geelongella* lie clearly with *Cytherella* and *Ankumia,* rather than with *Cytherelloidea* and *Keijcyoidea.* 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.

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

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

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

Diagnosis: A *Geelongella* 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 posteromedially.

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 posteromedially.

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 (Janjukian).

Genus *Cytherelloidea* Alexander, 1929

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

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

Holotypus: 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 posterodorsally; posterior broadly rounded; ventral outline very weakly inflexed medially and just overlapped by the marginal rim posteroventrally.

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

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).

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

1928 *Cytherella intermedia* Chapman, Crespin and Keeble, 129, figs. 69a, b.
1943 *Cytherelloidea intermedia* (Chapman, Crespin and Keeble); Crespin, 100.
1974 *Cytherelloidea intermedia* (Chapman, Crespin and Keeble); McKenzie, 166, pl. 1, fig. 2.
1983 *Cytherelloidea 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 *Cytherelloidea 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).

Cytherelloidea marginopytta 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 *pytt* (AS) = a pit; for the pitted marginal areas of this species.

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

Description: A moderately large *Cytherelloidea* (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-embryo broodchamber; such pits less numerous anteriorly and scattered irregularly over the medial valve surface. Anterior broadly rounded and marked by an anteromarginal ridge, posterior subtruncate, dorsal and ventral outlines both slightly inflexed medially. Valves swollen ventrally and posteriorly, flattening anteriorly to the marginal ridge.

Internal features typical for cytherellids; 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).

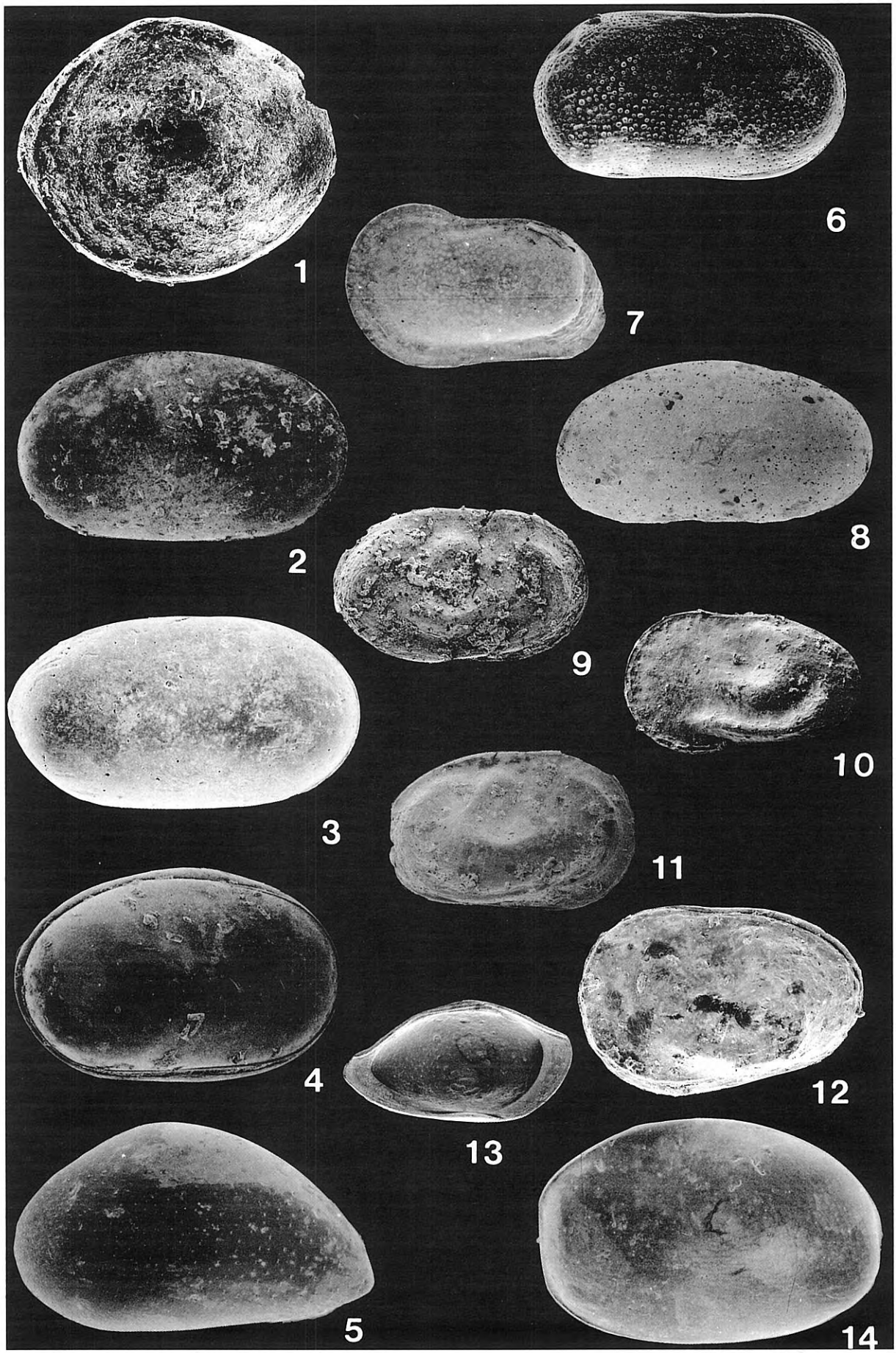
Neonesidea australis (Chapman, 1914)
Pl. I, fig. 5

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.

Plate I

1. *Polycope* sp. Female RV, PM Au 200. Angahook Formation, Bells Headland (B.H.), Victoria. Late Oligocene. x 110.
2. *Cytherella gullrockensis* sp. nov. Female RV, PM Au 202. Gull Rock Member, Blanche Point Formation, Aldinga Bay (AB), South Australia (AB). Late Eocene. x 65.
3. *Cytherella bellsi* sp. nov., Bells Headland, Late Oligocene. Male RV, PM Au 204. x 65.
4. *Cytherella gullrockensis* sp. nov. Gull Rock Member, Blanche Point Formation. (AB). Late Eocene. R view of female carapace, Holotype, PM Au 201. x 65.
5. *Neonesidea australis* (Chapman). Female LV, PM Au 212. BH. Late Oligocene. x 50.
6. *Platella victoriae* sp. nov. Female RV, Holotypus, PM Au 206. BH. Late Oligocene. x 75.
7. *Geelongella antyx* sp. nov. Male LV, Holotypus, PM Au 207. BH. Late Oligocene. x 50.
8. *Cytherella* sp. Male LV, PM Au 205. BH. Late Oligocene. x 50.
9. *Cytherelloidea* cf. *intermedia* (Chapman and Crespin). Female RV, PM Au 210. BH. Late Oligocene. x 50.
10. *Cytherelloidea jugifera* 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 Eocene. x 50.
14. *Cytherella bellsi* sp. nov. Female RV, Holotypus, PM Au 203. (BH). Late Oligocene. x 55.

Plate I



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 (Janjukian).

Genus *Bairdoppilata* Coryell, Sample and Jennings, 1935

Bairdoppilata 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 paratype 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 *Bairdoppilata* (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 rosette. Dorsum convex, venter inflexed medially, anteroventral margin broadly rounded, posteroventral 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.

Sexual 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 *Bairdoppilata* 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 (Janjukian).

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 (PM Au215).

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 (Janjukian).

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 (Janjukian).

Family **Bythocyprididae** Maddocks, 1969

Genus *Bythocypris* Brady, 1880

Bythocypris sudaustralis sp. nov.

Pl. II, figs. 2, 3

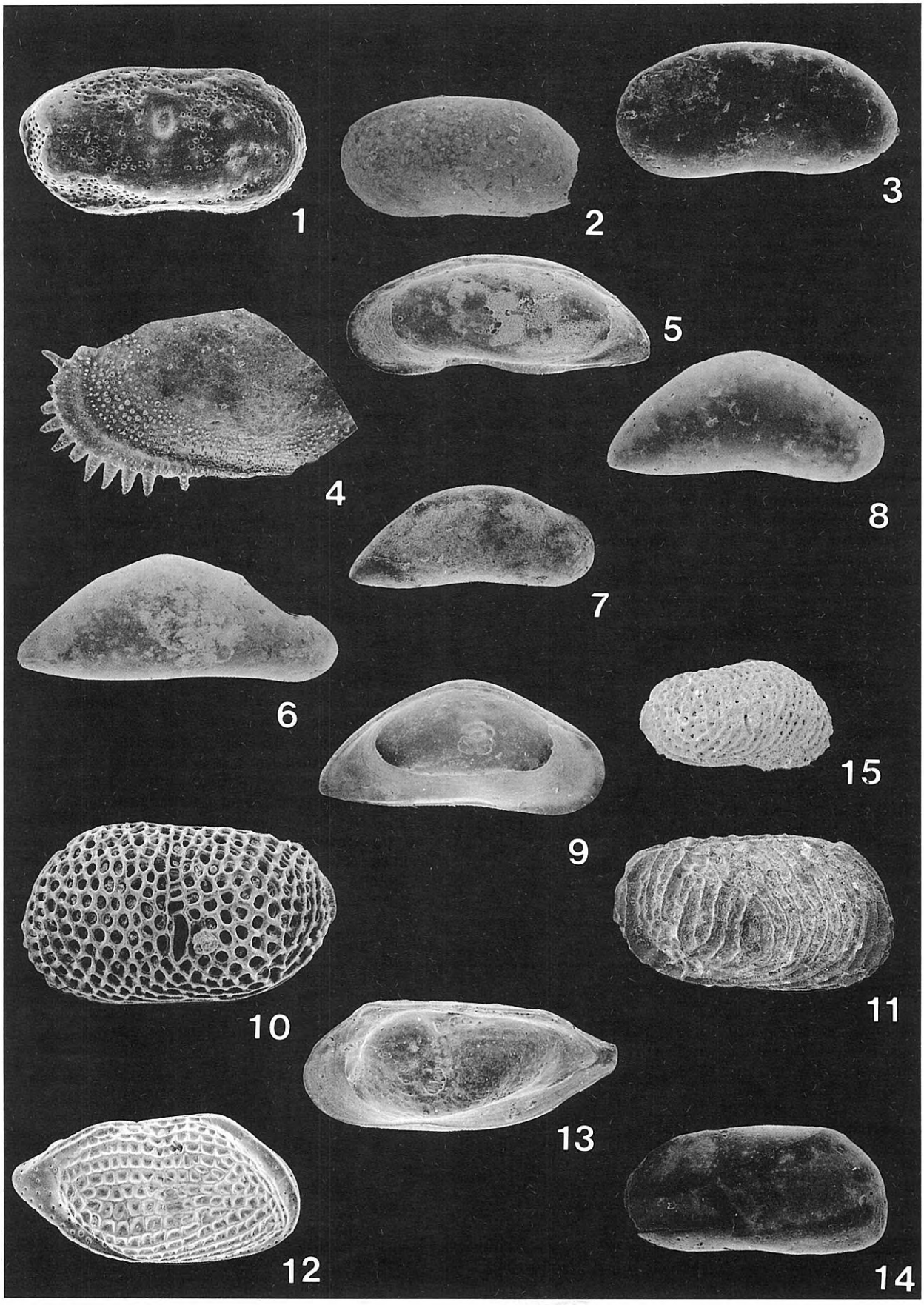
Holotypus: The specimen PAMAu 218 figured in Pl. II, fig. 2 from the Gull Rock Member (BPF), South Australia, a female LV. Figured paratype PM Au 219.

Derivatio Nominis: For the southern Australian provenance.

Plate II

1. *Cytherelloidea marginopytta* 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.
3. Same species. Female LV, PM Au 219. (BH). Late Oligocene. x 65.
4. *Orlovibairdia* (?) sp. Fragment of anterior LV, PM Au 221. (BH). Late Oligocene. x 80.
5. *Macromckenziea porcelanica* (Whatley and Downing). Male interior RV, PM Au 222. Lochard Gorge, near Port Campbell, Victoria. Early-Middle Miocene. x 45.
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. *Cytheralison* cf. *pravacauda* Hornibrook. Female LV, PM Au 236. (BH). Late Oligocene. x 75.
11. *Cytheralison corrugata* sp. nov. Male RV, Holotypus, PM Au 238. (BH). Late Oligocene. x 85.
12. *Hanaiceratina 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.
14. *Krithe nitida* Whatley and Downing. Male LV, PM Au 241. (AB). Late Eocene. x 60.
15. *Cytheralison corrugata* sp. nov. Female RV, PM Au 309. (BH). Late Oligocene. x 50.

Plate II



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; venter inflexed 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 adont; 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 boreholes 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 (Janjukian).

Genus *Orlovibairdia* McKenzie, 1978

Orlovibairdia sp.
Pl. III, fig. 5

Remarks: This is a relatively large *Orlovibairdia* with a length of 0.87 mm and a height of 0.50 mm. It is like the type species, *Orlovibairdia 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 (Janjukian).

Orlovibairdia? sp.
Pl. II, fig. 4; Pl. VI, fig. 17

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 *Orlovibairdia* it is neither smooth-surfaced nor pitted; 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 *Orlovibairdia* s.s. and the marginal valve spines are stouter and more prominent than in typical *Orlovibairdia.* 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 (Janjukian).

Family **Macrocyprididae** Müller, 1912
Genus *Macromckenziea* Maddocks, 1990

Macromckenziea porcelanica
(Whatley and Downing, 1983)
Pl. II, figs. 5, 6

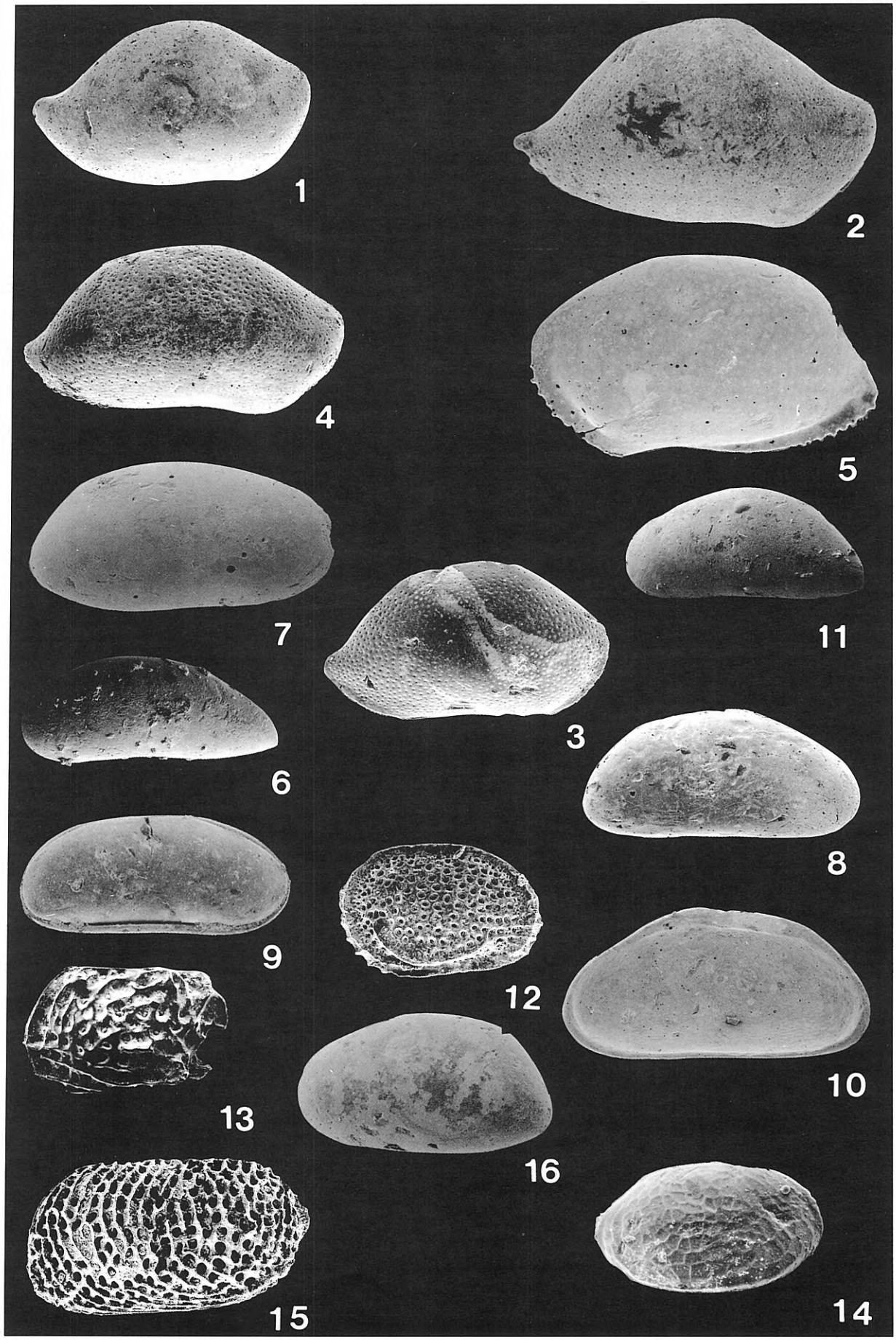
1983 *Macrocypris porcelanica* Whatley and Downing, 353, pl. 1, figs. 11-13.

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 *Macrocyprissa* by various authors probably belong either in *Macromckenziea* 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 *Macromckenziea.* 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

1. *Bairdoppilata torquayensis* sp. nov. Female RV, Holotypus, PM Au 214. (BH). Late Oligocene. x 50.
2. *Paranesidea* (?) sp. Female RV, PM Au 215. (BH). Late Oligocene. x 50.
3. *Paranesidea* cf. *vadum* Warne. Female RV, PM Au 216. (BH). Late Oligocene. x 75.
4. Same species and provenance. Female RV, PM Au 217. x 75.
5. *Orlovibairdia* sp. Female LV, PM Au 220. (BH). Late Oligocene. x 75.
6. *Argilloecia* sp. Male LV, PM Au 227. (AB). Late Eocene. x 50.
7. *Maddocksella obscura* Whatley and Downing. Male RV, PM Au 228. (BH). Late Oligocene. x 110.
8. *Maddocksella argilloeciaformis* (Whatley and Downing). Female RV, PM Au 229. (BH). Late Oligocene. x 50.
9. Same species. R view of carapace, PM Au 230. (AB). Late Eocene. x 45.
10. *Maddocksella tumefacta* (Chapman). Male interior RV, PM Au 231. (BH). Late Oligocene. x 50.
11. *Propontocypris* sp. Female LV, PM Au 232. (AB). Late Eocene. x 50.
12. *Saida bellsensis* sp. nov. Female RV, Holotypus, PM Au 233. (BH). Late Oligocene. x 110.
13. *Schizocythere inexpecta* sp. nov. Female LV, Holotypus, PM Au 234. (BH). Late Oligocene. x 110.
14. *Microcytherura* sp. Female RV, PM Au 235. (BH). Late Oligocene. x 120.
15. *Cytheralison corrugata* sp. nov. Male LV, PM Au 237. (BH). Late Oligocene. x 75. Aggraded specimen.
16. *Krithe nitida* Whatley and Downing. Juvenile LV (A-1), PM Au 242. (BH). Late Oligocene. x 75.

Plate III



Material Studied: Eight specimens, including 2 adult valves 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-infilled 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: Gull 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

Holotypus: 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: Eurys (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 subacuminate. 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 Macrocyprididae but although it is similar in shape to *Macrocyprina* and other macrocypridid 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. dartnalli* McKenzie, 1979 and *T. dietmarkeyseri* (Hartmann, 1979).

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

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

Family **Pontocyprididae** Müller, 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 Gull 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 (Janjukian); the Gull Rock Member (BPF), South Australia, Late Eocene (Aldingan).

Genus *Maddocksella* McKenzie, 1981

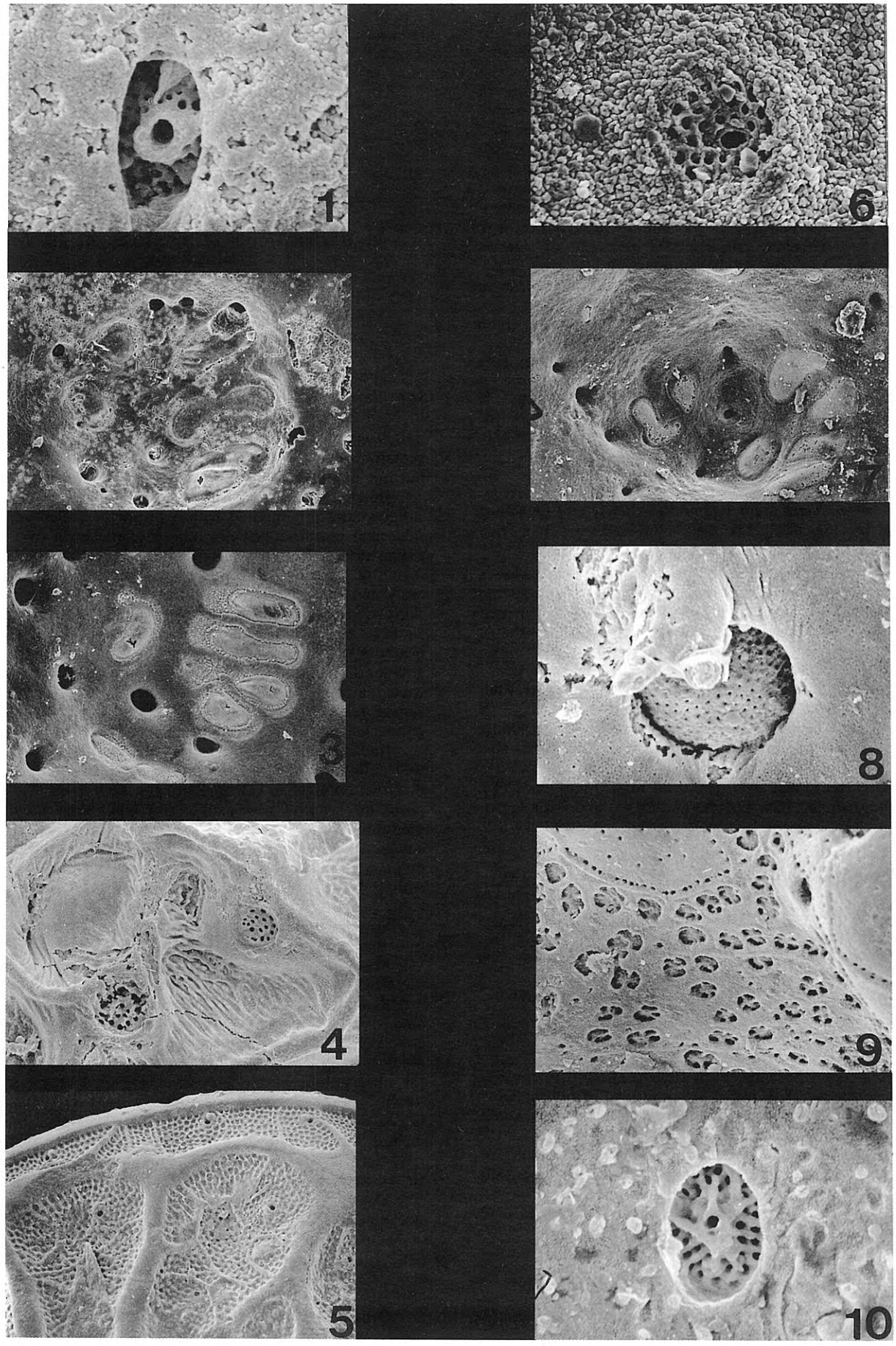
Maddocksella obscura
(Whatley and Downing, 1983)
Pl. III, fig. 7

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

Plate IV

1. *Saida bellsensis* sp. nov. Detail of a lateral sieve-type pore canal. x 4000.
2. *Hanaiceratina primitiva* 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 punctabella* sp. nov. Central muscle scar field of female interior RV figured in Plate V, fig. 5. x 500.
4. *Myrena lindsayi* sp. nov. Detail of surface texture and of lateral sieve-type pore canals. x 1000.
5. *Hemicytherura reeckmanni* 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. *Spinobradleva 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. *Deltaleberis rugosapytta* sp. nov. Catspaw pattern of surface ornament. x 1300.
10. *Alataleberis ornithopetra ornithopetra* McKenzie and Warne. Detail of a lateral sieve-type pore canal. x 4000.

Plate IV



Remarks: Recently, one of us (K.G.M.) had the opportunity to compare *Maddocksella* specimens against the types and other specimens of the genus *Proabyssocypris* Pokorny, 1979. The shell features which differentiate these genera are, first, the shape in dorsal view which is regularly elliptical in *Proabyssocypris* but box-like (with flattened ends) in *Maddocksella;* and secondly, the marginal pore canals which are straight in *Proabyssocypris* but flexuous in *Maddocksella.* In the second feature particularly, *Proabyssocypris* resembles closely the genus *Abyssocypris* van den Bold, 1974. There is also a difference between *Proabyssocypris* 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 (Janjukian).

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

1983 *Australoecia argilloeciaformis* 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. tumefacta* (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 Gull Rock Member (BPF), South Australia; Late Eocene (Aldingan) and Bells Headland, Late Oligocene.

Maddocksella tumefacta (Chapman, 1914)
Pl. III, fig. 10

1914 *Bythocypris tumefacta* Chapman, p. 30.
1974 *Australoecia tumefacta* (Chapman); McKenzie, 158, text-fig. 3g.
1981 *Maddocksella tumefacta* (Chapman); McKenzie, 105-107, fig. 1a-c.
1987 *Maddocksella tumefacta* (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 (Janjukian).

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: Gull Rock Member (BPF); Late Eocene (Aldingan).

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

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

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

Holotypus: The specimen PAMAu 233, figured in Pl. III, Fig. 12 from Bells Headland, Victoria. Figured paratype PM Au 347.
Derivatio 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 anteromedially; 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 Janjukian 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 ornamented genera - others include *Kangarina, Hemicytherura* and *Eucytherura;* - 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 (Janjukian).

Genus *Schizocythere* Triebel, 1950

Schizocythere inexpecta sp. nov.

Pl. III, fig. 13

Holotypus: 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 subquadrate, with a small posterodorsal cauda. There is a small anterodorsal eye tubercle. In dorsal view rather stout; subacuminate anteriorly, broadest posteriorly. Finally, our best preserved specimen displays an unusual posteroventral lug projecting outwards just above the margin.

Internally, with moderately broad inner lamellae 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 consisting in the LV of a socket followed by a schizodont tooth and crenulate 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 *Paijenborchella,* and McKenzie (1974) had recorded *Amphicytherura,* from the Tertiary; while another schizocytherine genus *Neomonoceratina* 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 *Microcytherura* Müller, 1894

Microcytherura sp.

Pl. III, fig. 14

Remarks: The relationship between *Microcytherura* and *Loxocythere* Hornibrook, 1952 is discussed in Howe and McKenzie (1989). Our single valve clearly belongs to the *Microcytherura* 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 *Cytheralison* Hornibrook, 1952

Cytheralison cf. *pravacauda* Hornibrook, 1952

Pl. II, fig. 10

1952 *Cytheralison pravacauda* Hornibrook, 66-67, pl. 18, figs. 285, 286, 288.

1974 *Cytheralison* sp., McKenzie, 160-161, pl. 4, figs. 12-14.

Remarks: Hornibrook (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 Hornibrook's species, and of a similar size (our largest specimen has a length of 0.89 mm). A closely similar form is *Cytheralison* 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).

Cytheralison corrugata sp. nov.

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

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

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

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

Description: A moderately large species (length about 0.75-0.80 mm) with a subquadrate 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 riblets creating an overall reticulate appearance in lateral view. Dorsal margin straight; venter nearly so; anterior broadly rounded; posterior also rounded but differs 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: Hornibrook (1952, p. 66) noted the occurrence of several undescribed species of *Cytheralison* in the New Zealand Tertiary; *C. corrugata* is an Australian example of this diversity, as is *Cytheralison* sp. 1 of Warne (1987, p. 445). Some specimens of *C. corrugata* while retaining the overall aspect of transverse ridges becoming concentric have aggraded 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 (Janjukian).

Genus *Hanaiceratina* McKenzie, 1974

Hanaiceratina primitiva sp. nov.

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

Holotypus: 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 subrhomboidal outline.

Description: A large species (about 1.00 mm) with a subrhomboidal 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 trending backwards more dorsally; posterior parallel to it and forming a subdorsal cauda. The valves are inflated on either side of a weak dorsomedial depression. Subhastate in dorsal view.

Internal features include moderately broad inner lamellae, with moderate-sized anterior and posteroventral vestibules; 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 dorsomedial ridge, which is the internal trace of the weak external dorsomedial 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 subrhomboidal shape suffice to distinguish *H. primitiva* from *H. arenacea* (2 subspecies), *H. posterospinosa* 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. posterospinosa,* and the regularly rectangular shape of the 2 *H. arenacea* subspecies; nor is a dorsomedial 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 (Janjukian).

Family **Krithiidae** Mandelshtam, 1960

Genus *Krithe* Brady, Crosskey and Robertson, 1874

Krithe nitida Whatley and Downing, 1983

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

1974 *Krithe* sp., McKenzie, 158, fig. 36.
1983 *Krithe nitida* Whatley and Downing, 368-369, pl. 4, figs. 7-13.
1984 *Krithe* C 22 to 24, McKenzie and Peypouquet, 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 Peypouquet (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 (Janjukian).

Family **Eucytheridae** Puri, 1954

Genus *Pseudeucythere* Hartmann, 1989

Pseudeucythere pseudosubovalis (Whatley and Downing, 1983)

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

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

Remarks: The species belongs in *Pseudeucythere* because it has a subacuminate, 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 (Janjukian).

Genus *Rotundracythere* Mandelshtam, 1958

Rotundracythere fragilis sp. nov.

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

Holotypus: 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 *Rotundracythere* 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; dorsum convex, slopes posteriorly; anterior broadly rounded; ventral margin nearly straight in LV, inflexed 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; hinge weakly antimerodont; 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 *Rotundracythere rotunda* (Hornibrook, 1952). The broadly rounded posterior distinguishes it from *P. pseudosubovalis* (Whatley and Downing, 1983) which we have transferred to *Pseudeucythere,* as noted above. The figured specimen bears what seems to be a muricid 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 (Janjukian).

Family **Loxoconchidae** Sars, 1925
Genus *Loxoconcha* Sars, 1866

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

Holotypus: 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 subrhomboidal shape –more regularly subrhomboidal 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 anteromedially; anterior broadly rounded, trending anteroventrally; posterior also rounded ending in a subdorsal cauda. Rather fat 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 gonglyodont; 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 loxoconchids and the fine surface punctation is also diagnostic for this species. It seems that loxoconchids 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 (Janjukian).

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

Holotypus: 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 subhastate 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 subhastate 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 lamellae; well defined selvages; elongate anterior and posteroventral vestibules; rather few, straight marginal pore canals; sieve type normal pore canals; a gonglyodont hinge; and muscle scars comprising a subarcuate 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 (Janjukian); Lochard Gorge, Port Campbell; Early Miocene (Gellibrand Marl).

Loxoconcha sp.
Pl. V, fig. 9

Remarks: This is a characteristic Australian loxoconchid. 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.

Holotypus: The specimen PAMAu 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 loxoconchid, more subrectangular than subrhomboidal 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 subrhomboidal 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 inflexed anteromedially; anterior broadly rounded; posteroventral margin broadly rounded, sweeping up posteriorly to the cauda; posterodorsal 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 gonglyodont, 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 *Loxoconcha*. 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.

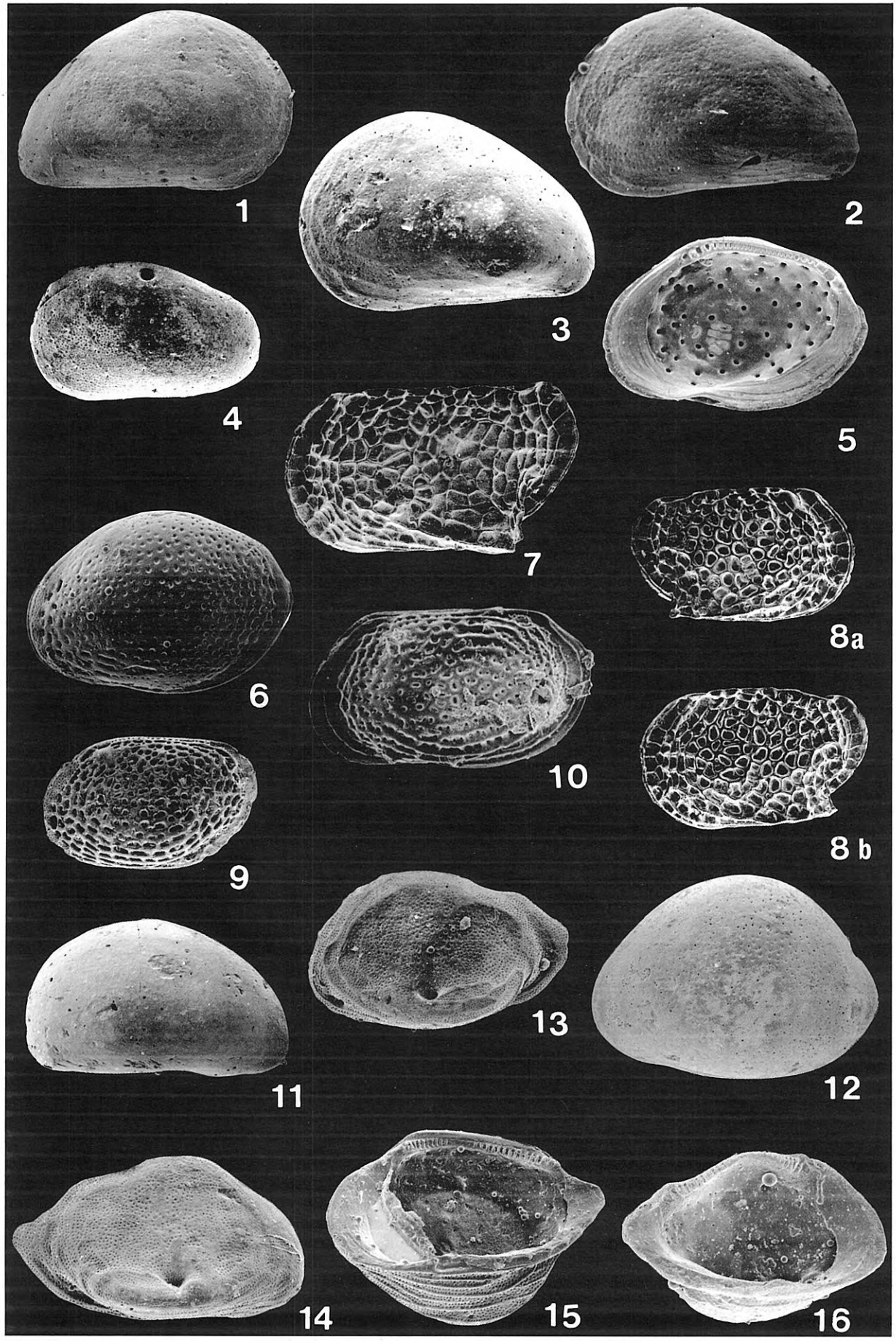
Material Studied: Four specimens; 2 juveniles, plus a mature female LV and RV.

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

Plate V

1. *Pseudeucythere pseudosubovalis* (Whatley 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. *Rotundracythere fragilis* sp. nov. Female (?), Holotypus, PM Au 246. (BH). Late Oligocene. x 75.
5. *Loxoconcha 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. *Loxoconcha macgowrani* 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. *Loxoconcha* 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.
13. *Oculocytheropteron parawellmani* (Whatley and Downing). Male LV, PM Au 255. (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.

Plate V



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 *Oculocytheropteron* Bate, 1972

Oculocytheropteron australopunctatarum sp. nov.
Pl. VI, fig. 1; Pl. VII, figs. 1, 2

Holotypus: The specimen PAMAu 255, a RV figured in Pl. VII, fig. 1 from the Gull 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 *Cytheropteron* (meaning 'the winged cytheracean') is a plural form and feminine in gender, hence the *-arum* ending for the species name.

Diagnosis: A highly punctate *Oculocytheropteron* 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 posteroventrally on each valve; also a weak submarginal dorsal riblet; inequivalved the RV overlapping, and higher, than the LV. Surface almost entirely punctate, except for the rim of each ala; slightly depressed medioventrally in the central muscle scars region. Dorsal margin broadly convex; anterior subrounded; posterior caudate; ventral margin inflexed anteromedially and overlapped by the ventral ala. Subhastate 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 anteroventrally, 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 *Cytheropteron wellmani* Hornibrook, 1952 and *C. parawellmani* Whatley and Downing, 1983. They seem close to the latter in their surface punctation 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 Gull 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: Gull Rock Member (BPF), South Australia, Late Eocene (Aldingan).

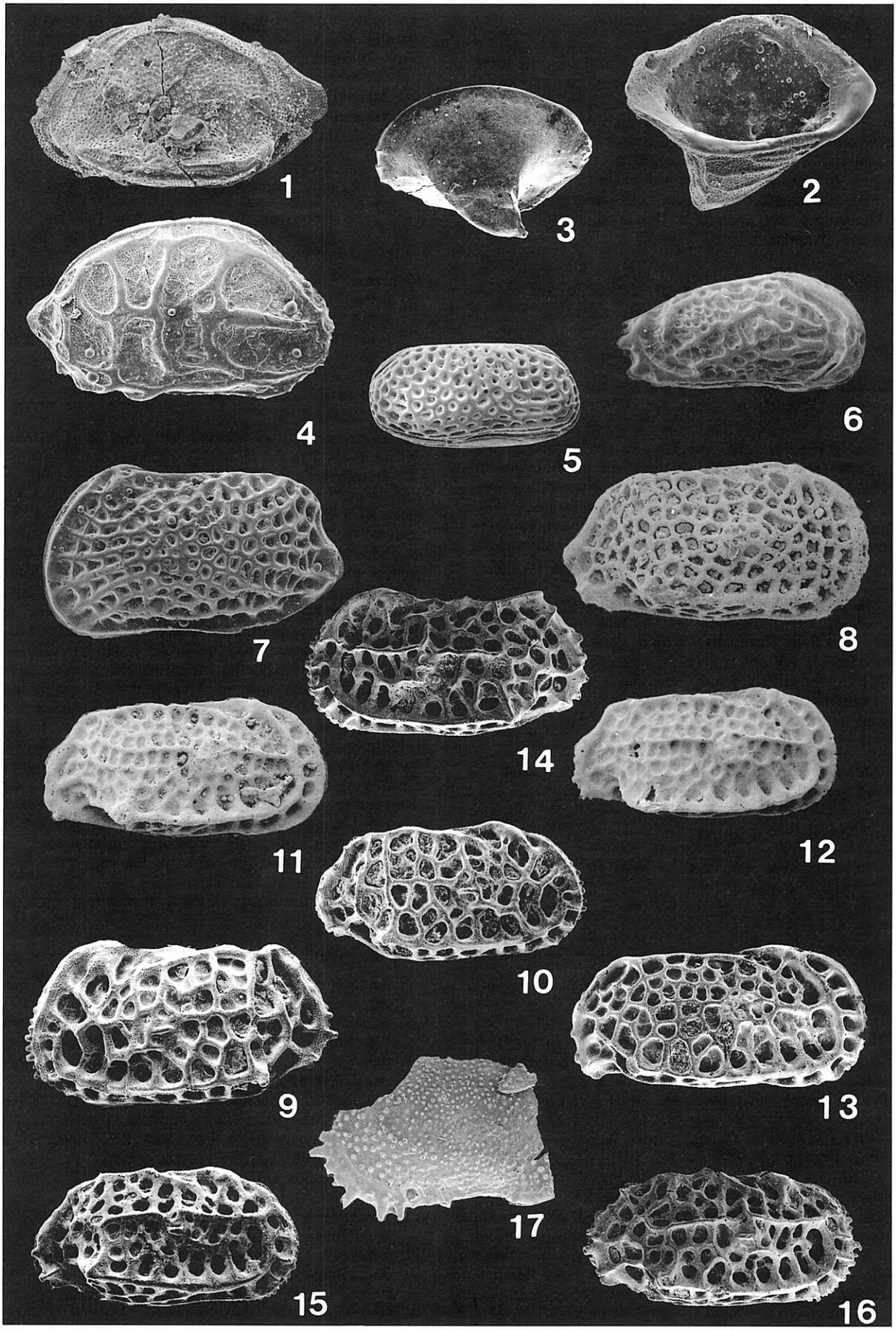
Oculocytheropteron parawellmani
Whatley and Downing, 1983
Pl. V, figs. 13-16

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

Plate VI

1. *Oculocytheropteron australopunctatarum* sp. nov. Male LV, PM Au 261. (AB). Late Eocene. x 100.
2. *Oculocytheropteron* cf. *microfornix* 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. *Hemicytherura reeckmanni* sp. nov. Female RV, Holotypus, PM Au 265. (BH). Late Oligocene. x 180.
5. *Arcacythere* sp. aff. *chapmani* Hornibrook. R view of female carapace, PM Au 266. (BH). Late Oligocene. x 110.
6. *Munseyella* sp. Female RV, PM Au 267. (BH). Late Oligocene. x 110.
7. *Hornibrookella* sp. Female (?) LV, PM Au 270. (BH). Late Oligocene. x 75.
8. *Bradleya lungalata* sp. nov. Female RV, Holotypus, PM Au 275. (BH). Late Oligocene. x 75.
9. *Bradleya dickbensoni* 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 regularis* 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 (Lochard Gorge). PM Au 280. x 75.
14. *Quasibradleya janjukiana* 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. *Orlovibairdia* (?) sp. Fragment of anterior LV, PM Au 312. BH. Late Oligocene. x 75.

Plate VI



1987 *Cytheropteron 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).

Oculocytheropteron cf. *microfornix*
Whatley and Downing, 1983
Pl. VI, fig. 2; Pl. VII, fig. 3

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

Remarks: As with *Oculocytheropteron* cf. *parawellmani,* our specimens (length 0.47-0.50 mm) are intermediate in size between the referred species and a Hornibrook species, to wit, *Oculocytheropteron fornix* (Hornibrook, 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. fornix,* 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.

Oculocytheropteron ? cf. *albomaculata*
(Whatley and Downing, 1983)
Pl. X, fig. 12

1983 *Cytheropteron 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** Hornibrook, 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, backswept ala with a pointed tip on each valve. Valves asymmetrical with LV larger than RV as characteristic for the genus. Dorsum gently convex; ventral margin slightly inflexed anteromedially; anterior rounded, trending anteroventrally; posterior evenly curved posteroventrally, produced posteriorly into a distinct cauda. Eye tubercle absent. Wing-shaped in dorsal view.

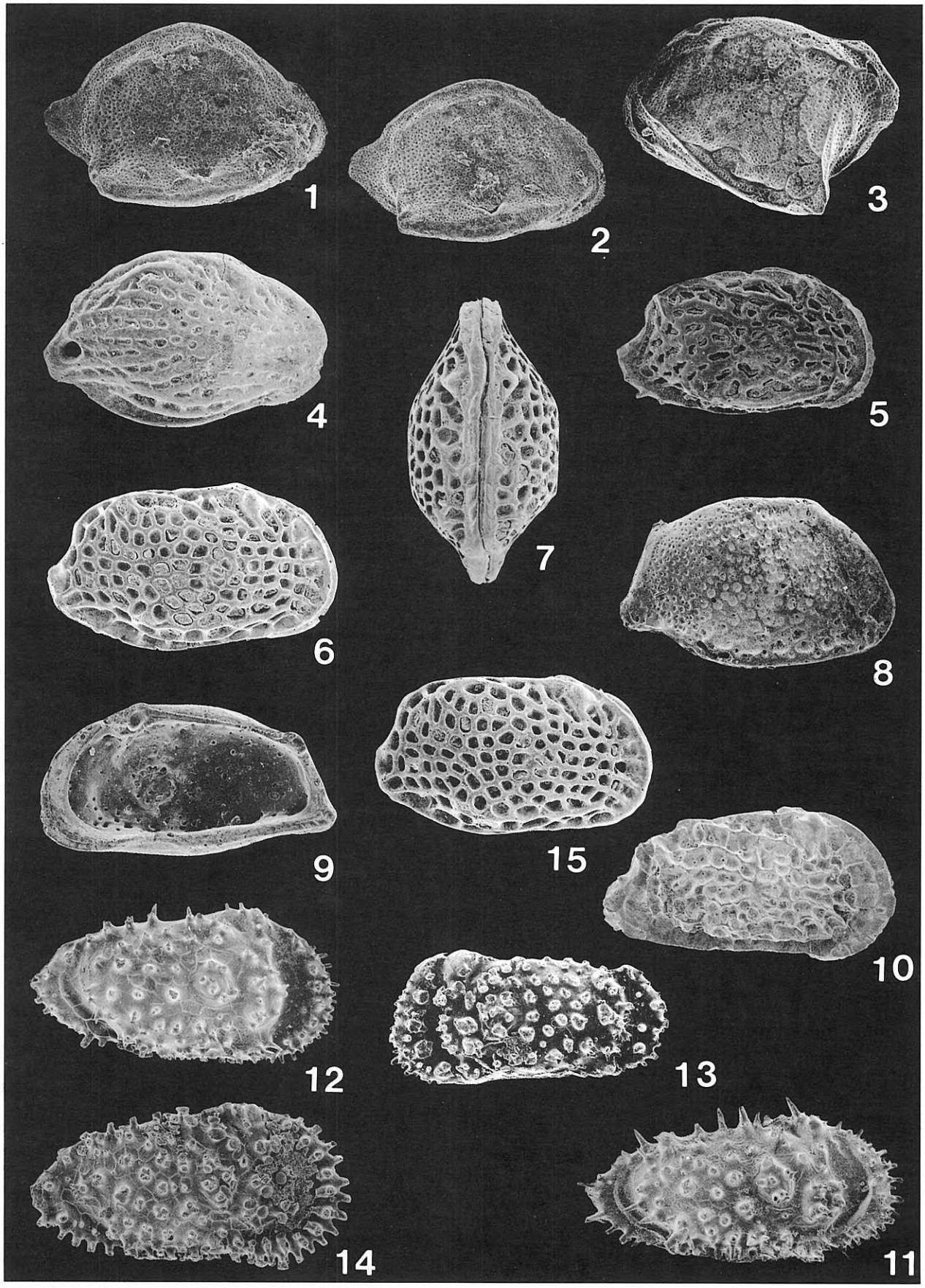
Internal features include broad inner lamellae anteriorly and posteriorly, the inner margin of each lamella running from the anterior hinge element around anteriorly, ventrally and posteriorly to the posterior hinge element; a small anterior vestibule; and few, flexuous anterior marginal pore canals, 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, mandibulars not observed (probably hidden within the hollow ala).

Sexual dimorphism distinct, males less high than females.

Plate VII

1. *Oculocytheropteron australopunctatarum* 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. *Oculocytheropteron* 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. *Hornibrookella aggradata* sp. nov. Female RV, Holotypus, PM Au 269. (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 airella* sp. nov. Female RV, Holotypus, PM Au 273. (BH). Late Oligocene. x 80.
9. Same species and provenance. Male interior RV, PM Au 274. x 80.
10. *Margocythere aspreta* sp. nov. Male RV, Holotypus, PM Au 285. (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.
13. *Trachyleberis brevicosta major* subsp. nov. Male LV, Holotypus, PM Au 292. (BH). Late Oligocene. x 80.
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.

Plate VII



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* Hornibrook, 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 (Janjukian).

Genus *Hemicytherura* Elofson, 1941

Hemicytherura reeckmanni 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.

Holotypus: 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 Reeckmann, 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 (Reeckmann, 1974 unpubl.).

Diagnosis: A *Hemicytherura* in which the surface ornament includes blebs of smooth calcite 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 calcite 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 cytheropteronine merodont type; muscle scars comprising 4 adductors in a vertical series plus a U-shaped frontal scar, mandibulars 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* Hornibrook, 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 (Janjukian).

Family **Pectocytheridae** Hanai, 1957

Genus *Arcacythere* Hornibrook, 1952

Arcacythere sp. aff. *chapmani* Hornibrook, 1952

Pl. VI, fig. 5

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

Remarks: Our single mature valve seems close to Hornibrook's taxon, except that it lacks the heavy posterior rim which he illustrates (Hornibrook, 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 (Janjukian).

Genus *Munseyella* van den Bold, 1957

Munseyella sp.

Pl. VI, fig. 6

1974 *Munseyella* sp., McKenzie, 160, pl. 2, fig. 9.

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 (Janjukian).

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.

Holotypus: 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 auriliform *Pokornyella,* with a reticulated surface formed by longitudinal ribs and transverse intercostal riblets.

Description: Carapace medium-sized (length about 0.65-0.75 mm), auriliform, with a reticulate surface; the network is formed by strong longitudinal ribs and transverse intercostal riblets - the difference between ribs and riblets 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 inflexed anteromedially then convex; posterior evenly rounded to the small cauda, inflexed between the posterodorsal 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 holamphidont, 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 *Aurila* Pokorny, 1955; muscle scars consist of 4 adductors, one divided, in a subvertical series and 2 frontal scars, plus 2 small mandibulars.

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, p. 159) 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, when 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 valves 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 (Janjukian).

Genus *Hornibrookella* Moos, 1965

Hornibrookella aggradata sp. nov.

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

Holotypus: 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 inflexed 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 holamphidont but not as strong as in *Pokornyella australiae;* muscle scars comprising a subvertical series of 4 adductors, one of these divided, plus 2 round frontal scars and 2 small mandibulars (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 0.37-0.39 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 *Quadracythere* Hornibrook, 1952 and *Mutilus* Neviani, 1928 in its characteristics. It seems to one of us (K.G.M.) that Recent *Mutilus* species in Australia, e.g. *Mutilus pumila* (Brady, 1866), may be regarded as descendants of Oligo-Miocene *Hornibrookella.*

In what we regard as *Quadracythere* 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 *Quadracythere truncula* (Brady, 1898) 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 (Janjukian).

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 (Janjukian).

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

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 (Janjukian). Lochard Gorge, Port Campbell, Victoria; Gellibrand Marl, Early to Middle Miocene.

Genus *Quadracythere* Hornibrook, 1952

Quadracythere singletoni sp. nov.

Pl. VII, figs. 6, 7, 15

Holotypus: 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 hemicytherid.

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 inflexure, 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 selvage is much more prominent and the hinge tending towards hemiamphidont 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 selvage 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 (Hornibrook, 1952) by its more rounded ventral ridge. Note that we regard *Quadracythere* as having hemicytherid, 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 (Janjukian).

Genus *Neobuntonia* Hartmann, 1981

Neobuntonia airella sp. nov.

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

1974 Trachyleberididae sp. 2, McKenzie, Pl. I, fig. 7.

Holotypus: 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 punctation than the type species, and also finer punctae posteriorly.

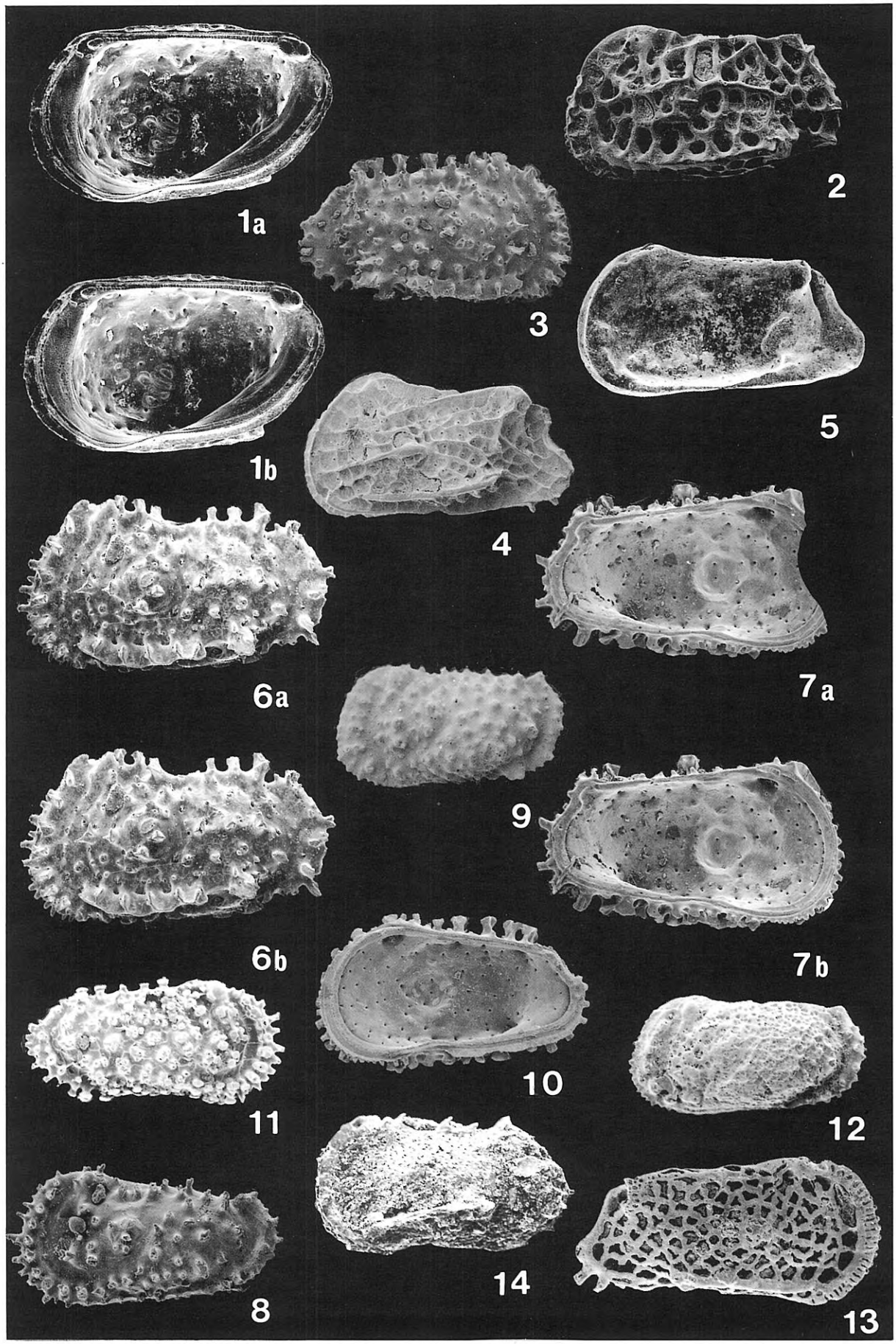
Description: Shell moderately large (length about 0.80-0.85 mm); subtrapezoidal; inflated ventrally with a broad ventrolateral keel; distinct eye tubercle; surface densely punctate, with larger punctae centrally and finer punctae posteriorly; pattern apparently concentric about the median area of the valve; LV slightly overlaps RV antero- and posterodorsally. 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 triangulate, with a small but distinct posteroventral cauda. Subelliptical in dorsal view, greatest breadth posteromedial.

Internally, with moderately broad inner lamellae; no

Plate VIII

1. a-b. *Loxoconcha macgowrani* sp. nov. Stereomicrographs of a female interior RV, PM Au 282. (BH). Late Oligocene. x 75.
2. *Quasibradleya janjukiana* 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.
8. *Trachyleberis* cf. *probesioides* Hornibrook. Male LV, PM Au 289. (BH). Late Oligocene. x 75.
9. *"Rocaeleberis" sudaustralis* 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.
12. *Echinocythereidinae (?)* sp. Male LV of the reticulate morph, PM Au 296A. (BH). Late Oligocene. x 55.
13. *Cletocythereis* cf. *rastromarginata* (Brady) McKenzie. Male RV, PM Au 341. BH. Late Oligocene. x 75.
14. *Cletocythereis* cf. *caudispinosa* (Chapman, Crespin and Keeble). Male LV. PM Au 342. (AB). Late Eocene. x 75.

Plate VIII



vestibules; strong marginal selvage; many relatively straight marginal pore canals; simple, rimmed normal pore canals; hinge holamphidont, anterior tooth in RV not stepped, median element smooth or only indistinctly crenulate, posterior tooth low, broad and strong; LV complementary; 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 larges 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 *Incongruellina* Ruggieri, 1958 and *Carinovalva* Sissingh, 1973. But both these genera are smooth whereas *Neobuntonia* is always punctate; punctation 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 (Janjukian).

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

Bradleya lungalata 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).

Derivatio Nominis: 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; subcentral 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. Subhastate 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 hemiamphidont; muscle scars consisting of 4 adductors in a subvertical series, the second from the top attenuated, plus 2 round frontal scars and indistinct mandibulars.

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 quadrazea* Hornibrook (1952) (Mungoarapan - 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 (Janjukian); and Early to Middle Miocene (Lochard Gorge).

Bradleya dickbensoni sp. nov.
Pl. VI, figs. 9, 10

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

Plate IX

1. *Acanthocythereis incerta* sp. nov. Male LV, Holotypus, PM Au 295. (BH). Late Oligocene. x 60.
2. *Cletocythereis* cf. *rastromarginata* (Brady). Male LV, PM Au 299. (BH). Late Oligocene. x 60.
3. *Alataleberis ornithopetra ornithopetra* McKenzie and Warne. Female LV, PM Au 307. (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.
6. *Cletocythereis* cf. *caudispinosa* (Chapman, Crespin and Keeble). Both valves of opened female carapace, PM Au 301. (AB). Late Eocene. x 75. Specimen coated with limey mud.
7. *Cletocythereis* cf. *curta* McKenzie. R view of female carapace, PM Au 302. (AB). Late Eocene. x 110.
8. *Idiocythere 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. *Arculacythereis thomasi* sp. nov. Female RV, *Holotypus,* PM Au 307. (BH). Late Oligocene. x 50.
11. *Deltaleberis rugosapytta* sp. nov. L view of female carapace, PM Au 306. (BH). Late Oligocene. x 75.
12. Same species and provenance. R view of female carapace, Holotypus, PM Au 307. x 75.
13. Same species. Male RV interior, PM Au 318. Lochard Gorge, near Port Campbell, Victoria. Early-Middle Miocene. x 100.
14. Same species. Female RV, PM Au 319. (BH). Late Oligocene. x 100.
15. *Arculacythereis 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. *Margocythere aspreta* 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.

Plate IX

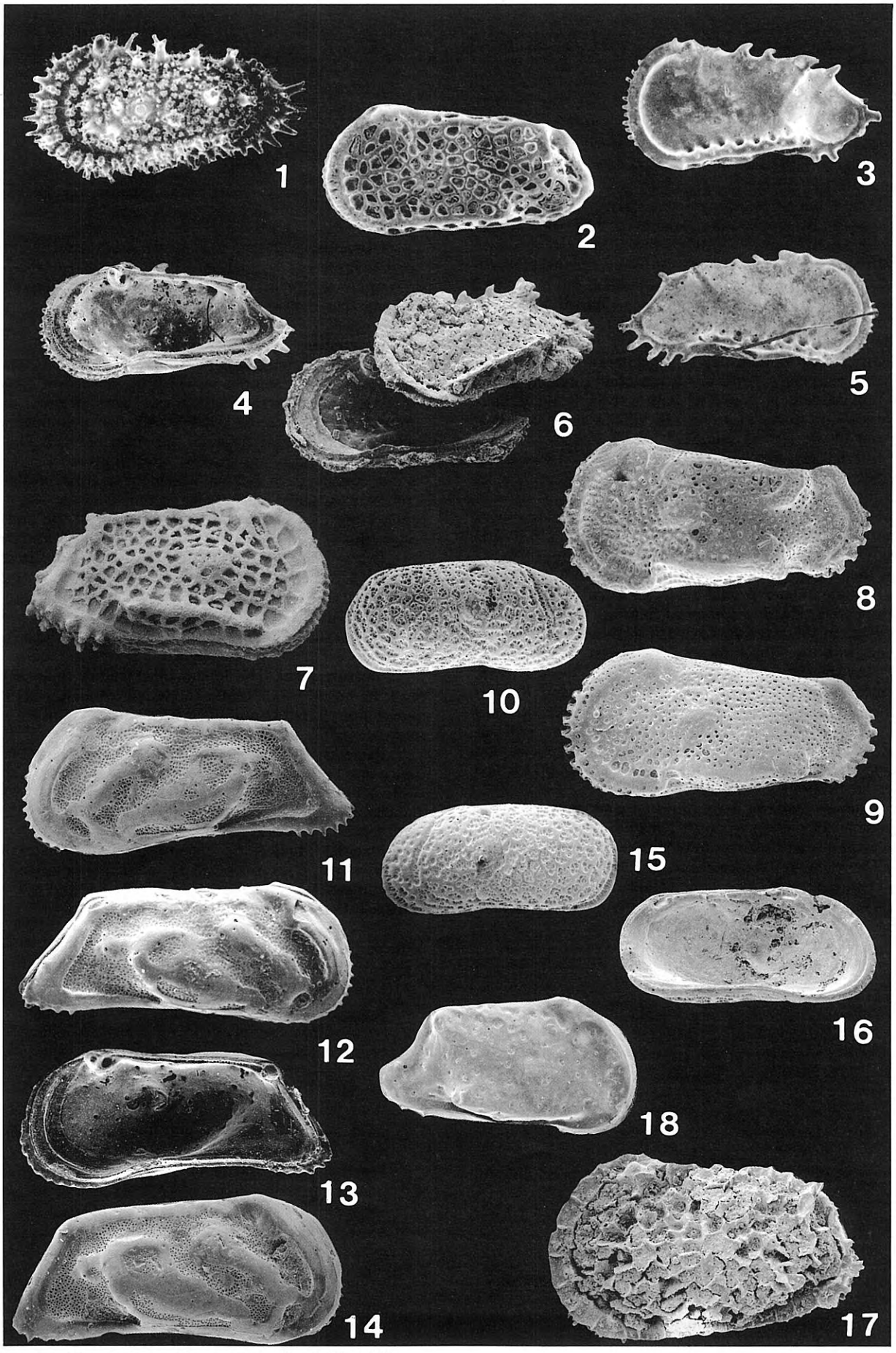


fig. 10 from Bells Headland, Victoria, male RV. Figured paratype PM Au 276.

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 denticulate; 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. lungalata.*

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. andamanae* 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. dickbensoni* 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 (Janjukian).

Bradleya regularis sp. nov.

Pl. VI, figs. 11-13

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

Holotypus: 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. dickbensoni* 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. dickbensoni*).

Internal features typical for the genus.

Sexual dimorphism present, males less high 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.

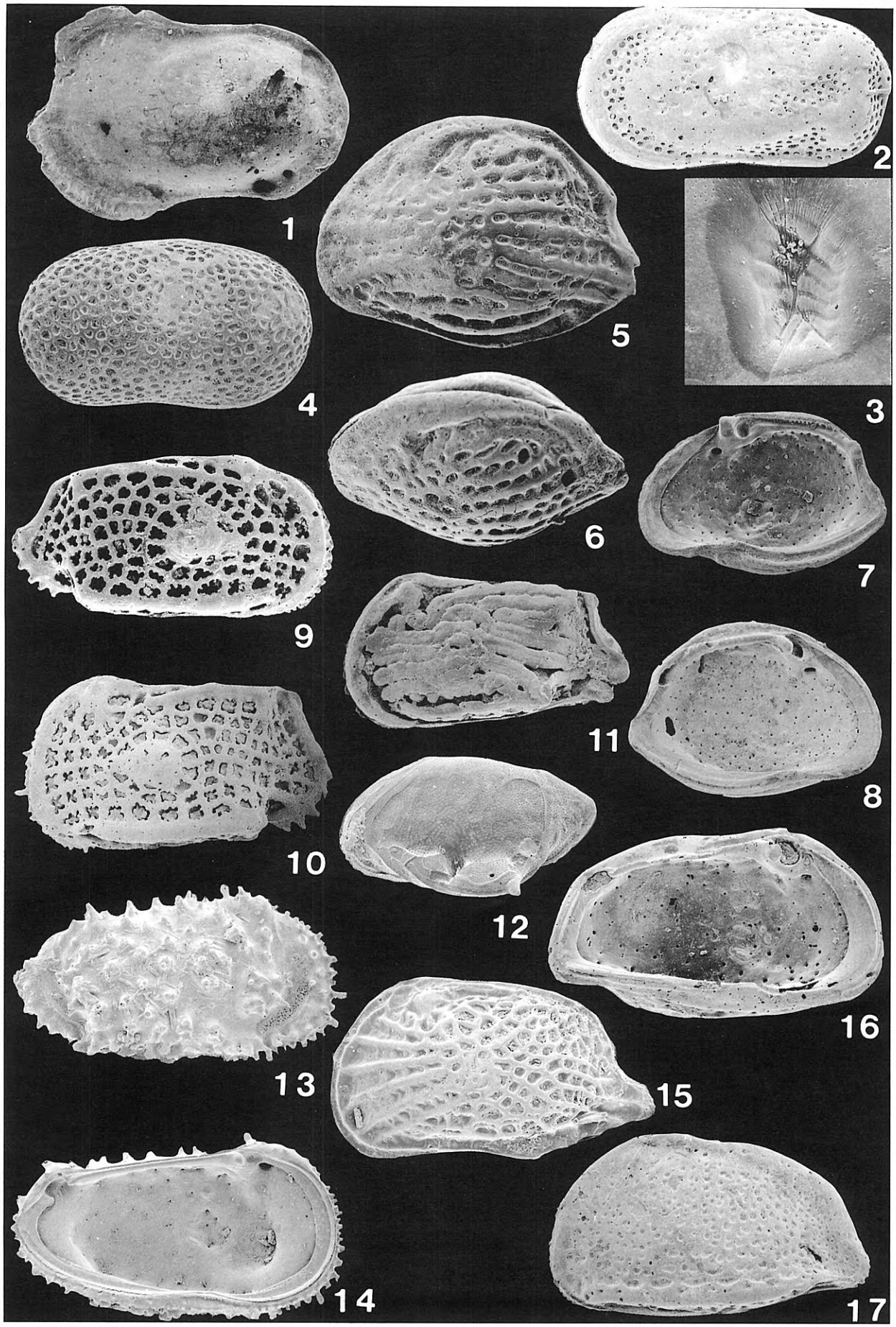
Remarks: The reticulation pattern; comprising 2 large, transverse anterior reticules, a regular meshwork behind with a lower row of larger reticules and upper rows of smaller reticules is not matched by any previously described species.

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.

Plate X

1. *Geelongella antyx* sp. nov. Female LV, PM Au 323. (BH). Late Oligocene. x 75.
2. *Cytherelloidea marginopytta* 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. *Platella 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.
6. Same species and provenance. Dorsal view of male carapace, PM Au 328. 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 lungalata* sp. nov. Female RV, PM Au 331. (BH). Late Oligocene. x 75.
10. Same species. Female LV, PM Au 332. Lochard Gorge, near Port Campbell, Victoria. Early-Middle Miocene. x 75.
11. *Hornibrookella flexicostata* (Chapman). Male LV, PM Au 336. (BH). Late Oligocene. x 75.
12. *Oculocytheropteron?* cf. *albomaculata* (Whatley and Downing). Male LV, PM Au 337. (BH). Late Oligocene. x 100.
13. *Trachyleberis careyi* sp. nov. Male RV, PM Au 333. (BH). Late Oligocene. x 50.
14. Same species and provenance. Male interior LV, PM Au 334. x 50.
15. *Hornibrookella* 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.

Plate X



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 mediodorsal 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 mediodorsal ridge which breaks the dorsal outline as a blunted mediodorsal spine. The eye tubercle is moderately-sized, spherical and distinct. Dorsal margin irregular; ventral margin almost straight; anterior broadly rounded and multispinose; posterior subcaudate, 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 simple rimmed and sieve type; hinge hemiamphidont; central muscle scars comprise 4 adductors in a subvertical series, plus 2 rounded frontal scars and 1 or 2 indistinct mandibular 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 paradictyonites* 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* Sissingh, 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 reawards 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 indistinctly 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 hemiamphidont; muscle scars consisting of 4 adductors in a subvertical series plus 2 frontal scars, mandibulars not observed.

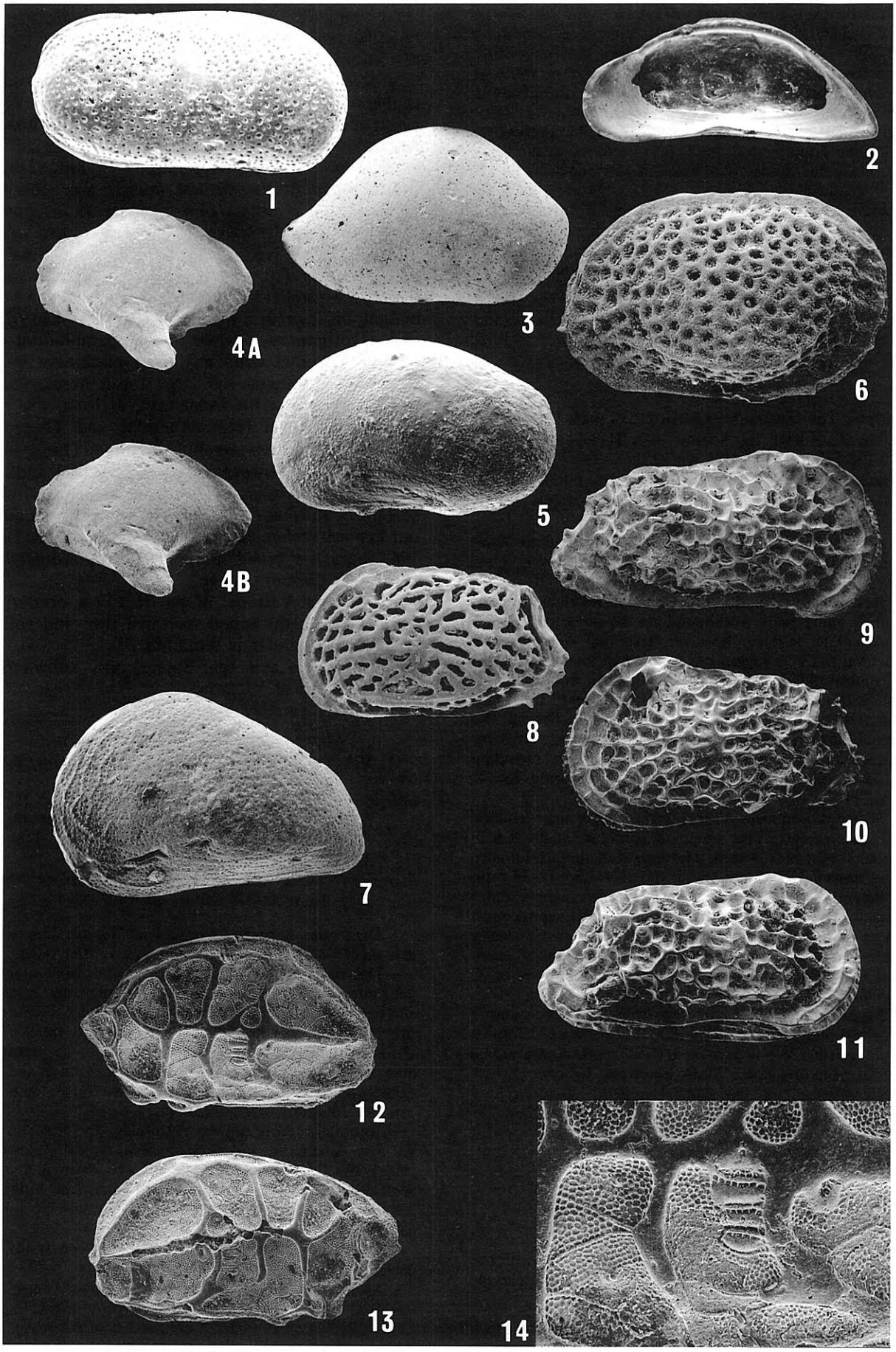
Sex dimorphism distinct; males longer, and relatively less high, than females.

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 eurylamella* sp. nov. Female RV, internal. (BH). PM Au 343. Late Oligocene. x 50.
3. *Bairdoppilata torquayensis* sp. nov. Juv. RV, PM Au 344. (BH). Late Oligocene. x 50.
4. *Aversovalva cooperi* sp. nov. Female LV, stereopair (A and B). PM Au 345. (BH). Late Oligocene. x 100.
5. *Rotundracythere fragilis* sp. nov. Female carapace. PM Au 346. (BH). Late Oligocene. x 100.
6. *Saida bellsensis* sp. nov. Male LV, PM Au 347. (BH). Late Oligocene. x 180.
7. *Pseudeucythere pseudosubovalis* (Whatley and Downing). Male LV. PM Au 351. (BH). Late Oligocene. x 100.
8. *Hornibrookella aggradata* sp. nov. Female LV, PM Au 352. (BH). Late Oligocene. x 75.
9. *Margocythere aspreta* 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. *Hemicytherura reeckmanni* 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.
14. Same species and provenance. Detail of external appearance of adductor scars on specimen figured in fig. 12. x 500.

Plate XI



Remarks: *Tenedocythere,* like *Jugosocythereis* 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 *Jugosocythereis* or even to *Hermanites* Puri, 1955. The type locality for the genus is Tenedos, in the Mediterranean so, presumably, the Indopacific 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 mature female carapace, female RV, and male LV.

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

Tenedocythere nuda sp. nov.

Pl. VIII, fig. 5; Pl. IX, fig. 18

Holotypus: The specimen PAMAu 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 *Tenedocythere* 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 ruggedly 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 selvage 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 PAMAu 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: Aspretum (L.) = a rough place; for the ruggedly 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 riblets (5-6) 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 selvage 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 (Janjukian).

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 hemiamphidont.

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 *Carinocythereis* Ruggieri, 1956, has more ridges than *Spinobradleya.*

Derivatio Nominis: Spina (L.) = a spine, for the spinose 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: Akantha (GK.) = a thorn; for the spinose 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 subcaudate in RV - as is typical, the LV overlaps the RV posteriorly. In dorsal view moderately inflated and spinose, with spinose, thickened extremities.

Internally, having moderately broad inner lamellae; no vestibules; prominent marginal selvages, weak inner selvages; numerous straight to flexuous marginal pore canals; normal pore canals simple rimmed and sieve type; hinge hemiamphidont; 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 (Janjukian).

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

Trachyleberis cf. *probesioides* Hornibrook, 1952

Pl. VIII, fig. 8

1952 *Trachyleberis probesioides* 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 polyfurcate or furcate 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 remainder adults representing both sexes.

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

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 spinose 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-furcate, tri-furcate or poly-furcate, 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 hemiamphidont, 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 (Janjukian).

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 spinosity; 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 (Janjukian). 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 (Janjukian); 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: An *Acanthocythereis* with a surface ornament of scattered large polyfurcated spines and numerous interspersed spinules.

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 spinule, 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. hystrix* (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.

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

Derivatio Nominis: Sudaustralis (L.) = south-austral; for the southern Australian provenance.

Diagnosis: A spinose *"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 periphery 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 amphidont, 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, mandibulars 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-branched (*Rocaeleberis* has branched m.p.c. anteroventrally). In view of these differences, we have left our taxon in Trachyleberidinae rather than cite 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 Gull Rock Member (BPF), South Australia was found.

Occurrence and Age: Bells Headland, Victoria; Late Oligocene (Janjukian). The species is also known from the Gull Rock Member (BPF), South Australia in boreholes (McKenzie, 1979, cf. Synonymy). Its age range 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 *Bradleya 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 Cainozoic 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, Willunga Embayment, S.A. (McKenzie, 1979, cf. Synonymy).

Cletocythereis cf. *curta* McKenzie, 1967

Pl. IX, fig. 7

1967 *Cletocythereis curta* McKenzie, 95, 96, Fig. 5g, 6a.

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 *Oertliella* sp., McKenzie, 98, pl. 2, fig. 1.
1983 *Cletocythereis caudispinosa* (Chapman, Crespin and Keeble); Whatley 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 *Oertliella,* 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 Whatley 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 *Idiocythere* Triebel, 1958

Idiocythere thalassea sp. nov.

Pl. IX, figs. 8, 9

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

Holotypus: 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 *Idiocythere* 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 postero-ventrally. 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: *Idiocythere* 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 (Janjukian). Also consulted in material from the Early Miocene Fishing Point Marl (McKenzie, 1974).

Genus *Deltaleberis* gen. nov.

Type Species: *Deltaleberis rugosapytta* 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 posteromedial. 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 (Gk.) = letter D, shaped like a triangle; and suffix - *leberis* (Gk.) = 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 (Bairnsdalian).

Deltaleberis rugosapytta sp. nov.

Pl. IV, fig. 9; Pl. IX, figs. 11-14

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

Holotypus: 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; *pytt* (AS) = a pit; for the species ornament.

Diagnosis: A *Deltaleberis* 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 denticulate. 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 *Deltaleberis* 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 **Pterygocytherideinae** Puri, 1957
Genus *Alataleberis* McKenzie and Warne, 1986

Alataleberis ornithopetra ornithopetra
McKenzie and Warne, 1986
Pl. IV, fig. 10; Pl. IX, figs. 3-5

1974 *Alatacythere* sp., McKenzie, 158, pl. 2, fig. 7.
1986 *Alataleberis ornithopetra ornithopetra* 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. ornithopetra ornithopetra* 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 **Campylocytheridae** Puri, 1960
Subfamily **Arculacythereinae** Hartmann, 1981
Genus *Arculacythereis* Hartmann, 1981

Arculacythereis thomasi sp. nov.
Pl. IX, figs. 10, 15, 16

Holotypus: 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 reticules. 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 selvage of RV strong, accommodated by a RV groove; inner selvage 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 campylocytherids; in their soft anatomy, however arculacythereines differ from typical campylocytherids (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 *Cytherella gullrockensis, Cytherelloidea jugifera, Cytheropteron australopunctatarum* and *Myrena lindsayi.* Thus, the Late Oligocene assemblage is much more diverse, 70 species, versus 16 for the Late Eocene faunule. 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 Gull Rock Member and the many bythocytherids in the Bells Headland assemblage indicate that both the facies are offshore in type. Of the two, the Gull Rock Member with its many Krithiidae, Cypridacea, and large cytherellids seems to have been deposited in deeper water than the Bells Headland unit, which is characterized by numerous hemicytherids, thaerocytherids (bradleyines), 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 *–Pokornyella, Hornibrookella, Quadracythere, Neobuntonia–* 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.

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