# OSTRACODS FROM THE EOCENE OF SEYMOUR ISLAND, ANTARCTIC PENINSULA

JANINA SZCZECHURA

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Fifteen podocopid ostracod species, belonging to 16 genera and 9 families, are described from the Eocene La Meseta Formation of Seymour Island, Antarctic Peninsula. Most of the taxa are left in open nomenclature due to their rarity and/or poor state of preservation, however two new species, i.e. ?*Echinocythereis hartmann*i and *Majungaella antarctica* are erected. This ostracod assemblage is the first described from the Eocene of Antarctica. The fauna suggests a shallow-water environment and the close geographical proximity of West Antarctica and southern Argentina in the Eocene. The paleozoogeographic extent of the ostracod fauna indicates the existence of a marine connection between West Antarctica, New Zealand and Australia, as well as its bipolar exchange.

Key words: Ostracoda, taxonomy, paleoecology, paleobiogeography, Eocene, Antarctica.

*Janina Szczechura [janina.s@twarda.pan.pl], Instytut Paleobiologii PAN, ul. Twarda 51/55, PL-00-818 Warszawa, Poland.*

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## INTRODUCTION

The present knowledge of the evolution of ostracods in the Tertiary of Southern Hemisphere is based mostly on data from Hornibrook (1953), Bertels (1973, 1976), McKenzie *et al.* (1991, 1993), Ayress (1995), Majoran (1996b), and Echevarría (1998). No evidence was available from Antarctica until a small collection of ostracod carapaces from the Eocene La Meseta Formation of Seymour Island has been assembled.

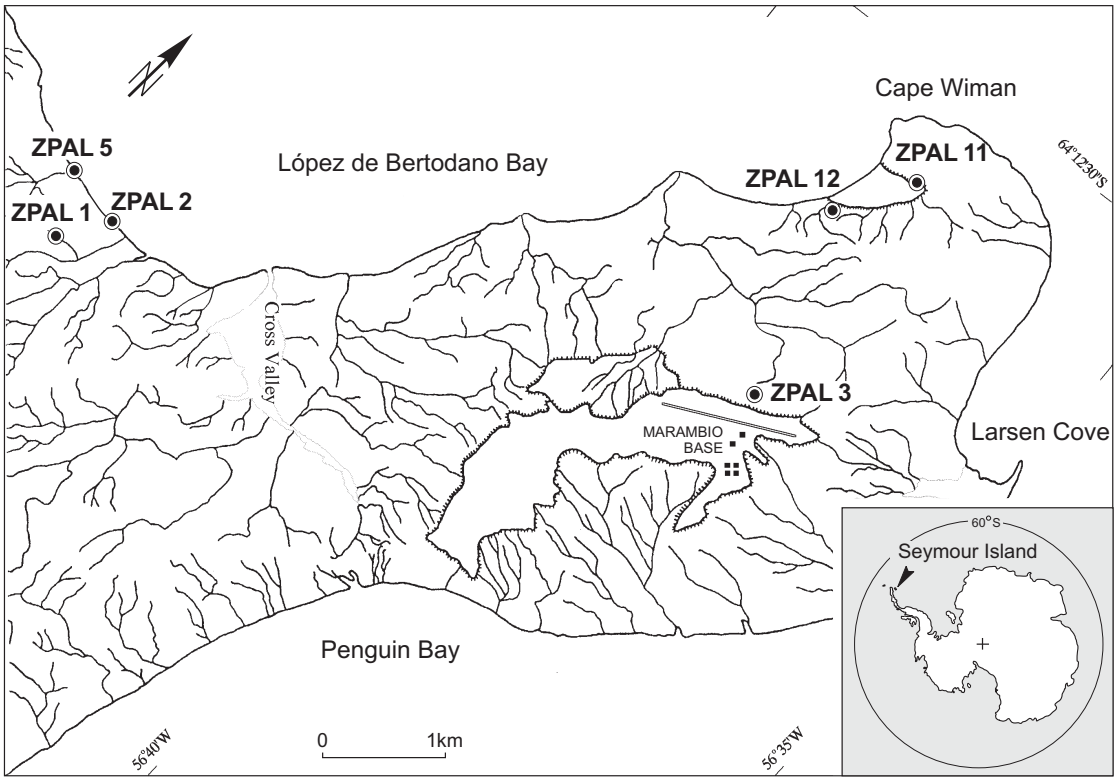


Fig. 1. Map of the northern part of Seymour Island showing the localities with ostracod fauna.

The ostracods described here were collected from the Eocene La Meseta Formation of Seymour Island (Text-fig. 1). This sequence represents the one of the youngest unit of the sedimentary infill of the James Ross Basin and yielded the most diverse Eocene biota known from Antarctica (Feldmann and Woodburne 1988; Stilwell and Zinsmeister 1992; Gaździcki 1998). In this paper the first ostracod fauna of Eocene age from Antarctica is described and some paleoecological and paleobiogeographical implications are discussed.

The material described is housed at the Institute of Paleobiology of the Polish Academy of Sciences in Warszawa under the catalogue number ZPAL O.49/1-63.

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## MATERIAL

Samples collected by A. Gaździcki during the Argentine-Polish field parties on Seymour Island in the austral summers of 1987–88, 1991–92 and 1993–94 supplied (among other biota) the Eocene ostracod collection reported here.

The ostracod collection comprises 63 specimens, mostly complete carapaces, mainly of adults. In many cases they are poorly preserved, i.e. crushed, abraded or encrusted with sediment particles. There are few very well preserved specimens; this may indicate that they are of different origin. In comparison with the coexisting benthic foraminifera and various invertebrates, the ostracods are rather rare.

## GEOLOGICAL AND STRATIGRAPHICAL SETTING

Seymour Island is located about 100 km southeast of the tip of the Antarctic Peninsula, West Antarctica (Text-fig. 1). The La Meseta Formation (Elliot and Trautman 1982) is an up to 800 metres thick, richly fossiliferous marine-estuarine sequence exposed in the northern part of the island (Stilwell and Zinsmeister 1992, Porębski 1995, Marenssi *et al.* 1998). The formation rests unconformably on Late Cretaceous to Paleocene units and is overlain by post-Pliocene glacial deposits (Feldmann and Woodburne 1988, Gaździcki *et al.* 1999). It is composed of poorly consolidated clastic sediments with very well preserved micro- and macrofossils (Stilwell and Zinsmeister 1992; Baumiller and Gaździcki 1996; Bitner 1996; Radwańska 1996; Stolarski 1996, 1998; Hara 1997, 2001). Sadler (1988) subdivided the formation into seven lithofacies Telm1–Telm7 (acronyms for Tertiary Eocene La Meseta). This division is accepted here (Text-fig. 2). The age of the La Meseta Formation, based on the marine palynoflora assemblages is late Early Eocene for the base (Cocozza and Clarke 1992) and Late Eocene for the uppermost part (Wrenn and Hart 1988; Askin *et al.* 1991; see also Dingle and Lavelle 1998).

The ostracods reported here were sampled at sites ZPAL 1, ZPAL 2, ZPAL 5, ZPAL 11, and ZPAL 12, and represent the lower part (Telm1) of the formation (Text-fig. 2). A single specimen, difficult to identify taxonomically, was also found at the locality ZPAL 3, taken from the upper part of the section (Telm7).

The ostracods of Seymour Island include representatives of *Wichmannella*, a genus known from southern Argentina from the Late Cretaceous to the Late Oligocene (Bertels 1976). They also include representative of *Henryhowella*, which, although described from the Cretaceous of southern Argentina, is considered by Bertels (1976) as appearing there only later in the early Tertiary (Late Eocene?–Early Oligocene). The presence of both these genera, as well as the general similarity of the Antarctic ostracod assemblage to those known from the Eocene of southern Australia, appear to prove the Eocene age of the studied ostracods.

## PALEOECOLOGY

The rather poor state of preservation of the ostracod fauna, dominated by complete, adult carapaces of similar size, may suggest a high energy environment and rapid deposition (Whatley 1983; this author's observations). Their low frequency seems to result from their dilution in clastic sedimentation.

The ostracod fauna is fairly diverse, especially considering the low abundance of fossils. They comprise normal marine forms, such as those known from the Eocene of New Zealand and even southern Australia. Deeper water species e.g. belonging to the Cytherellidae, Bairdiidae, Krithiidae, Bythocytheridae, and (some) Thaerocytheridae, are absent. The genera *Argilloecia* and *Propontocypris* are poorly represented.

Among the recognized genera, particularly interesting as an indicator of the environment, is the quite well represented *Wichmannella*. This genus is known of the Late Cretaceous–Early Tertiary of southern Argentina where it occurs in shelf deposits intercalated with non-marine deposits, i.e. transgressive-regressive sedimentary sequences. The representative of the genus *Henryhowella*, found in the Eocene of Seymour Island, is often associated with *Wichmannella* in the above mentioned sediments from southern Argentina.

Among the other genera from the La Meseta Formation, particularly well represented are: ?*Maddocksella*, ?*Echinocythereis*, *Majungaella*, and ?*Hornibrookella*. In the Tertiary of southern Australia, *Maddocksella* is considered to be characteristic of shelf deposits, from inshore to 250 m (McKenzie *et al.* 1991). *Echinocythereis* is known (Van Morkhoven 1963) as preferring infraneritic and bathyal waters. *Majungaella* is considered in this paper as being related to ?*Loxocythere* sp., found (together with *Australicythere*) in the Pliocene of Cockburn Island, Antarctic Peninsula, where it probably lived in shelf zone, at depths above 250 m (Szczechura and Błaszyk 1996; see also Gaździcki and Webb 1996). According to Whatley (personal communication) all previous Mesozoic records of *Majungaella* are from warm and shallow waters. *Hornibrookella*, as well as *Quadracythere* and *Hermanites*, are regarded as predomi-

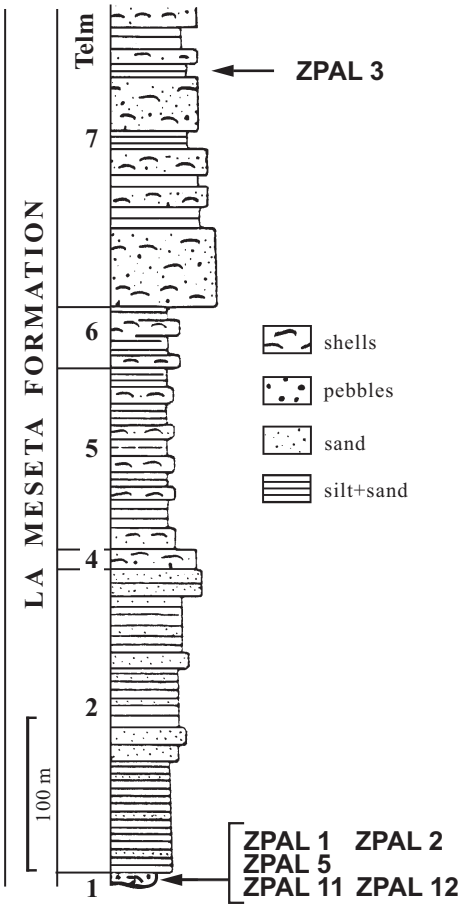


Fig. 2. Composite stratigraphical column of the La Meseta Formation on Seymour Island (South Section) adapted from Sadler (1988), showing the

nantly epi-neritic ostracod genera; this group of ostracods is common in the Miocene of Victoria, southeastern Australia, as a members of a fauna which has "a warm-temperate to subtropical character, and indicate a shallow-water, high-energy, near-shore environment of deposition, with abundant phytal associates" (Neil 1994: p. 1).

The remining genera, e.g. *Phlyctenophora*, *Kuiperiana*, and ?*Ameghinocythere* are represented by species close to those still living, i.e. *Phlyctenophora zealandica*, *Kuiperiana meridionalis*, and *Ameghinocythere reticulata*, respectively. *P. zealandica* occurs in the Gulf of Carpentaria, northeastern Australia, where it is a member of "a lower tidal and foreshore assemblage" (Yassini *et al.* 1993); *K. meridionalis* is known from the Antarctic and the Magellan Strait from a depth of 143 to 525 m (Whatley *et al*. 1996, 1998b), while *A. reticulata* is recorded from the continental shelves of the South West Atlantic (Whatley *et al*. 1997a).

Thus the taxonomic content of the La Meseta ostracod assemblage seems to indicate shallow-marine and rather high energy environments, which is consistent with other faunal assemblages (Sadler 1988; Stilwell and Zinsmeister 1992; Stilwell and Gaździcki 1998; Hara 2001).

As is known, however, e.g. Whatley *et al.* (1997b), the geographical distribution of ostracods is controlled not only by depth but also by the trophic level they occupy, as well as temperature and salinity of their environment.

## PALEOBIOGEOGRAPHY

Of the fifteen ostracod genera recognized in the Eocene of Seymour Island, especially those of more certain taxonomic position, almost half also occurred in the Eocene of southern Australia and/or New Zealand (McKenzie *et al*. 1991, 1993; Ayress 1995; Majoran 1996a, b). They represent *Argilloecia*, *Propontocypris*,

*Actinocythereis*, *Munseyella*, and *Kuiperiana*. It is probable, moreover, that also (at least) tentatively distinguished here *Hornibrookella* and *Maddocksella* are an additional element common to the Eocene of the mentioned areas. Considering a species level of comparision of the faunas, more similarity exists between the Eocene ostracods of West Antarctica and Australia.

The similarity of Eocene ostracods from southern Australia and New Zealand was demonstrated by Ayress (1995) and Majoran (1996b), both authors working on rich ostracod fauna from these areas. According to Ayress (1995) the late Eocene ostracods of New Zealand (South Canterbury) indicate their deeper neritic or upper slope origin, transgressive marine condition and their eastward direction of migration. Also the Eocene–Oligocene ostracods of Australia, i.e. Southern Australia and Victoria, are considered as the off-shore biofacies (McKenzie *et al*. 1991).

Some of the above mentioned genera, i.e. *Argilloecia*, *Actinocythereis*, and *Munseyella* are also recorded from the early Tertiary of southern Argentina (Echevarría 1998), where both *Actinocythereis* and *Munseyella* had appeared already in the Late Cretaceous (Bertels 1973). However, *Australicythere*, *Wichmannella*, and *Henryhowella*, which are present in the Eocene of Seymour Island, also occur in the Paleogene and/or Late Cretaceous of southern Argentina (Bertels 1973, 1975; Echevarría 1998) and are restricted to these areas being unknown from the Eocene of Australia and New Zealand. *Tumidoleberis* (recte *Majungaella*), on the other hand, besides the Eocene of Seymour Island, occurred in the Late Cretaceous of western Australia (Neale 1976) and Late Cretaceous of southern Argentina (Bertels 1975); Whatley and Ballent (1996) described *Majungaella* from the Early Cretaceous (Aptian–Albian) and the Late Cretaceous (?Late Campanian– Early Maastrichtian) of southern Argentina, and the Albian of the Falkland Plateau. Within these latter genera, *Wichmannella* deserves particular attention. According to Bertels (1976), it is an endemic genus typical for shallow-waters of the Southern Atlantic basins, known from the Late Cretaceous up to the Oligocene. Subsequent studies seem to proove Bertels's opinion; *Wichmannella bradyi* (Ishizaki) distinguished by Zhao and Wano (1988), within modern ostracod fauna from the shelf sea off China, belongs to a separate genus.

The shallow-water character of the ostracod biofacies containing *Australicythere*, *Majungaella*, and *Wichmannella* seems to be supported by the present studies.

As the above mentioned, Paleogene forms, common to West Antarctica and southern Argentina, have their ancestors in the Late Cretaceous of Argentina, one might suggests that these forms represent a relic fauna, which even in the Paleogene was at least partly restricted to the shallow seas of the Southern Ocean.

The similarity of the Eocene ostracod biofacies of southern Australia, New Zealand and West Antarctica suggests, however, that at that time there was marine connection between these areas, enabling exchange of faunas (Zinsmeister 1982; Case 1989; Shen 1998). Existing differences between these biofacies (mostly greater diversity and the deeper-water character of the Australian and New Zealand ostracods) evidently resulted from their different environment as a consequence of their different paleogeographic situation. The occurrence of common, shallow-marine (including rather endemic forms) ostracod biofacies in the Eocene of West Antarctica and the Paleogene of southern Argentina suggests the proximity of these areas and their shallow-marine connection. Wood *et al*. (1999) have examined the paleobiogeography of marine, benthic ostracods and they concluded that the epicontinental connection between southern Argentina (Patagonia) and West Antarctica existed up to the Oligocene–Miocene boundary.

Ostracods from the Eocene of Seymour Island (*Phlyctenophora* sp., ?*Echinocythereis hartmanni* sp. n., *Majungaella antarctica* sp. n., ?*Ameghinocythere* cf. *Cytheromorpha*? *flexuosa*, *Kuiperiana* sp.) are similar to those known as subfossils or forms still living in Antarctica, i.e. they have (to some extent) a modern character. Some similarity of the Eocene ostracods of southern Australia and New Zealand to the Recent (or subfossil) ones (representatives of this group of microfossils) of Antarctica has been also observed by Ayress (1995).

The longevity of some Tertiary ostracods of New Zealand was recognized by Ayress (1995), who followed similar observations by Hornibrook in the 1950s, while long lasting ostracods from the Tertiary of southern Australia were indicated by Majoran (1996b). All these observations are also in agreement with Hartmann's (1997) observations that the early Tertiary ostracods of Antarctica are the ancestral forms for the Recent fauna of that area. In the Eocene of Seymour Island there occur ostracod genera, e.g.: *Argilloecia*, *Propontocypris*, *Henryhowella*, *Echinocythereis*, *Hornibrookella*, and *Munseyella* which, at least from the early Paleogene up to the Recent, are also known from the North Atlantic and/or its borderlands (Keen 1977; Coles *et al.* 1990; Whatley and Coles 1991). It suggests that since the Tertiary there has existed bipolar migration of these faunas.

## SYSTEMATIC PALEONTOLOGY

Suborder **Podocopina** Sars, 1866
Superfamily **Cypridacea** Baird, 1845
Family **Paracyprididae** Sars, 1923
Genus *Phlyctenophora* Brady, 1880
*Phlyctenophora* sp.
(Pl. 1: 9, 10)

**Material**. — Two adult carapaces, fairly well preserved.

**Description**. — Sub-lunate in side view, rather evenly and markedly laterally inflated, narrowly rounded anteriorly, more so posteroventrally, arched dorsally, highest in the middle, weakly concave ventrally. The left valve larger than right, overlapping the latter mostly anterodorsally.

**Remarks**. — All these features seem typical of *Phlyctenophora*, a genus described by Brady 1880, based on material found by him during the Challenger Expedition in the Southern Pacific. In comparison with *Phlyctenophora zealandica* Brady, 1880, the type species, as figured (only internally) by Yassini *et al.* (1993), from the Gulf of Carpentaria (northwestern Australia), the present specimens are much smaller, and more triangular in lateral view. The present species differ in details from all other species of this genus, especially those from the Neogene of Europe. It is possible that *Paracypris*? sp., described by Kielbowicz (1988) from the Late Oligocene–Early Miocene of Argentina (Austral Basin) should also be referred to *Phlyctenophora*. In comparison with this latter species, the present species is smaller and differs in outline and length to height ratio.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, ZPAL 5; Telm1 (Eocene).

Family **Pontocyprididae** G.W. Müller, 1894
Genus *Argilloecia* Sars, 1866
*Argilloecia* cf. *A. mesa* McKenzie, Reyment *et* Reyment, 1993
(Pl. 1: 8)

**Material**. — One adult carapaces, well preserved.

**Remarks**. — The specimen resembles *Argilloecia mesa*, described by McKenzie *et al.* (1993), from the Eocene of Victoria, southeastern Australia, but is smaller, less pointed posteroventrally and has a smaller length to height ratio. Moreover, the valve overlap in the present species seems more pronounced. McKenzie *et al.* (l.c.) admit, however, rather large variability within *Argilloecia mesa* resulting from its sexual dimorphism.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 5, Telm1 (Eocene). *Argilloecia mesa* McKenzie *et al.,* 1993 is known from the Middle(?)–Late Eocene of Victoria, southeastern Australia.

Genus *Maddocksella* McKenzie, 1981
?*Maddocksella* sp.
(Pl. 1: 1–6)

**Material**. — Six adult carapaces, in most cases well preserved.

**Description**. — Smooth, oblong in lateral outline, evenly and rather weakly inflated laterally, broadly rounded anteriorly, less broadly rounded posteroventrally; dorsal and ventral margins nearly parallel, somewhat arched. The left valve larger than right and overlapping the latter, except at the anterior end, mainly along the posterodorsal and anterodorsal margin.

**Remarks**. — All these external features are close to those typical of *Maddocksella* McKenzie, 1981, and particularly to those of *Maddocksella tarparriensis* McKenzie *et al*., 1993, from the Eocene of Victoria, southeastern Australia. According to these authors (l.c.) some specimens formerly recognized by them (McKenzie *et al*. 1991) as *Maddocksella argilloeciaformis* (Whatley *et* Downing, 1983), from the Late Eocene of Southern Australia, should be referred to *Maddocksella tarparriensis*. Majoran (1996a) also found *M. tarparriensis* in the Late Eocene of Southern Australia. In comparison with *Maddocksella tarparriensis*, as figured by McKenzie *et al*. (1993), the present specimens are much smaller and has less

steep anterodorsal and posterodorsal margins. Because the internal features are unknown, the generic assignement is only tentative.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, ZPAL 2; Telm1 (Eocene).

Genus *Propontocypris* Sylvester-Bradley, 1948
*Propontocypris* sp.
(Pl. 3: 1, 2; Pl. 1: 7; Pl. 3: 3)

**Material**. — Two adult right valves, one juvenile right valve and one ?adult carapace, poorly preserved.

**Remarks**. — The general appearance of the preserved parts of specimens, and as their internal features, mainly the inner lamella, allow assignation to *Propontocypris*. They resemble *Propontocypris* sp., described by McKenzie *et al*. (1993), from the Eocene of Australia. The present form is, however, much smaller, less pointed posteriorly and less angulated dorsally. The specimens presented on Pl. 1: 7 and Pl. 3: 3, somewhat different in side view from the above mentioned ones, are only tentatively included to this form.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, ZPAL 5; Telm1 (Eocene).

Superfamily **Cytheracea** Baird, 1850
Family **Trachyleberididae** Sylvester-Bradley, 1948
Genus *Actinocythereis* Puri, 1953
*Actinocythereis* cf. *A. indigena* Bertels, 1969
(Pl. 4: 6)

**Material**. — One fragment of adult right valve.

**Remarks**. — Shape of the preserved, anterior part of the specimen and its ornamentation resemble *Actinocythereis indigena* Bertels, 1969, from the Early Danian of southern Argentina, especially as figured by Echevarría in Malumián *et al.* (1984). The Eocene specimen from Antarctica is, however, more densely tuberculated. It also seems close to *Actinocythereis tetrica* (Brady, 1880), a Recent species from Booby Island (near Australia), and later reviewed by Puri and Hulings (1976). Yassini *et al.* (1993) found this species in the Gulf of Carpentaria, northeastern Australia. The present fragment is particularly similar, regarding the development and arrangement of tubercles in its frontal part, to the specimen presented by Yassini *et al.* (1993) on pl. 7, fig. 131. More complete material from Antarctica is necessary to establish the taxonomic assignment of this form.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 11, Telm1 (Eocene). *Actinocythereis indigena* Bertels, 1969 is known from the Early Danian of southern Argentina (Rio Negro and Neuquén provinces).

Genus *Henryhowella* Puri, 1957
*Henryhowella* sp.
(Pl. 5: 5)

**Material**. — One adult left valve, rather well preserved.

**Description**. — Indistinctly plicate, with well developed eye tubercle and indistinctly marked subcentral tubercle. Valve surface covered by strong conjunctive, tubercle-like spines. Short spines extend along the free margin. Internal features obscured.

**Remarks**. — The ornamentation of this specimen distinguishes it from other representatives of the genus *Henryhowella*.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 5, Telm1 (Eocene).

Genus *Wichmannella* Bertels, 1966
*Wichmannella* cf. *W. meridionalis* Bertels, 1969
(Pl. 2: 1–4)

**Material**. — Three adult carapaces, two adult left valves, one adult right valve, two juvenile carapaces and one juvenile left valve, in most cases well preserved.

**Remarks**. — The deep and rather regular reticulation of the valve surface is very similar to that of *Wichmannella meridionalis* Bertels, 1969, described from the Early Danian of Southern Argentina. In com-

parison with representatives of this species, especially as described and figured by Bertels (1973), they are slightly larger, lack eye tubercle and have somewhat different ornamentation pattern anterolaterally. However, details of ornamentation of specimens, referred here to *Wichmannella* cf. *W. meridionalis*, are somewhat variable. Internally, the Eocene form reveals rather smooth median element of the hinge of the left valve, and rather narrow inner lamella with deep vestibulum. According to Whatley (personal communication) *Wichmannella* is a junior synonym of *Henryhowella*.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 11, ZPAL 12; Telm1 (Eocene). *Wichmannella meridionalis* Bertels, 1969 is known from the Early Danian of southern Argentina (Rio Grande, Rio Negro and Neuquén provinces).

Family **Thaerocytheridae** Hazel, 1967
Genus *Echinocythereis* Puri, 1954
?*Echinocythereis hartmanni* sp. n.
(Pl. 5: 1–4)

Holotype: adult carapace ZPAL O.49/27 figured on Pl. 5: 3.

Paratype: adult carapace ZPAL O.49/47 figured on Pl. 5: 2.

Type horizon: Telm1, La Meseta Formation; Eocene.

Type locality: ZPAL 1, Seymour Island, Antarctic Peninsula.

Derivation of the name: *hartmanni*, named in honour of Professor Gerd Hartmann, in recognition of his contribution to our knowledge of the Antarctic Ostracoda.

**Diagnosis**. — ?*Echinocythereis* species, subrectangular in lateral outline, inflated, covered by a reticulation formed by small ribs bearing weakly developed pappillae.

**Material**. — Two adult carapaces, one adult right valve, one adult left valve and one juvenile left valve, rather well preserved, obscured from inside.

**Description**. — Carapace subrectangular in lateral outline, with distinct cardinal angles, nearly uniform and moderate lateral inflation, and large, well developed eye tubercle. Shallow furrow occurs near and along the anterior margin. Anterior margin somewhat obliquely, but broadly rounded, posterior margin narrowly rounded, dorsal and ventral margin nearly straight and parallel to each other. The valve surface ornamentation (Pl. 5: 3d), consists of tiny pappilose ribs forming a net-like pattern. Small marginal denticles also occur along the anterior and posterior margins. Internal features unknown.

Dimensions (in mm):

| ZPAL O.49/27, adult carapace, holotype | ZPAL O.49/47, adult carapace, paratype |
|---|---|
| Length 1.12 | Length 1.12 |
| Height 0.62 | Height 0.62 |

**Remarks**. — In overall external appearance and ornamentation this species is not typical of any known ostracod genera. Their morphological features may be compared, however, to those characteristic of *Echinocythereis heros* Whatley, Staunton, Kaesler *et* Moguilevsky, 1996, a Recent species described from the Strait of Magellan, Chile; later this species, found in the South West Atlantic, was referred by Whatley *et al.* (1997a) to *Henryhowella*. In comparison with this species the Antarctic form is much smaller and more inflated, bearing a more or less distinct furrow (incision) along the anterior margin. It is interesting, that the authors of *Henryhowella heros* found some similarity between their species and *Henryhowella beckerae* Bertels, 1975, as well as *Wichmannella deliae* Bertels, 1975, both species known from the early Tertiary of southern Argentina (Patagonia).

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, ZPAL 5; Telm1 (Eocene).

Family **Progonocytheridae** Sylvester-Bradley, 1948, emend. Whatley *et* Ballent, 1996
Genus *Majungaella* Grekoff, 1963
*Majungaella antarctica* sp. n.
(Pl. 2: 5–8)

Holotype: adult right valve ZPAL O.49/33 figured on Pl. 2: 7.

Paratype: adult right valve ZPAL O.49/32 figured on Pl. 2: 8.

Type horizon: Telm1, La Meseta Formation; Eocene.
Type locality: ZPAL 12, Seymour Island, Antarctic Peninsula.
Derivation of the name: *antarctica*, occurring in Antarctica.

**Diagnosis**. — *Majungaella* species, subtriangular in lateral outline, most inflated ventrolaterally, covered by distinct, separate punctae and ribs, close and parallel to the free margin.

**Material**. — One adult carapace, two adult right valves and one adult left valve, well preserved.

**Description**. — Carapace of medium size, subtriangular in lateral view, longest at mid-height, highest in the anteromedian part. Left valve somewhat larger than the right and overlapping the latter along the entire margin. Dorsal margin straight, ventral margin nearly straight and slightly incised in the middle, anterior margin obliquely rounded, posterior margin narrowly rounded. Eye tubercle absent. Strong lateral inflation greatest above the ventral margin. Valve surface rather evenly and distinctly punctate with fine ribs along the free margin, which are most distinct on the ventral side.

Inner lamella moderately wide in the anterior part, without vestibulum. Muscle scars barely visible but seem to consist of four scars of the main group and one, round scar in front. Hinge margin rather poorly preserved, clearly entomodont, however, with distinctly dentate terminal teeth separated by a median, loculate groove, enlarging anteriorly, in the right valve.

Dimensions (in mm):

| ZPAL O.49/33, adult right valve, holotype | ZPAL O.49/32, adult right valve, paratype |
|---|---|
| Length 1.04 | Length 0.96 |
| Height 0.65 | Height 0.55 |

**Remarks**. — The specimens are very similar to ?*Loxocythere* sp., a Pliocene species described from Cockburn Island, Antarctic Peninsula (Szczechura and Błaszyk 1996). The Eocene form, however, is less coarsely punctate and may have (if well preserved) a somewhat different hinge. Both these forms seem to be related to that described by Bertels (1975) from the Late Cretaceous of Argentina, as *Tumidoleberis australis*. In comparison with Bertels's species, the Eocene (and Pliocene) species is punctate and not reticulate. The hinge of the Eocene form, although not well preserved, seems also similar to that of the Cretaceous one from Argentina. At the same time, however, all the above discussed forms, when compared with species referred to *Tumidoleberis*, from the Late Cretaceous of France (Deroo 1966) are much more angulated dorsally and have a different hinge. The Antarctic species is also similar (as kindly suggested by Dr M. Ayress, personal communication), to *Majungaella verseyi* Neale, 1975 from the Late Cretaceous of Western Australia. In comparison with this latter species the Eocene species is more punctate than costate, especially in its central part. In comparison with *Majungaella santacruziana* (Rossi de Garcia, 1972), from the Early Cretaceous of southern Argentina, especially as figured by Whatley and Ballent (1996) and Ballent *et al.* (1998), the Eocene species is not reticulate centrally. This species is the first progonocytherid recorded from the Cenozoic.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 5, ZPAL 12; Telm1 (Eocene).

Family **Hemicytheridae** Puri, 1953
Genus *Australicythere* Benson, 1964
*Australicythere* sp.
(Pl. 4: 3)

**Material**. — One adult right valve, badly preserved.

**Remarks**. — In size and external morphology, mostly its lateral outline and the arrangement of the posterior and ventrolateral ribs, this form is close to *Australicythere* sp. 2, a species distinguished by Echevarría (1998), from the Paleogene of Santa Cruz Province, southern Argentina. The lack of a median rib in front of the muscle scars field in the Eocene Antarctic form separate the species.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 5, Telm1 (Eocene).

Genus *Hornibrookella* Moos, 1965
?*Hornibrookella* sp.
(Pl. 4: 1, 2, 4, ?5)

**Material**. — Two adult carapaces and two adult right valves, rather well preserved.

**Description**. — The specimens large, thick-shelled, subrectangular in lateral outline, with large eye tubercle. Anterior margin broadly rounded, distinctly thickened at the border, the posterior margin somewhat pointed below mid-height, especially in the right valve. The dorsal and ventral margins nearly parallel; the ventral margin indistinctly incised anteriorly. Conspicuous lateral inflation increases posteriorly, where it abruptly disappears close to the posterior margin. The lateral inflation bordered, in its upper part, by subdorsal rib, which is somewhat downturned posteriorly, while anteriorly disappearing below the eye tubercle. Ventrolateral rib bounds the lower part of the lateral valve inflation. Valve surface coarsely reticulate, i.e. covered by thickened muri and deep intermural fossae; these are elongated anteriorly and tend to be fan-shaped, not reaching the anterior margin, while posteriorly, especially in the posteroventral part, they are also elongated and parallel but obliquely arranged. Some variability in details of ornamentation of specimens (mostly anteriorly), included within this species, may result from their different state of preservation.

Hinge holamphidont. Inner lamella narrow, with inner margin parallel to the valve margin. The scarcely visible muscle scars seem to contain few, elongated scars of the main group and three small, round antennal scars.

**Remarks**. — The general appearance, as well as the type of ornamentation and internal features of this species resemble those in representatives of *Hornibrookella* Moos, 1965, especially as reviewed by Liebau (1991) from the Paleogene of northwestern Europe. Additional material is necessary to decide the generic affiliation of this species. The Antarctic species does not seem to resemble closely any known species.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 5, Telm1 (Eocene).

Family **Pectocytheridae** Hanai, 1957
Genus *Munseyella* van den Bold, 1957
*Munseyella* sp.
(Pl. 3: 7)

**Material**. — One adult carapaces, well preserved.

**Remarks**. — The specimen is similar to *Munseyella* sp. described by Szczechura (1971) from the Paleocene of Greenland but is more rectangular in lateral outline and differs in details of the subcentral ornamentation. Small differences in lateral ornamentation as well as in arrangement of the posterodorsal rib also distinguish the present specimen from *Munseyella japonica* (Hanai, 1957) from the shelf seas of China, as illustrated by Zhao and Wano (1988).

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, Telm1 (Eocene).

Genus *Ameghinocythere* Whatley, Moguilevsky, Toy, Chadwick *et* Ramos, 1997
?*Ameghinocythere* cf. *Cytheromorpha*? *flexuosa* Bertels, 1975
(Pl. 3: 4–6)

**Material**. — Three adult carapaces, rather well preserved.

**Remarks**. — In size and shape as well as in the arrangement of the main external morphological features i.e. lateral reticulation tending to merge in frontal part of the carapace, this species is similar to *Cytheromorpha*? *flexuosa*, described by Bertels (1975) from the Late Cretaceous of Argentina. The present material is, however, more evenly inflated and more uniformly reticulate. Along the anterior margin they bear distinct, parallel ribs. The Eocene Antarctic specimens also remind valves recorded by Whatley *et al.* (1996) from the Strait of Magellan, Chile, determined as *Keijia falklandi* (Brady), but differ from specimens, referred to this species, mostly by being not ribbed laterally, described by Whatley *et al*. (1997a, 1998a) from the Atlantic coast of southern South America (see also remarks concerning *Keijia* sp.). The general apppearance as well as the type of ornamentation, especially lack of lateral ribs in the Antarctic specimens are similar to those in *Ameghinocythere reticulata* Whatley, Toy, Chadwick *et* Ramos, 1997, the genus and species so far known from the South West Atlantic. In comparison with this species the Antarctic form is, at first, covered by parallel instead of rather irregularly arranged ribs on the ventral side. Additional data, concerning internal features of the discussed form, are indispensable to decide its generic affiliation. Whatley *et al*. (1997a) compared *Ameghinocythere reticulata* with *Cytheromorpha*? *flexuosa* and suggested their congeneric affiliation.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 2, ZPAL 5; Telm1 (Eocene). *Cytheromorpha*? *flexuosa* Bertels, 1975 is known from the Late Cretaceous of Argentina.

Genus *Keijia* Teeter, 1975
?*Keijia* sp.
(Pl. 3: 8)

**Material**. — One adult left valve, rather well preserved, obscured from inside.

**Description**. — Small, elongate, subrectangular in lateral outline, compressed laterally, bearing spines on the posterior margin. Thin lateral ribs tend to follow valve outline and cross its central part; among these latter most characteristic seem subdorsal and median ribs which are joined by the vertical posterior rib. Coarse, irregular reticulation is developed over the entire valve surface. Internal features obscured.

**Remarks**. — The specimen is similar to *Keijia falklandi* (Brady, 1880) described from the Falkland Islands, also recorded by Whatley *et al*. (1997a) from the South West Atlantic, but is more evenly compressed laterally, not elevated along the anterior and the posterior margins, and differs in the details of ornamentation; the specimens from Brady's collection, assigned to *Cythere falklandi*, reviewed by Puri and Hullings (1976) seem to be markedly variable. Almost identical form, as that referred by Whatley *et al.* (1997a) to *Keijia falklandi* but assigned to *Munseyella fuegoensis* Echevarría, 1987, was recorded by Bertels and Martinez (1997) from the Holocene of Argentina; according to Whatley *et al.* (1998) these species are conspecific. The specimens figured Bertels and Martinez (l.c.), however, distinctly differ, mostly in ornamentation, from the holotype of this latter species.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, Telm1 (Eocene).

Family **Loxoconchidae** Sars, 1925
Genus *Kuiperiana* Bassiouni, 1962
*Kuiperiana* sp.
(Pl. 3: 9, 10)

**Material**. — One adult carapace and one juvenile carapace, well preserved.

**Remarks**. — The size, general external appearance, as well as the type of ornamentation allow to suppose that the specimens belong to *Kuiperiana* (synonymous with *Myrena* Neale, 1967). They differ from *Loxoconcha similis* Bertels, 1973, described from the Paleocene of Argentina, in being a little smaller, more rounded in lateral view and not pointed posteriorly. They also seem close to *Kuiperiana meridionalis* (Müller, 1908), a Recent species known from the Antarctica. In comparison with the representatives of that species, figured by Müller (1908) and reproduced by Hartmann (1997), the Eocene specimens seem more densely and more deeply reticulated. When compared with the specimens referred to *Kuiperiana meridionalis* by Whatley *et al*. (1998b), from the Halley Bay (Antarctica), the Eocene form somewhat differs in lateral view, mostly in its posterior part, and lacks ventrolateral rib. In comparison with specimen described by Błaszyk (1987), from the Oligocene of King George Island (South Shetland Islands), referred to *Loxoconcha rolnickii*, the present material is more evenly and more pronouncedly reticulated; see also Whatley *et al.* (1998b: p. 128).

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 1, ZPAL 5; Telm1 (Eocene).

Family unknown
Gen. et sp. indet.
(Pl. 5: 6–8)

**Material**. — Two adult carapaces, one juvenile carapace, and one juvenile right valve, rather badly preserved, abraded.

**Description**. — The carapace of medium size, oblong and subovate in side view, with weakly marked cardinal angles, indistinct eye tubercle, and almost uniform, moderate lateral inflation. The left valve slightly larger than right and overlapping it along almost the entire margin. The anterior margin obliquely and broadly rounded, the posterior margin weakly truncate, narrowly rounded. The dorsal and ventral margins almost straight, slightly converging to the rear and bearing tiny dents. The entire valve surface rather regularly reticulate; the meshes of reticulation tend to converge near the dorsal margin, while arranged in parallel rows along the anterior and ventral margins. Internal features unknown.

**Remarks**. — Presented external features seem unlike those of the so far known ostracod genera and species.

**Occurrence**. — Seymour Island, La Meseta Formation: ZPAL 12, Telm1 (Eocene).

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The following abbreviations are used: a – adult, j – juvenile, C – carapace, RV – right valve, LV – left valve.

PLATE 1

?*Maddocksella* sp. . . . . 163

Fig. 1. aC; *a* right side, *b* oblique ventral view, × 60, ZPAL O.49/48, ZPAL 2.
Fig. 2. aC; *a* right side, *b* ventral view, × 60, ZPAL O.49/21, ZPAL 1.
Fig. 3. aC; *a* right side, *b* ventral view, × 60, ZPAL O.49/19, ZPAL 1.
Fig. 4. aC; *a* right side, *b* ventral view, × 55, ZPAL O.49/51, ZPAL 1.
Fig. 5. aC; *a* right side, *b* ventrolateral view, × 50, ZPAL O.49/52, ZPAL 1.
Fig. 6. aC; left side, × 60, ZPAL O.49/20, ZPAL 1.

*Propontocypris* sp. . . . . 164

Fig. 7. aC; left side, × 55, ZPAL O.49/24, tentatively referred to *Propontocypris* sp., ZPAL 1.

*Argilloecia* cf. *A. mesa* McKenzie, Reyment *et* Reyment, 1993 . . . . . 163

Fig. 8. aC; *a* left side, *b* right side, *c* dorsal view, × 50, ZPAL O.49/8, ZPAL 5.

*Phlyctenophora* sp. . . . . 163

Fig. 9. aC; *a* left side, × 56, *b* ventral view, × 60, *c* dorsal view, *d* right side, × 56, ZPAL O.49/1, ZPAL 1.
Fig. 10. aC; *a* right side, *b* ventral view, × 60, ZPAL O.49/41, ZPAL 5.

Telm1, La Meseta Formation (Eocene), Seymour Island.

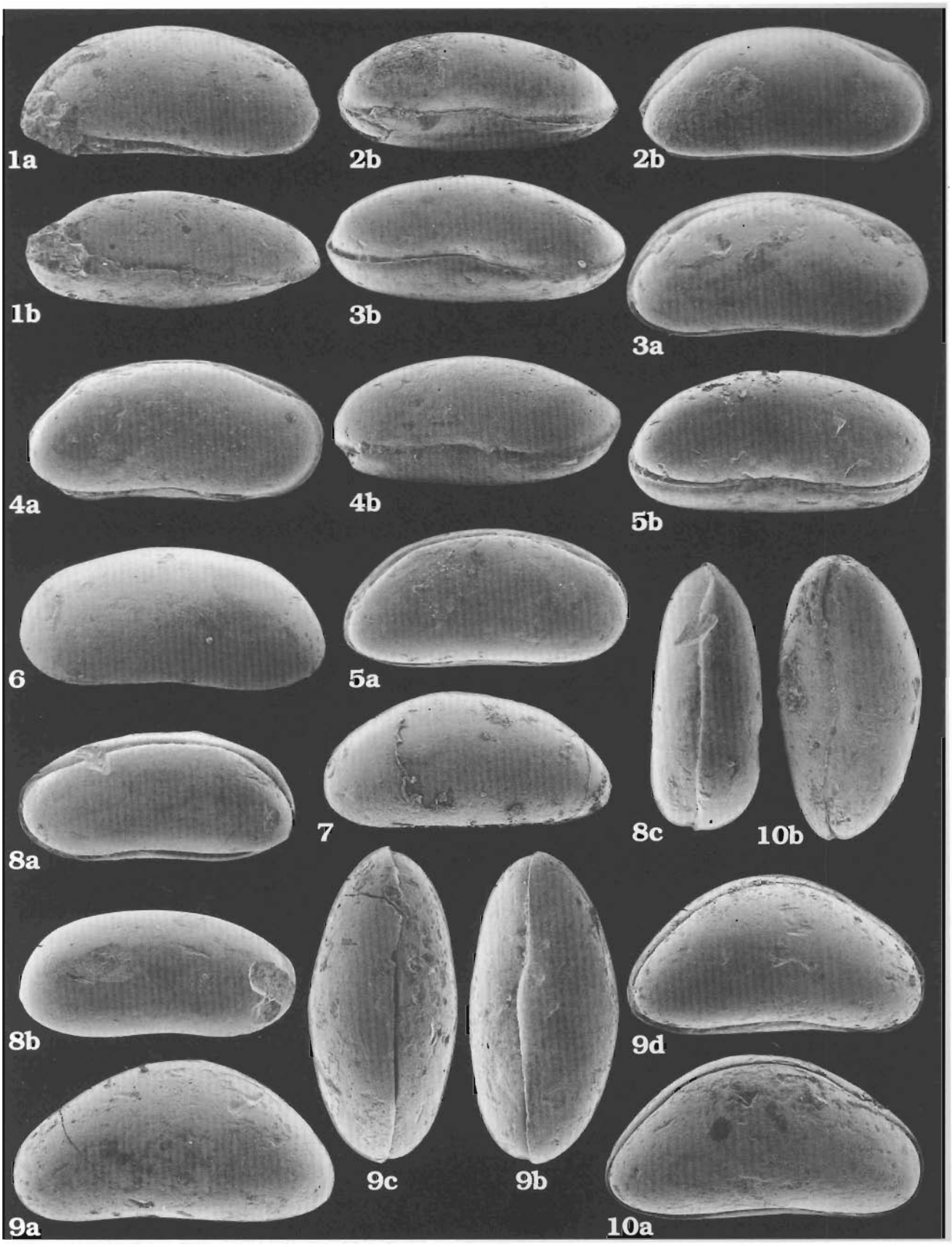


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PLATE 2

*Wichmannella* cf. *W. meridionalis* Bertels, 1969 . . . . . 164

Fig. 1. aRV; seen from outside, ×, 45, ZPAL.O.49/54, ZPAL 12.
Fig. 2. aC; right side, × 45, ZPAL O.49/5, ZPAL 12.
Fig. 3. aC; damaged carapace showing inner side of right valve, × 45, ZPAL O.49/55, ZPAL 12.
Fig. 4. aLV; *a* seen from inside, *b* seen from outside, *c* dorsal view, *d* ventral view, × 45, ZPAL O.49/13, ZPAL 12.

*Majungaella antarctica* sp. n. . . . . 165

Fig. 5. aC; *a* somewhat oblique ventral view, × 60, *b* ventral view, *c* left side, *d* dorsal view, *e* right side, × 55, ZPAL O.49/7, ZPAL 12.
Fig. 6. aLV; ventral view, × 60, ZPAL O.49/31, ZPAL 5.
Fig. 7. aRV, holotype; seen from outside, × 60, ZPAL O.49/33, ZPAL 5.
Fig. 8. aRV, paratype; *a* seen from inside, *b* oblique view of inner side, × 75, ZPAL O.49/32, ZPAL 5.

Telm1, La Meseta Formation (Eocene), Seymour Island.

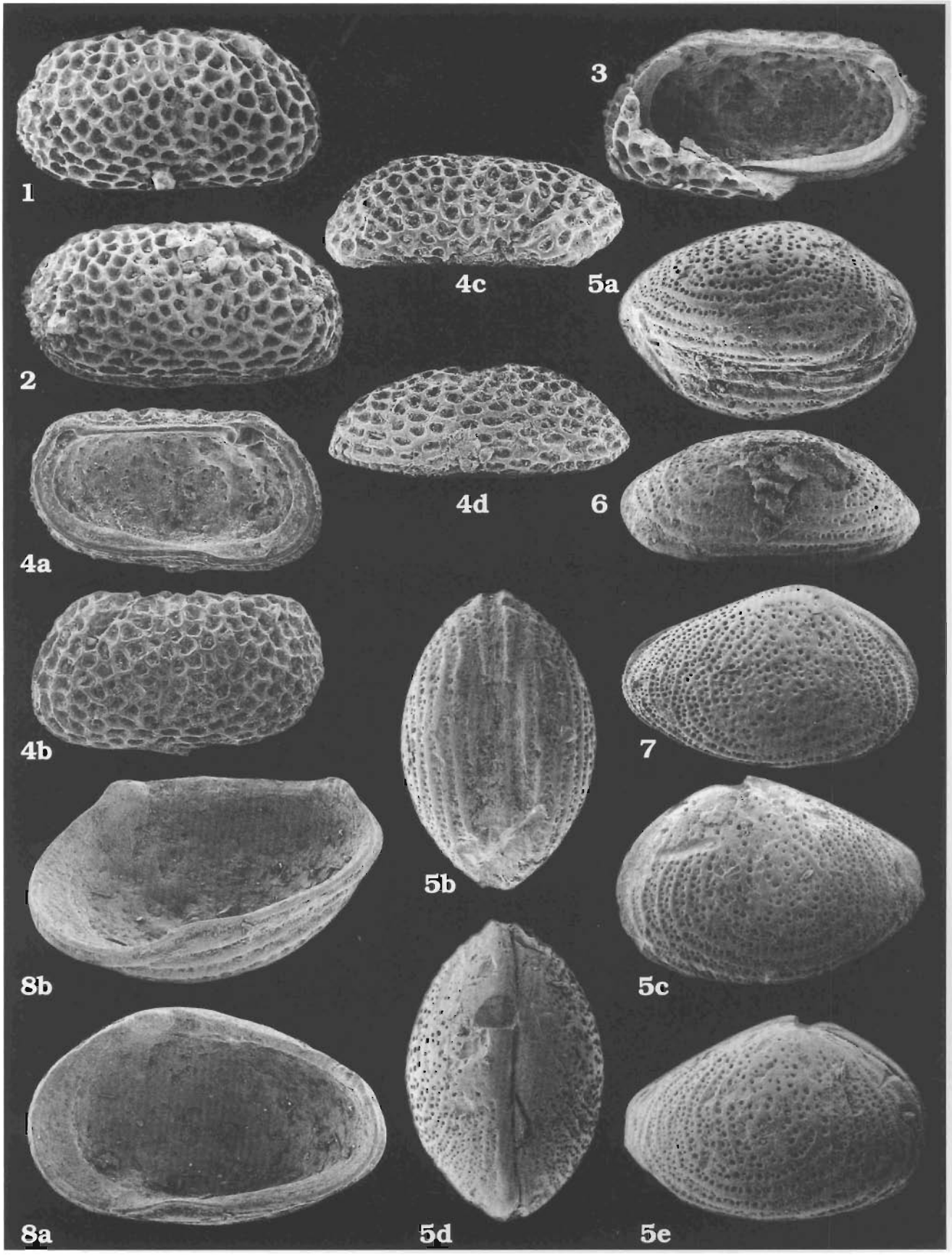


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PLATE 3

*Propontocypris* sp. . . . . 164

Fig. 1. Damaged aRV; *a* seen from inside, *b* seen from outside, × 65, ZPAL O.49/3, ZPAL 5.
Fig. 2. Damaged aRV; *a* seen from inside, *b* oblique ventral view, × 55, ZPAL O.49/25, ZPAL 1.
Fig. 3. jRV; seen from outside, × 75, ZPAL O.49/23, tentatively referred to *Propontocypris* sp., ZPAL 5.

?*Ameghinocythere* cf. *Cytheromorpha*? *flexuosa* Bertels, 1975 . . . . . 167

Fig. 4. aC; *a* dorsal view, *b* ventral view, *c* right side, × 90, ZPAL O.49/49, ZPAL 2.
Fig. 5. aC; right side, × 86, ZPAL O.49/40, ZPAL 2.
Fig. 6. aC; left side, × 86, ZPAL O.49/42, ZPAL 5.

*Munseyella* sp. . . . . 167

Fig. 7. Damaged aC; *a* oblique ventrolateral view, *b* left side, *c* oblique dorsal view, *d* right side, × 60, ZPAL O.49/53, ZPAL 1.

?*Keijia* sp. . . . . 168

Fig. 8. aLV; *a* oblique dorsal view, *b* ventral view, *c* seen from outside, × 40, ZPAL O.49/44, ZPAL 1.

*Kuiperiana* sp. . . . . 168

Fig. 9. jC; right side, × 45, ZPAL O.49/26, ZPAL 1.
Fig. 10. aC; *a* ventral view, *b* left side, × 60, ZPAL O.49/35, ZPAL 5.

Telm1, La Meseta Formation (Eocene), Seymour Island.

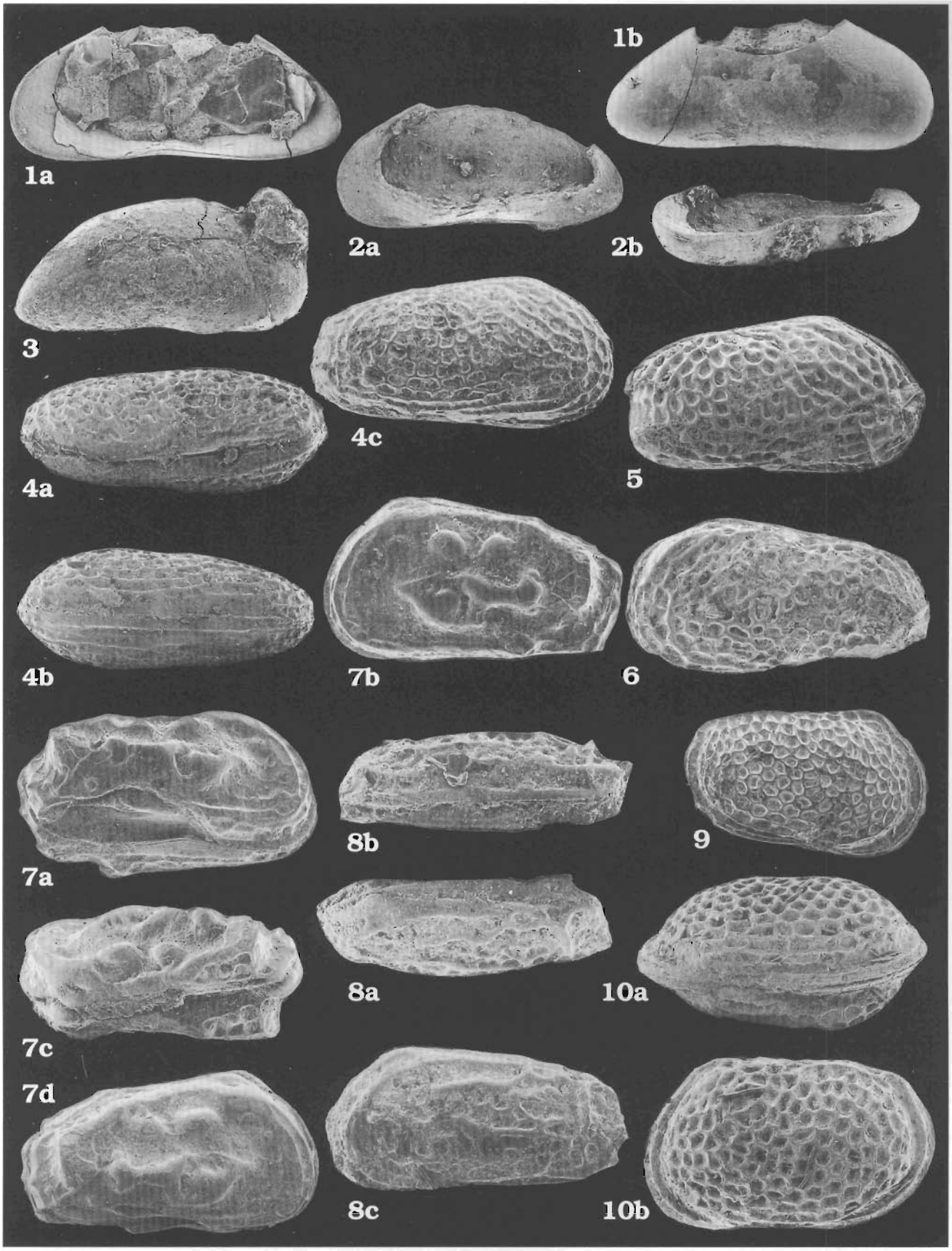


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PLATE 4

?*Hornibrookella* sp. . . . . 166

Fig. 1. aC; *a* right side, *b* left side, *c* ventral view, *d* dorsal view, × 45, ZPAL O.49/37, ZPAL 5.
Fig. 2. aRV; *a* seen from outside, *b* oblique view of inner side, *c* seen from inside, *d* outer ventrolateral view, × 45, ZPAL O.49/11, ZPAL 5.
Fig. 4. aRV; *a* somewhat oblique outer view, *b* laterodorsal view, *c* ou ter view, × 45, ZPAL O.49/39, ZPAL 5.
Fig. 5. aC; *a* left side, *b* dorsal view, × 60, ZPAL O.49/46, tentatively referred to ?*Hornibrookella* sp., ZPAL 5.

*Australicythere* sp. . . . . 166

Fig. 3. Damaged aRV; *a* outer side, *b* dorsal view, *c* ventrolateral view, × 45, ZPAL O.49/36, ZPAL 5.

*Actinocythereis* cf. *A. indigena* Bertels, 1969 . . . . . 164

Fig. 6. Fragment of aRV; *a* outer ventrolateral view, *b* outer view, × 60, ZPAL O.49/18, ZPAL 11.

Telm1, La Meseta Formation (Eocene), Seymour Island.

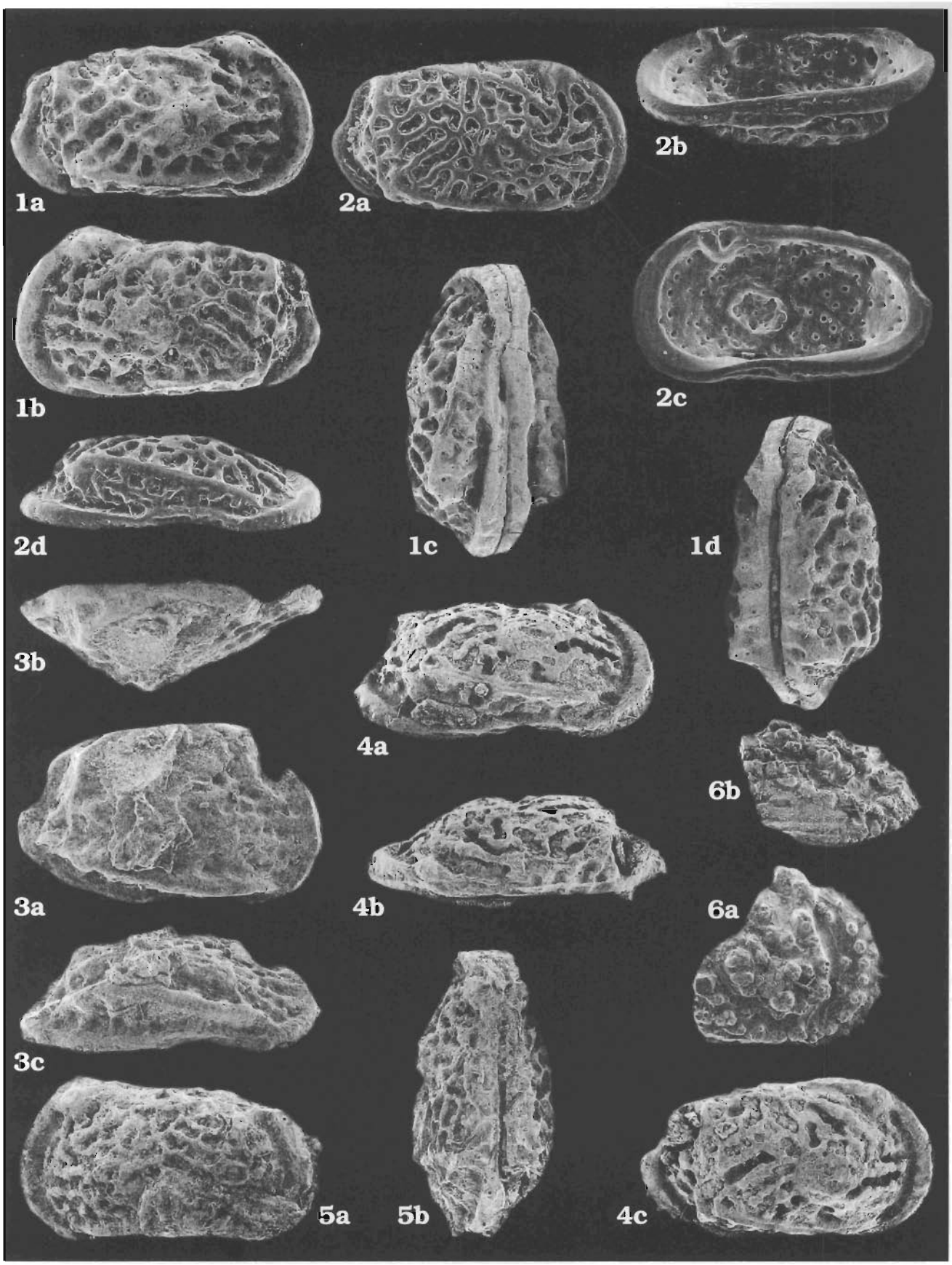


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PLATE 5

?*Echinocythereis hartmanni* sp. n. . . . . 165

Fig. 1. aRV; seen from outside, × 50, ZPAL O.49/34, ZPAL 5.
Fig. 2. aC; paratype, left side, × 50, ZPAL O.49/47, ZPAL 1.
Fig. 3. aC; holotype; *a* dorsal view, *b* left side, *c* oblique view of ventral side, × 50, *d* details of ornamentation, × 240, ZPAL O.49/27, ZPAL 1.
Fig. 4. aLV; *a* ventrolateral external view, *b* seen from outside, × 50, ZPAL O.49/22, ZPAL 1.

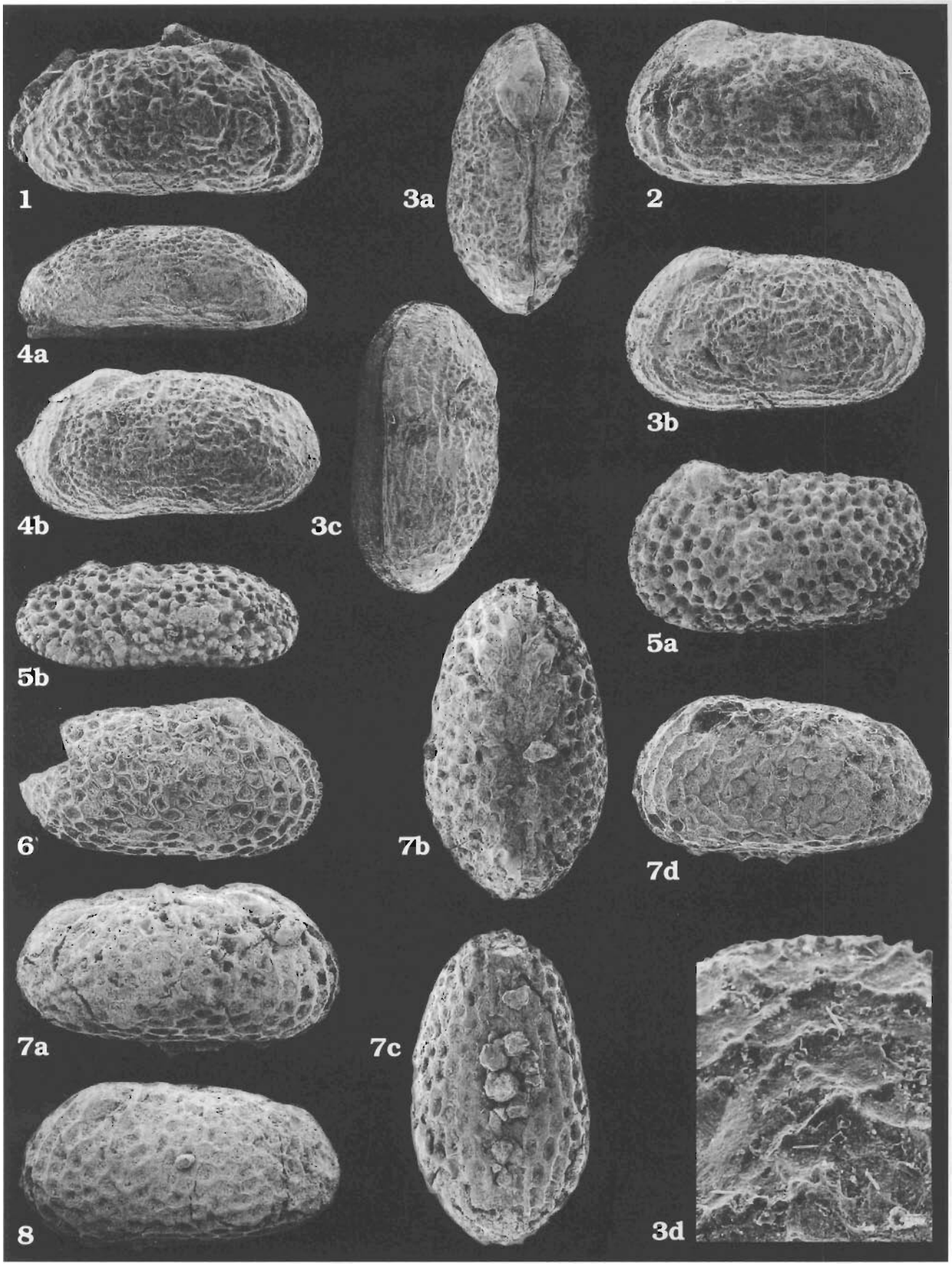
*Henryhowella* sp. . . . . 164

Fig. 5. aLV; *a* seen from outside, *b* lateroventral view, × 50, ZPAL O.49/30, ZPAL 5.

Genus et species indet. . . . . 168

Fig. 6. Damaged jRV; seen from outside, × 60, ZPAL O.49/12, ZPAL 12.
Fig. 7. aC; *a* right side, *b* dorsal view, *c* ventral view, *d* left side, × 45, ZPAL O.49/4, ZPAL 12.
Fig. 8. aC; left side, × 45, ZPAL O.49/56, ZPAL 12.

Telm1, La Meseta Formation (Eocene), Seymour Island.

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