

OSTRACODS FROM THE *PECTEN* CONGLOMERATE (PLIOCENE) OF COCKBURN ISLAND, ANTARCTIC PENINSULA

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Sixteen species of Ostracoda, belonging to 15 genera and 8 families, representing Podocopina only, are described from the Pliocene *Pecten* Conglomerate of Cockburn Island, Antarctic Peninsula. Four species are referred to still living species, four are regarded as close to those inhabiting Antarctic waters and the south-west Atlantic today, while the remainder appear to be endemic. The fauna suggests an environment similar to that presently existing in Antarctica. Some of the genera i.e. *Patagonacythere* and *Australicythere*, described here for the first time from the Pliocene of the Southern Hemisphere, are known from the Plio-Pleistocene of the Northern Hemisphere. They indicate bipolar distribution of the ostracod faunas in the Pliocene.

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

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INTRODUCTION

Because there is no earlier published account of Neogene Antarctic ostracods, we felt it important to publish this rare fauna, despite its poor preservation. The material comprises two ostracod collections from the Pliocene *Pecten* Conglomerate of Cockburn Island, off the Antarctic Peninsula (Text-fig. 1). One of the collections (numbered ZPAL O.XXXVII/1–19) and housed in the Institute of Paleobiology of the Polish Academy of Sciences in Warszawa, was collected by Andrzej GAŹDZICKI, during the Argentine–Polish Antarctic Expedition to Seymour (Marambio) Island in the 1987–1988 austral summer. The second collection (numbered Ar 54414–54435) and deposited in the Naturhistoriska Riksmuseet in Stockholm was taken during the Swedish South Polar Expedition (1901–1903) led by Otto NORDENSKJÖLD. The Swedish collection was to some extent elaborated by G.W. MÜLLER (see HENNIG 1910, p. 10).

BŁASZYK (1987) described an ostracod assemblage from the so-called “*Pecten* Conglomerate” *i.e.* the Low Head Member of the Polonez Cove Formation on King George Island, South Shetland Islands

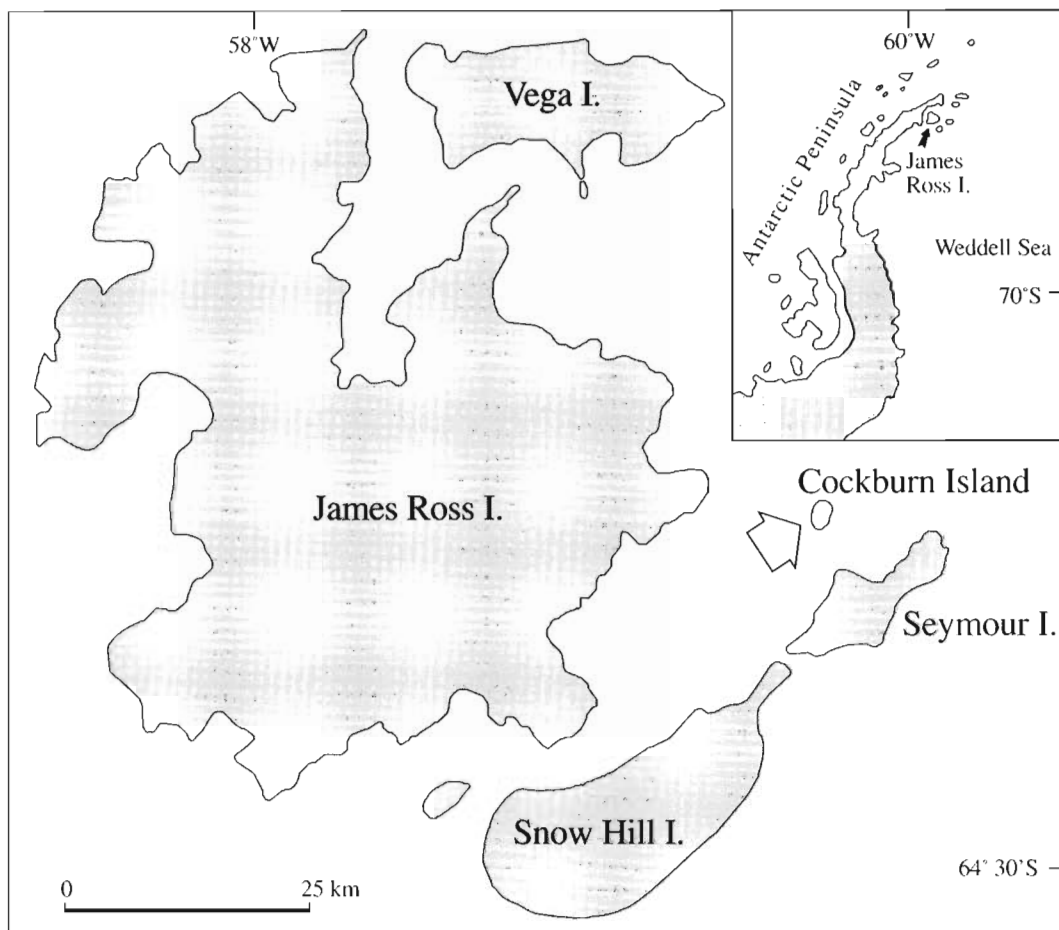


Fig. 1

Location map for James Ross Island area, Antarctic Peninsula. Cockburn Island arrowed.

(BIRKENMAJER 1982), attributed to Pliocene (BARTON 1965) and later corrected to be of Oligocene age (GAŹDZICKA and GAŹDZICKI 1985; BIRKENMAJER and GAŹDZICKI 1986).

The pectinid-bearing conglomerate from King George Island does not correlate with the *Pecten* Conglomerate of Cockburn Island, which is regarded as Pliocene in age (BIRKENMAJER *et al.* 1991; GAŹDZICKI and WEBB 1996 this volume). The ostracod assemblages from these two localities are quite different in their taxonomical composition; one species is (tentatively) referred to a genus common between the ostracod assemblages from the *Pecten* Conglomerates of the Cockburn Island and the Polonez Cove Formation of King George Island. The genus *Cytheropteron*, found in the compared ostracod assemblages, is represented by various species.

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elaboration of the material collected by the 1901–03 Swedish South Polar Expedition. SEM photographs were taken at the Electron Microscopy Laboratory of the Institute of Paleobiology of the Polish Academy of Sciences, Warszawa.

MATERIAL

The ostracods collected by A. GAŹDZICKI during the Argentine–Polish Antarctic Expedition (1987–88) consist of 19 specimens, including carapaces and valves of adult and juveniles. In many cases these are badly preserved, *i.e.* crushed and encrusted with secondary mineralisation. In contrast to the co-occurring benthic foraminifera (see GAŹDZICKI and WEBB 1996 this volume), ostracods are very rare.

While the ostracods collected by the 1901–03 Swedish South Polar Expedition are better preserved than those in our collection, they are rather less diverse. In the original Swedish collection there are 30 specimens, including carapaces and valves of adult and juvenile forms. G.W. MÜLLER, as mentioned by HENNIG (1910), recognized within this collection: *Cythereis speyeri* BRADY, *Cythereis* sp. gr. *margaritifera* BRADY, *Cythereis* sp. gr. *convexa* BAIRD, and *Cytheropteron* or *Loxoconcha*.

GEOLOGICAL AND STRATIGRAPHICAL SETTING

Cockburn Island lies in the northwestern Weddell Sea at the northern end of the Antarctic Peninsula, some 8 km from Seymour Island (Text-figs 1–2).

Cretaceous and Tertiary strata and basalt flows are exposed on Cockburn Island. Fossil-bearing shallow marine successions of the Upper Cretaceous López de Bertodano and the Eocene La Meseta Formations are exposed in the lower slopes of the island (ASKIN *et al.* 1991; BARNES and RIDING 1994).



Fig. 2.

Cockburn Island viewed from the López de Bertodano Bay, Seymour Island. Arrow shows the *Pecten* Conglomerate collecting site. Photograph taken by A. GaŹDZICKI, January 1988.

During the Argentine–Polish Antarctic Expedition in the austral summer of 1987–1988, Andrzej GAŹDZICKI visited Cockburn Island. The purpose of this visit was to locate *in situ* outcrops of the *Pecten* Conglomerate and to sample for micropaleontological and geochemical studies (see DOKTOR *et al.* 1988).

The *Pecten* Conglomerate is preserved on an erosional horizontal bench in the Pliocene basalts located approximately 250 m above sea level (Text-fig. 2, see also ANDERSSON 1906; ZINSMEISTER and WEBB 1982; GAŹDZICKA and GAŹDZICKI 1994; GAŹDZICKI and WEBB 1996 this volume). The conglomerate consists of poorly sorted conglomeratic and gravely sandstones. The clasts in the conglomerate are mostly basaltic in composition. The name of the unit is taken from the bivalve *Chlamys anderssoni* (HENNIG, 1910) which occurs in abundance at the type locality.

The K/Ar radiometric data obtained from the basalts which underlie the *Pecten* Conglomerate (WEBB and ANDREASEN 1986; R.A. KELLER personal communication, 1992) as well as the studies of diatoms (HARWOOD 1986) and benthic foraminifera (GAŹDZICKI and WEBB 1996 this volume) recognized in the conglomerate, point to a late Pliocene age.

The rich and diverse biota of the *Pecten* Conglomerate indicate interglacial conditions during the deposition of this sequence (GAŹDZICKI and WEBB 1996 this volume).

PALEOBIOGEOGRAPHY

Of the sixteen ostracod species recognized in the studied samples, four: *Copytus caligula* SKOGSBERG, 1939; *Pseudocythereis spinifera* SKOGSBERG, 1928; *Australicythere polylyca* (G.W. MÜLLER, 1908) and *Antarctiloconochoa frigida* (NEALE, 1967), still inhabit Antarctic waters today and are restricted to that area; four species: *Procythereis* cf. *robusta* SKOGSBERG, 1928; *Patagonacythere* cf. *longiducta* (SKOGSBERG, 1928), *Patagonacythere* cf. *tricostata* HARTMANN, 1962 and *Hemicytherura* cf. *reticulata* HARTMANN, 1962, are regarded as close to those still living in Antarctica or the southeastern Atlantic, while the remainder seem to be endemic. These species belong to the cosmopolitan genera *Leptocythere*, *Semicytherura* or *Hemicytherura*, or to genera restricted to the Southern Hemisphere; i.e. *?Loxocythere*, *?Meridionalicythere*, *Antarctiloconochoa* and *?Loxoreticulatum*.

There are, however, also representatives of *Australicythere*, i.e. *A. polylyca* (G.W. MÜLLER, 1908), *Patagonacythere*, i.e. *Patagonacythere* cf. *longiducta* (SKOGSBERG, 1928) and *Patagonacythere* cf. *tricostata* HARTMANN, 1962) as well as *?Rabilimis*, i.e. *?Rabilimis* sp. Among these forms the representatives of *Patagonacythere* and *Australicythere* seem to be particularly important as biogeographical indicators; tentatively determined *Rabilimis* appear to be a doubtful paleobiogeographical marker and it is not employed here.

The genus *Australicythere* occurs in the Eocene and Upper Oligocene–Lower Miocene of Argentina, in the Miocene deposits of southern Brazil (see KELBOWICZ 1988) and in the Pliocene of Iceland, while *Patagonacythere* is recorded in the Oligocene of southern Argentina (ECHEVARRIA 1991), the late Miocene (IRIZUKI 1994) as well as the Plio-Pleistocene of Japan (CRONIN and IKEYA 1987). KELBOWICZ (1988) also mentioned records of *Copytus* in the Upper Oligocene–Lower Miocene deposits of southern Argentina (Austral Basin) and the Lower Miocene of southern Chile, while BŁASZYK (1987) described *Copytus* from the Oligocene Polonez Cove Formation of King George Island (South Shetland Islands).

All these latter records suggest that migration routes of the late Neogene ostracods could have simultaneously followed Atlantic as well as the Indo-Pacific pathways. They may also suggest that ostracods typical of the Pliocene and present-day environments of the Antarctica (mostly the circum-Antarctic shelf) appeared much earlier *i.e.* in the late Paleogene in the southern Atlantic. COLES *et al.* (1990) indicated, that there were numerous Cainozoic deep-sea ostracod species common between the North Atlantic and the Pacific; these common genera, according to these authors, appeared in the Eocene of the North Atlantic. The above mentioned records argue, moreover, for the direct bipolar exchange of at least some ostracod taxa (especially the deeper water ones) *via* Atlantic, following old, marine pathways known at least since Eocene. COLES *et al.* (1990) proposed the Drake Passage for the Neogene interchange of ostracods between the Atlantic and Pacific. SZCZETCHURA (1994, 1995) suggested the Middle Miocene exchange of the Indo-Pacific and North Atlantic deep-water ostracod faunas *via* southern Atlantic, excluding the Tethys as a route.

PALEOECOLOGY

Analysis of the environmental parameters, mostly the depth and the water temperatures preferred by Recent members of some of the ostracod species identified, permit the reconstruction of the environmental parameters of the Pliocene ostracod assemblage from Cockburn Island. Recent representatives of *Copytus caligula*, *Pseudocythereis spinifera*, *Australicythere polylyca* and *Antarctiloxoconcha frigida* live on the Antarctic shelf at depths between 60–200 m and temperature less than 2°C (HARTMANN 1986, 1990). *Patagonacythere* and *Loxoreticulatum* include species inhabiting the shelf areas, including today's Antarctic shelf (BENSON 1964; HARTMANN 1986, 1990). *Hemicytherura* as well as *Semicytherura* and *Cytheropteron* include species of wide temperature and bathymetrical ranges; *Cytheropteron*, however, is known to prefer deeper waters. Similar environmental conditions *i.e.* close to those existing now in the Antarctic outer shelf, were probably characteristic of the Pliocene ostracods from Cockburn Island (see also GAŹDZICKI and WEBB 1996 this volume). KĘLBOWICZ (1987), working on the early Neogene microfauna of Argentina (Austral Basin), stated cold water environment of the ostracod assemblage containing, among others, *Australicythere* and *Copytus*.

The above proposition, concerning the paleoenvironment (mostly depth) of the studied ostracods, seems to be supported by the rather large diversity of the studied ostracods.

SYSTEMATIC PALEONTOLOGY

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

Family **Cytheridae** BAIRD, 1850
 Genus *Loxocythere* HORNIBROOK, 1953
 ?*Loxocythere* sp.
 (Pl. 40: 3–5)

Material. — One jLV from the Polish collection, two aRV from the Swedish collection.

Remarks. — In comparison with published *Loxocythere*, especially the Recent *Loxocythere kingi* HORNIBROOK, 1953, from New Zealand, the *Pecten* Conglomerate (Pliocene) form is more triangular in lateral outline and lacks the lateroventral inflation overhanging the ventral margin. It seems also to be more concentrically pitted and delicately ribbed along the margins both posteriorly and anteriorly. Internally, the Pliocene form has rather narrow duplicature along the entire free margin.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

Family **Neocytherideididae** PURI, 1957
 Genus *Copytus* SKOGSBERG, 1939
Copytus caligula SKOGSBERG, 1939
 (Pl. 39: 1)

1939. *Copytus caligula* SKOGSBERG new species; SKOGSBERG, p. 415, text-figs 1–13.

1986. *Copytus caligula* SKOGSBERG, 1939; HARTMANN, p. 156, text-fig. 17, pl. 1: 1–4.

1990. *Copytus caligula* SKOGSBERG, 1939; HARTMANN, p. 203.

Material. — One aC from the Swedish collection.

Remarks. — The external features of this form seem not to differ from those of living representatives of the species. In the Pliocene specimen, however, in the right valve, there are 2–3 weak anteroventral ribs. In comparison with *Copytus elongatus* BENSON, 1964, a Recent species described from the Antarctica, found there also by NEALE (1967) and HARTMANN (1986, 1990), it is only slightly less elongated.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island; Recent of Antarctica, *i.e.* South Georgia (SKOGSBERG 1939), Elephant Island (HARTMANN 1986), and the Antarctic Peninsula region (HARTMANN 1990); it also occurs along the southern coast of Brazil at depth of at some 250 m (R. WHATLEY personal communication, 1995).

Family **Leptocytheridae** HANAI, 1957Genus *Leptocythere* SARS, 1925? *Leptocythere* sp.

(Pl. 40: 1–2)

Material. — Two ?aC from the Polish collection.

Remarks. — External appearance of specimens resembles *Leptocythere*. Internal features obscured. Carapaces elongated, with nearly parallel dorsal and ventral margins, distinctly rounded anterior margin and rather abruptly truncated posterior margin. They are weakly and almost evenly inflated with a tubercle-like inflation in the anterodorsal part. The carapace surface is regularly and densely pitted and covered by tiny ribs along the anterior, ventral and posterior margins. The free margin is bordered by a rim, best developed posterodorsally. In comparison with specimens of *Leptocythere patagonica* HARTMANN, 1962, a Recent species described by HARTMANN (1962) from Chile, the Magellan Strait and Argentina, and those described by WHATLEY and MOGUILVSKY (1975) from Argentina, it has a more distinct anterodorsal inflation and a deep sulcus. WHATLEY *et al.* (1995) placed *Leptocythere patagonica* HARTMANN in the synonymy of *L. mosleyi* (BRADY, 1880)

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.Family **Trachyleberididae** SYLVESTER-BRADLEY, 1948Genus *Pseudocythereis* SKOGSBERG, 1928*Pseudocythereis spinifera* SKOGSBERG, 1928

(Pl. 41: 1–2)

1928. *Pseudocythereis spinifera* SKOGSBERG new species; p. 130, text-fig. 22: 1–5.1990. *Pseudocythereis spinifera* SKOGSBERG, 1928; HARTMANN, p. 203, pl. 1: 7.**Material.** Two aC and one aLV from the Swedish collection.

Remarks. — The adult specimens referred to the species vary somewhat in the details of their ornamentation *i.e.* shape and arrangement of reticulæ (meshes, fossae), and, at the same time, and to the same extent, they differ a little from specimens of *Pseudocythereis spinifera* SKOGSBERG, 1928, especially as illustrated by HARTMANN (1990).

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island. *Pseudocythereis spinifera*, described by SKOGSBERG (1928) as Recent form from the southern Atlantic, was also found by HARTMANN (1986, 1990) in the South Shetland Islands as well as the Antarctic Peninsula area.

Family **Hemicytheridae** PURI, 1953Genus *Rabilimis* HAZEL, 1967? *Rabilimis* sp. (Pl. 42: 1–7)

Material. — Four aC and one aLV from the Swedish collection, and one aC and one LV from the Polish collection.

Remarks. — Specimens seem to be somewhat similar to those referred to *Rabilimis paramirabilis*. Plio-Pleistocene specimens of this latter species were described by SWAIN (1963) and BROUWERS and MARCINOVICH (1987) from Alaska, and from the Plio-Pleistocene of the Eastern Beaufort Sea by SIDDIQUI (1988). In comparison with this latter species, the Pliocene form from Antarctica is, at first, less triangular in its lateral outline, generally has a less distinct anterior cardinal angle, and is reticulated on the entire valve surface with elements of ornamentation in the lateroventral part of the valve which are not parallel to its margin. According to Dr. Q. SIDDIQUI (personal communication), since the muscle scars of the specimens are unknown, it would be better to refer them to *Rabilimis* only tentatively. Prof. R. WHATLEY (personal communication) suggests that this form is probably congeneric with a new genus which WHATLEY *et al.* have described (in press) from Patagonia.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.Genus *Procythereis* SKOGSBERG, 1928*Procythereis cf. robusta* SKOGSBERG, 1928

(Pl. 39: 2–3)

Material. — One aC and one aLV from the Swedish collection.

Remarks. — The specimens are badly preserved. However, they seem to have uniformly distributed pits over the entire valve surface, as in the Recent Antarctic specimens, referred to by SKOGSBERG (1928) as *Cythereis (Procythereis) robusta*. In comparison with specimen figured by SKOGSBERG (*l.c.*) our *Procythereis cf. robusta* individuals seem to be less distinctly ribbed posteriorly and ventrolaterally. Moreover, the right valves of the compared species differ, right valve of *Procythereis cf. robusta* species being more rectangular. Discussion concerning differences between *Hemicythere kerguelenensis* (BRADY, 1880), *Hemicythere sp. aff. H. kerguelenensis* (BRADY, 1880) described by BENSON (1964) and *Cythereis (Procythereis) robusta* SKOGSBERG (1928), *i.e.* all these Recent species from the Antarctic area, is given by BENSON (1964). According to this last author specimens with the most uniform puncta are typical of the more northern populations *i.e.* beyond the shelves around Antarctica. HARTMANN (*l.c.*) referred *Procythereis robusta* SKOGSBERG, 1928, to the subgenus *Serratocythereis*.

Distribution. — *Pecten Conglomerate* (Pliocene) from Cockburn Island. *Procythereis robusta* SKOGSBERG (1928), described as a Recent species from South Georgia, was found later by HARTMANN (1986, 1990) in Antarctica, in the South Shetland Islands and around the Antarctic Peninsula.

Genus *Australicythere* BENSON, 1964
Australicythere polylyca (G.W. MÜLLER, 1908)
 (Pl. 43: 1–5)

1908. *Cythereis polylyca* MÜLLER n. sp.; p. 135, text-figs 1–4, pl. 17: 1, 5–6.

1964. *Australicythere polylyca* (MÜLLER), 1908; BENSON, p. 24, text-figs 15–17, pl. 2: 10, pl. 4: 1–7.

1967. *Australicythere polylyca* (MÜLLER) 1908; NEALE, p. 36, text-fig. 12, pl. 4: e, k–n.

1990. *Australicythere polylyca* (G.W. MÜLLER, 1908); HARTMANN, p. 204, pl. 1: 8–9; pl. 2: 10–15.

Material. — One aC and two aRV from the Swedish collection, and one aC and one aRV from the Polish collection, all rather badly preserved.

Remarks. — The specimens referred to the species vary somewhat in the details of their ornamentation. They also differ slightly from specimens referred to *Australicythere polylyca* (BENSON 1964; HARTMANN 1986, 1990). In comparison with (some) of BENSON's and HARTMANN's (*l.c.*) specimens, they generally are lacking the fine, almost vertical posterior rib. Some of the specimens illustrated by BENSON (*l.c.* pl. 5: 4) also lack this rib.

Distribution. — *Pecten Conglomerate* (Pliocene) from Cockburn Island. Recent of Antarctica *i.e.* lat. 65°S; long. 90°E (*Gauss Station*) (*cf.* NEALE 1967), McMurdo Sound (BENSON 1964), Halley Bay (Weddell Sea) see NEALE (1967), and the Antarctic Peninsula area (HARTMANN 1990).

Genus *Patagonacythere* HARTMANN, 1962
Patagonacythere cf. longiducta longiducta (SKOGSBERG, 1928)
 (Pl. 44: 2, 4, 6; ?Pl. 44: 3, 5)

Material — One aC, aLV from the Swedish collection, and one aC, one aRV and one aLV from the Polish collection.

Remarks. — The *Pecten Conglomerate* specimen seems to differ slightly from the Recent Antarctic material, referred to *Patagonacythere longiducta* (SKOGSBERG) by HARTMANN (1990). In comparison with HARTMANN's adult specimens the present material has a distinct, almost vertical ridge joining the posterior end of the ventrolateral rib and the posterodorsal loop. This feature is characteristic of SKOGSBERG's form. Similar differences are observed between specimens collected in McMurdo Sound (Ross Sea) by BENSON (1964) and also figured by SKOGSBERG (1928), and this allowed BENSON (*l.c.*) to erect the new subspecies, *P. longiducta antarctica*.

Distribution. — *Pecten Conglomerate* (Pliocene) from Cockburn Island. *Patagonacythere longiducta longiducta* is known as a Recent form from South Georgia (SKOGSBERG 1928) and the Antarctic Peninsula (HARTMANN 1990).

Patagonacythere cf. tricostata HARTMANN, 1962
 (Pl. 44: 1)

Material. — One aC from the Polish collection.

Remarks. — The shape of carapace as well as the arrangement of its main morphological features *i.e.* posterior, median and lateroventral ribs, and the type of ornamentation, seem to be similar to those

characteristic of *Patagonacythere tricostata*, a Recent species described from Patagonia and southern Chile. In comparison with the holotype of *Patagonacythere tricostata* the Pliocene species is higher and more densely reticulated. WHATLEY *et al.* (1995) referred *Patagonacythere tricostata* into the *Ambostracon* (*Patagonacythere*) *tricostata* group, characteristic of the Tertiary of southern South America.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island. *Patagonacythere tricostata* HARTMANN occurs at the present in the South-Eastern Atlantic (HARTMANN 1962) as well as in the South-Western Atlantic (along the coast of East Falkland) see WHATLEY *et al.* (1995).

Genus *Meridionalicythere* WHATLEY, CHADWICK, COXILL *et* TOY, 1987

?*Meridionalicythere* sp.

(Pl. 40: 6)

Material. — One ?jC from the Polish collection.

Remarks. — The general external appearance of the specimen, mostly its shape, *i.e.* subtrapezoidal lateral outline and lateral inflations, including the subcentral elevation and eye tubercle-like inflation, are reminiscent of the morphological features typical of *Meridionalicythere*. The smooth valve surface is like in the juvenile representatives of the Recent species ?*Meridionalicythere* sp. described by WHATLEY *et al.* (1987) from the southwestern Atlantic. Pliocene specimen, however, bear more developed posterodorsal and posteroventral inflations.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

Family *Loxoconchidae* SARS, 1925

Genus *Antarctiloxoconcha* HARTMANN, 1986

Antarctiloxoconcha frigida (NEALE, 1967)

(Pl. 45: 2–5)

1967. *Loxocythere frigida* NEALE sp. nov.; p. 29, pl. 2: 9.

1988. ?*Cytheropteron frigidum* (NEALE), 1967; WHATLEY, CHADWICK, COXILL and TOY; p. 183, pl. 4: 3–5.

1990. *Antarctiloxoconcha frigida* (NEALE, 1967); HARTMANN, p. 205, pl. 4: 30.

Material. — One aLV and one aRV from the Swedish collection, and one aC and one ?jC from the Polish collection.

Remarks. — HARTMANN (1990) put into the synonymy of this species his species *Antarctiloxoconcha rotundicaudata*. For an additional remarks see WHATLEY *et al.* (1988). The specimen on Pl. 45: 2 is rather tentatively regarded as juvenile.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island, Recent of Antarctica *i.e.* the Halley Bay (Weddell Sea) see NEALE (1967) and the Antarctic Peninsula area (HARTMANN 1990).

Family *Cytheruridae* G.W. MÜLLER, 1894

Genus *Semicytherura* WAGNER, 1957

?*Semicytherura* sp.

(Pl. 41: 3)

Material. — One ?aC from the Swedish collection.

Remarks. — A closed and badly preserved carapace does not allow of a definite generic determination. Its general appearance, however, allows us to refer it (tentatively) to *Semicytherura*. It seem to be covered entirely by delicate, horizontally arranged ribs.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

Genus *Hemicytherura* ELOFSON, 1941

Hemicytherura cf. *reticulata* HARTMANN, 1962

(Pl. 41: 5)

Material. — One aC from the Polish collection.

Remarks. — In its general shape as well as type of ornamentation, the carapace seems similar to *Hemicytherura reticulata* HARTMANN, 1962, a Recent species from the South-Western Atlantic. In comparison with HARTMANN's species, the Pliocene form is more pronouncedly rimmed along its margins, except anteriorly, and it has coarser punctuation, limited to its central part.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island. *Hemicytherura reticulata* HARTMANN, 1962, is known, as a Recent species, from Southern Chile, Magellan Strait, East Falkland, and southern Argentina (Province of Santa Cruz) see WHATLEY *et al.* (1988), WHATLEY *et al.* (1995).

Genus *Cytheropteron* SARS, 1866

?*Cytheropteron* sp.

(Pl. 45: 1)

Material — One aC from the Polish collection.

Remarks. — The general appearance of the carapace *i.e.* its semiovate lateral outline, weakly (indistinctly) developed ventrolateral alae and moderate lateral inflation, as well as the type of ornamentation which consists of coarse puncta, best developed and distributed in its posterodorsal part, suggests that this specimen belongs to an unknown species.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

Genus *Loxoreticulatum* BENSON, 1964

?*Loxoreticulatum* sp.

(Pl. 41: 4)

Material. — One badly preserved ?aC from the Swedish collection.

Remarks. — The external appearance of the carapace *i.e.* its subrhomboidal lateral outline, and the posterolateral compression, distinct arched rib along the dorsal margin, well marked ventrolateral rib and the type of ornamentation allows this specimen to be tentatively referred to *Loxoreticulatum*. The type of ornamentation of the carapace, consisting of longitudinal ribs and rather rare but large puncta, differs from known species of *Loxoreticulatum*.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

Family unknown

Gen. et sp. incert.

(Pl. 42: 8)

Material. — One ?aC from the Polish collection.

Remarks. — The carapace almost egg-shaped, somewhat truncated posterodorsally and anterodorsally, indistinctly compressed posteriorly, with a weak and oblique sulcus centrodorsally. Nearly the entire carapace surface is finely and irregularly reticulated, and punctate.

Distribution. — *Pecten* Conglomerate (Pliocene) from Cockburn Island.

REFERENCES

- ANDERSSON, J.G. 1906. On the geology of Graham Land. — *Bulletin of the Geological Institute of the University of Upsala* **7**, 19–71.
- ASKIN, R.A., ELLIOT, D.H., STILWELL, J.D. and ZINSMEISTER, W.J. 1991. Stratigraphy and paleontology of Campanian and Eocene sediments, Cockburn Island, Antarctic Peninsula. — *Journal of South American Earth Sciences* **4**, 99–117.
- BARNES, R.P. and RIDING, J.B. 1994. Angular unconformity between the López de Bertodano and La Meseta Formations (Campanian-Maastrichtian and Eocene), Cockburn Island, northern Antarctic Peninsula. — *Journal of South American Earth Sciences* **7**, 35–44.
- BARTON, C.M. 1965. The geology of the South Shetland Islands. III. The stratigraphy of King George Island. — *British Antarctic Survey, Scientific Reports* **44**, 1–33.
- BENSON, R.H. 1964. Recent Cytheracean Ostracodes from McMurdo Sound and the Ross Sea, Antarctica. — *The University of Kansas Paleontological Contributions, Arthropoda* **6**, 1–36.
- BIRKENMAJER, K. 1982. Pliocene tillite-bearing succession of King George Island (South Shetland Islands, Antarctica). — *Studia Geologica Polonica* **74**, 7–72.
- BIRKENMAJER, K. and GAZDZICKI, A. 1986. Oligocene age of the *Pecten* Conglomerate on King George Island, West Antarctica. — *Bulletin of the Polish Academy of Sciences, Earth Sciences* **34**, 219–226.
- BIRKENMAJER, K., GAZDZICKI, A., GRADZIŃSKI, R., KREUZER, H., PORĘBSKI, S.J. and TOKARSKI, A.K. 1991. Origin and age of pectinid-bearing conglomerate (Tertiary) on King George Island, West Antarctica. *In*: M.R.A. Thomson, J.A. Crame and J.W. Thomson (eds) *Geological Evolution of Antarctica*, 663–665. Cambridge University Press.

- BLASZYK, J. 1987. Ostracods from the Oligocene Polonez Cove Formation of King George Island, West Antarctica. In: A. Gaździcki (ed.) *Palaeontological Results of the Polish Antarctic Expeditions. Part I.* — *Palaeontologica Polonica* **49**, 63–81.
- BROUWERS, E.M. and MARINCOVICH, Jr., L. 1987. Ostracode and Molluscan Assemblages from the Late Neogene Nuwok Member of the Sagavanirktok Formation, North Slope. — *Geologic Studies in Alaska by the U.S. Geological Survey during 1987*, 24–26.
- COLES, G., AYRESS, M. and WHATLEY, R. 1990. A comparison of North Atlantic and Pacific Cainozoic deep-sea Ostracoda. In: R. Whatley and C. Maybury (eds) *Ostracoda and Global Events*, 287–301. Chapman and Hall, London–New York–Tokyo–Melbourne–Madras.
- CRONIN, T.M. 1991. Late Neogene marine Ostracoda from Tjornes, Iceland. — *Journal of Paleontology* **65**, 767–794.
- CRONIN, T.M. and IKEYA, N. 1987. The Omma-Manganji Ostracod fauna (Plio-Pleistocene) of Japan and the zoogeography of circumpolar species. — *Journal of Micropalaeontology* **6**, 65–88.
- DOKTOR, M., GAŹDZICKI, A., MARENSSI, S.A., POREBSKI, S.J., SANTIJJANA, S.N. and VRBA, A.V. 1988. Argentine–Polish geological investigations on Seymour (Marambio) Island, Antarctica, 1988. — *Polish Polar Research* **9**, 521–541.
- ECHEVARRIA, A.E. 1991. Ostracodos del Oligoceno del sudeste del Lago Cardiel, Santa Cruz, Argentina. — *Ameghiniana*, 267–285.
- GAŹDZICKA, E. and GAŹDZICKI, A. 1985. Oligocene coccoliths of the *Pecten* Conglomerate on King George Island, West Antarctica. — *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte* **12**, 727–735.
- GAŹDZICKA, E. and GAŹDZICKI, A. 1994. Recycled Upper Cretaceous calcareous nannoplankton from the *Pecten* Conglomerate of Cockburn Island, Antarctica. — *Polish Polar Research* **15**, 3–13.
- GAŹDZICKI, A. and WEBB, P.N. 1996. Foraminifera from the *Pecten* Conglomerate (Pliocene) of Cockburn Island, Antarctic Peninsula. In: A. Gaździcki (ed.) *Palaeontological Results of the Polish Antarctic Expeditions. Part II.* — *Palaeontologica Polonica* **55**, 147–174.
- HARWOOD, D.M. 1986. *Diatom biostratigraphy and paleoecology with a Cenozoic history of Antarctic ice sheets.* — Unpublished Ph. D. dissertation. The Ohio State University, Columbus, 592 pp.
- HARTMANN, G. 1962. Ostracodendes Eulitorals. In: G. Hartmann-Schröder and G. Hartmann (eds) *Zur Kenntnis des Eulitorals der chilenischen Pazifikküste und der argentinischen Küste, Südpatagoniens unter besonderer Berücksichtigung der Polychaeten und Ostracoden.* — *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **60** suppl., 169–270.
- HARTMANN, G. 1986. Antarktische bentische Ostracoden I (Mit einer Tabelle der bislang aus der Antarktis bekannten Ostracoden). — *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **83**, 147–221.
- HARTMANN, G. 1990. Antarktische bentische Ostracoden VI Auswertung der Reise der "Polarstern" Ant. VI-2 (I. Teil, Meiofauna und Zehnererien) sowie Versuch einer vorläufigen Auswertung aller bislang vorliegenden Daten). — *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **87**, 191–245.
- HENNIG, A. 1910. Le Conglomérat pleistocène à *Pecten* de l'île Cockburn. — *Wissenschaftliche Ergebnisse der Schwedischen Südpolar-Expedition 1901–1903* **3** (10), 1–73.
- HORNIBROOK, N. de B. 1953. Tertiary and Recent marine Ostracoda of New Zealand — their origin, affinities, and distribution. — *New Zealand Geological Survey, Palaeontological Bulletin* **18**, 5–82.
- IRIZUKI, T. 1994. Late Miocene ostracods from the Fujikotogawa Formation, northern Japan — with reference to cold water species involved with trans-Arctic interchange. — *Journal of Micropalaeontology* **13**, 3–15.
- KELBOWICZ, A.A. 1988. Upper Oligocene — Lower Miocene Ostracods from the YPF, SCA, ECa X-1 (El Campamento) Borehole, Austral Basin, Argentina. In: R. Whatley and C. Maybury (eds) *Ostracoda and Global Events*, 1125–1145. Chapman and Hall, London–New York–Tokyo–Melbourne–Madras.
- NEALE, J.W. 1967. An ostracod fauna from Halley Bay, Coats Land, British Antarctic Territory. — *British Antarctic Survey Scientific Reports* **58**, 1–50.
- SIDDIQI, Q.A. 1988. The Iperk Sequence (Plio-Pleistocene) and its Ostracod Assemblages in the Eastern Beaufort Sea. In: T. Hanai, N. Ikeya and K. Ishizaki (eds) *Evolutionary biology of ostracoda its fundamentals and applications*, 533–540. Developments in Palaeontology and Stratigraphy 11, Kodansha-Elsevier, Tokyo.
- SKOGBERG, T. 1928. Studies on marine ostracods, part II. External morphology of the genus *Cythereis* with description of twenty-one new species. — *California Academy of Sciences, Occasional Papers* **15**, 1–55.
- SKOGBERG, T. 1939. A new genus and species of marine ostracods from South Georgia. — *California Academy of Science, Proc.* **33**, 415–425.
- SWAIN, F.M. 1963. Pleistocene Ostracoda from the Gubik Formation, Arctic Coastal Plain, Alaska. — *Journal of Paleontology* **37**, 798–834.
- SZCZĘCHURA, J. 1994. Paleogeographic meaning of psychrospheric Miocene ostracodes from the Fore-Carpathian Depression. — *Acta Geologica Polonica* **44**, 137–151.
- SZCZĘCHURA, J. 1995. The ostracod genus *Xylocythere* Maddocks and Steineck, 1987, from the Middle Miocene of the Fore-Carpathian Depression, southern Poland (Central Paratethys), and its significance as an indicator of past oceanic pathways. — *Acta Geologica Polonica* **45**, 31–44.
- WEBB, P.N. and ANDREASEN, J.E. 1986. Potassium-argon dating of volcanic material associated with the Pliocene *Pecten* Conglomerate (Cockburn Island) and Scallop Hill Formation (McMurdo Sound). — *Antarctic Journal of the United States* **21** (5), 59.
- WHATLEY, R., CHADWICK, J., COXILL, D. and TOY, N. 1987. New genera and species of cytheracean Ostracoda from the S.W. Atlantic. — *Journal of Micropalaeontology* **6**, 1–12.

- WHALLEY, R., CHADWICK, J., COXILL, D. and TOY, N. 1988. The ostracod family Cytherinidae from the Antarctic and South-West Atlantic. — *Revista Española de Micropaleontología* **20**, 171–203.
- WHALLEY, R.C. and MOGULIEVSKY, A. 1975. The family Leptocytheridae in Argentine waters. In: F.M. Swain, L.S. Komicker and R. Lundin (eds) *Biology and paleobiology of Ostracoda*. A Symposium University of Delaware, 14–17 August, 1975, 201–227.
- WHALLEY, R., TOY, N., MOGULIEVSKY, A. and COXILL, D. 1995. Ostracoda from the South West Atlantic. Part I. The Falkland Islands. — *Revista Española de Micropaleontología* **27**, 17–38.
- ZINSMEISTER, W.J. and WEBB, P.-N. 1982. Cretaceous–Tertiary geology and paleontology of Cockburn Island. — *Antarctic Journal of the United States* **17** (2), 41–42.

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OF COCKBURN ISLAND, ANTARCTIC PENINSULA

PLATE 39

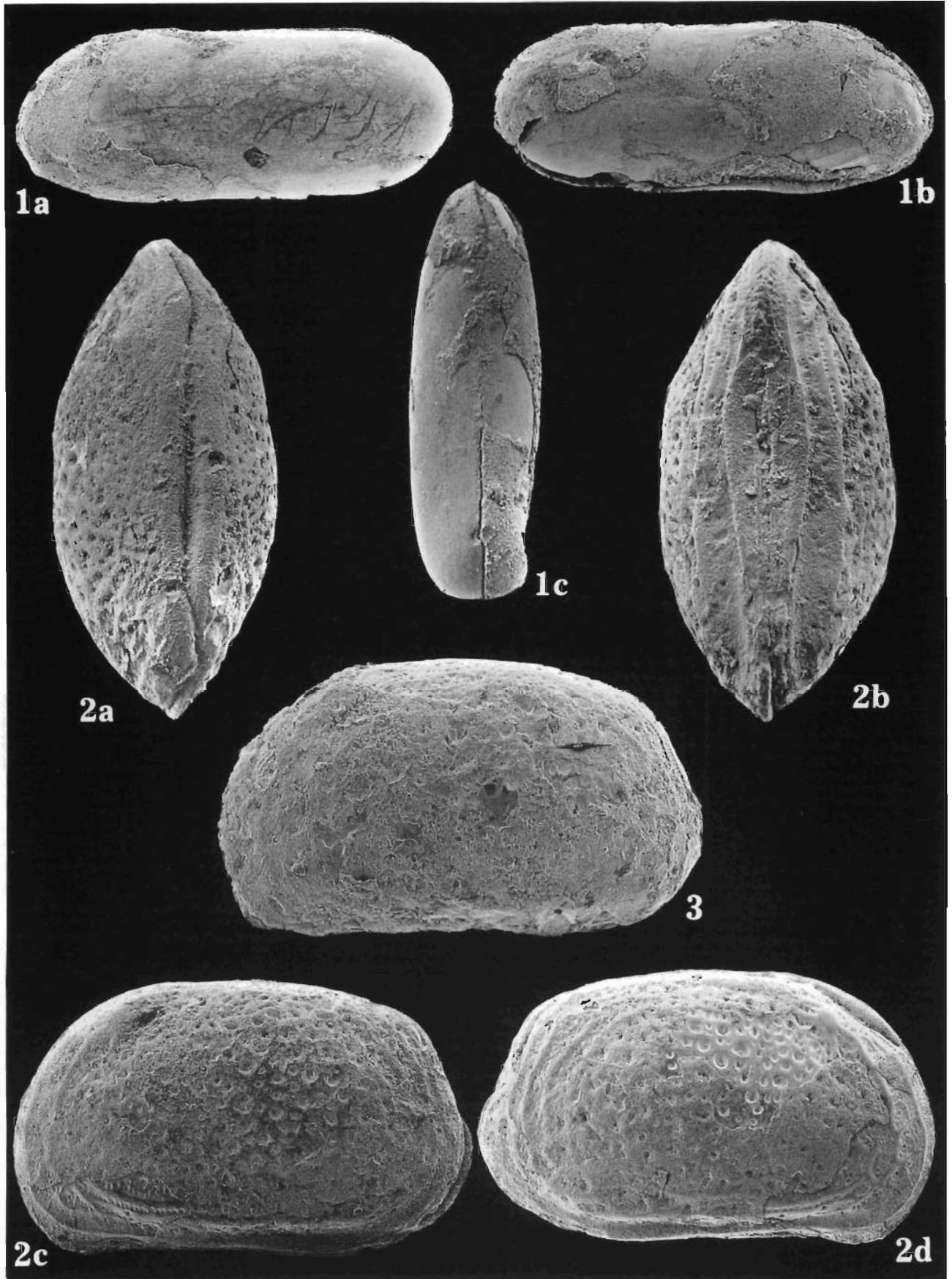
Copytus caligula SKOGSBERG, 1939 180

Fig. 1. aC, a – left side, × 80 b – right side, × 80, c – dorsal view, × 70, Ar 54429.

Procythereis cf. *robusta* SKOGSBERG, 1928 181

Fig. 2. aC, a – dorsal view, b – ventral view, c – left side, d – right side, × 70 resp., Ar 54427.

Fig. 3. aLV, seen from outside, × 60, Ar 54426.

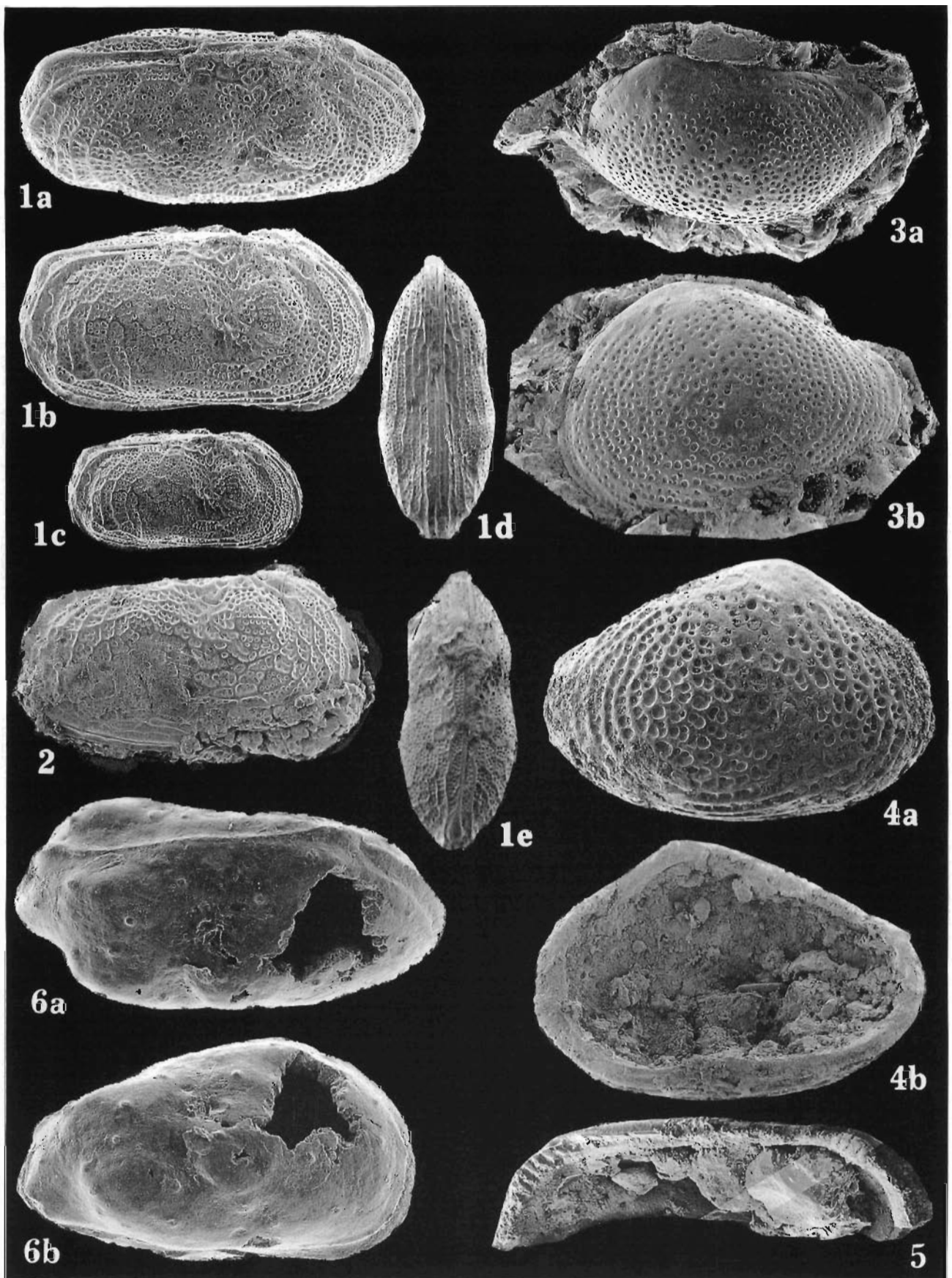


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PLATE 40

- ?Leptocythere* sp. 181
Fig. 1. aC, a – somewhat oblique view of the right side, × 110, b – right side, × 90, c – right side, × 95, d – ventral view, × 76, e – dorsal view, × 74, ZPAL O.XXXVII/9.
Fig. 2. aC, right side, × 95, ZPAL O.XXXVII/8.
- ?Loxocythere* sp. 180
Fig. 3. jLV, a – somewhat oblique dorsal view, × 60, b – seen from outside, × 66, ZPAL O.XXXVII/11.
Fig. 4. aRV, a – seen from outside, × 58, b – seen from inside, × 58, Ar 54430.
Fig. 5. Hinge margin of aRV, × 78, Ar 54414.
- ?Meridionalicythere* sp. 180
Fig. 6. ?jC, a – oblique view of the right side, × 233, b – right side, × 233, ZPAL O.XXXVII/10.

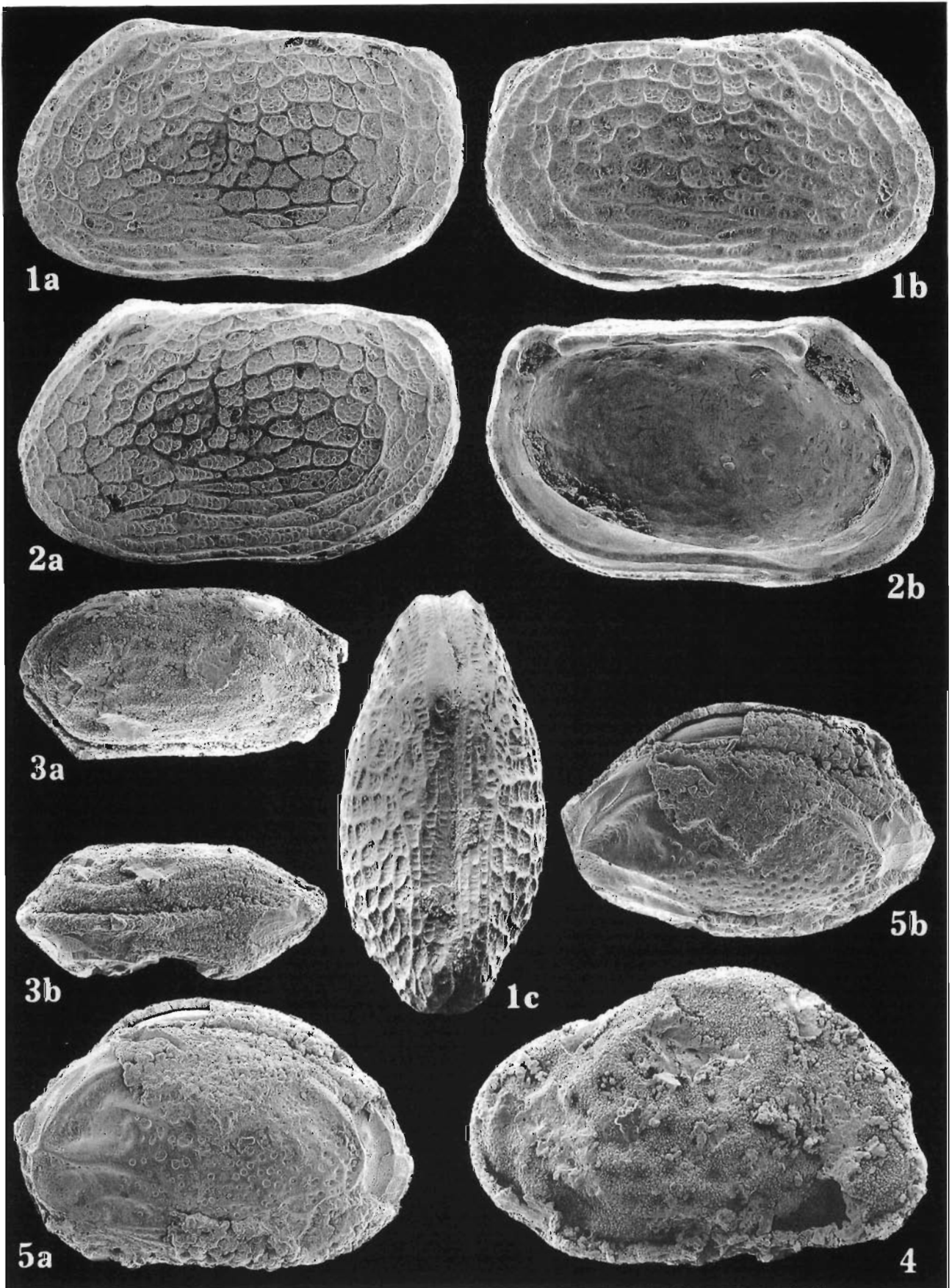


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PLATE 41

<i>Pseudocythereis spinifera</i> SKOGSBERG, 1928	181
Fig. 1. aC, a – left side, × 67, b – right side, × 67, c – dorsal view, × 60, Ar 54415.	
Fig. 2. aLV, a – seen from outside, × 67, b – seen from inside, × 7, Ar 54416.	
? <i>Semicytherura</i> sp.	183
Fig. 3. ?aC, a – right side, × 116, b – dorsal view, × 114, Ar 54431.	
? <i>Loxoreticulatum</i> sp.	184
Fig. 4. ?aC, right side, × 153, Ar 54432.	
<i>Hemicytherura</i> cf. <i>reticulata</i> HARTMANN, 1962	183
Fig. 5. aC, a – right side, × 138, b – oblique view of the right side, × 132, ZPAL O.XXXVII/7.	

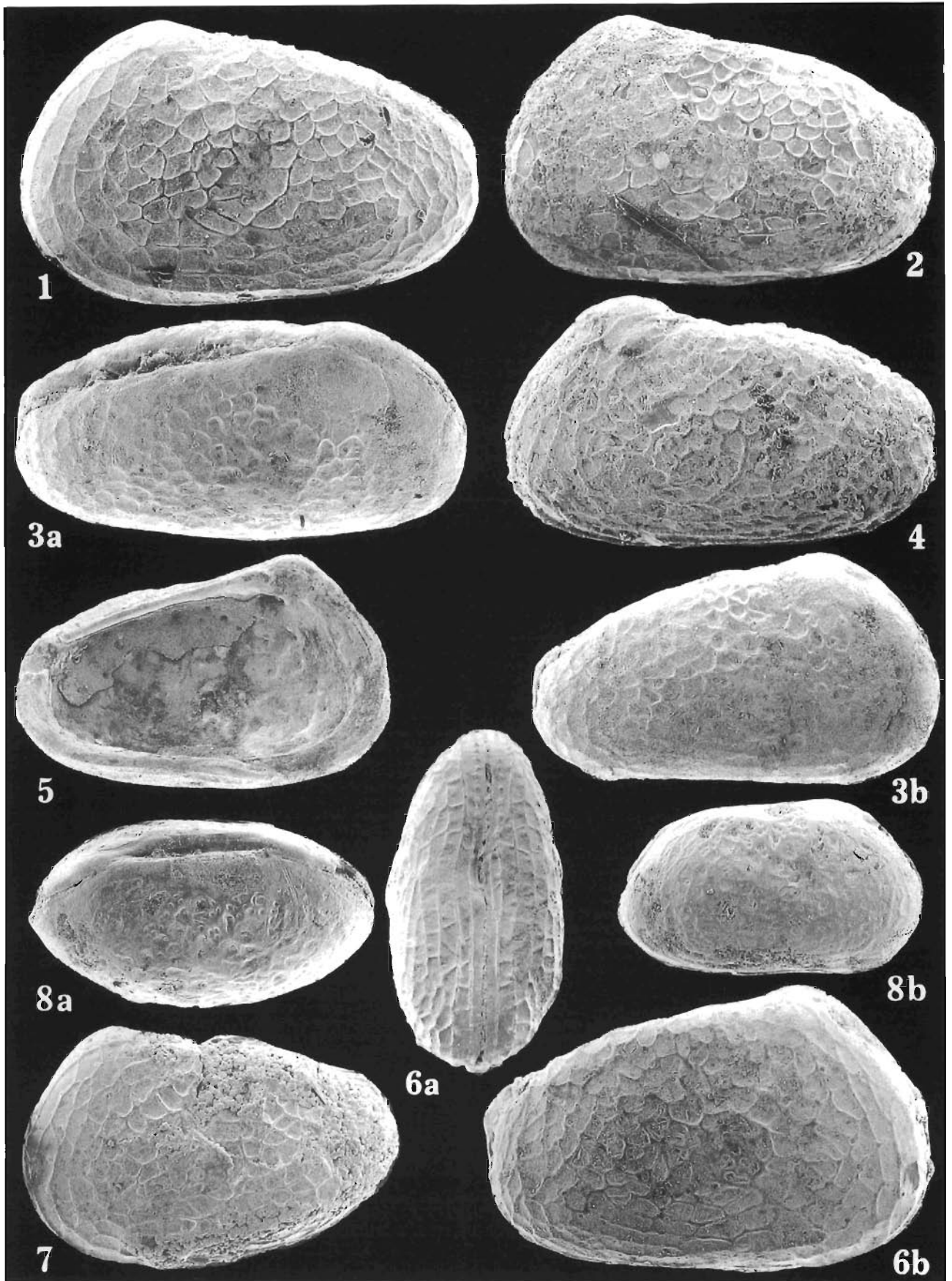


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PLATE 42

<i>?Rabilimis</i> sp.	181
Fig. 1. aLV, seen from outside, × 117, Ar 54422.	
Fig. 2. aC, left side, × 86, Ar 54420.	
Fig. 3. aC, a – oblique view of the right side, × 104, b – right side, × 94, ZPAL O.XXXVII/12.	
Fig. 4. aC, left side, × 94, Ar 54423.	
Fig. 5. aLV, seen from inside, × 76, Ar 54421.	
Fig. 6. aC, a – ventral view, × 73, b – right side, × 94, ZPAL O.XXXVII/1.	
Fig. 7. aLV, seen from outside, × 96, ZPAL O.XXXVII/14.	
Gen. et sp. incert.	184
Fig. 8. ?aC, a – oblique view of the right side, × 83, b – right side, × 77, ZPAL O.XXXVII/4.	



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PLATE 43

Australicythere polylyca (G.W. MÜLLER, 1908) 182

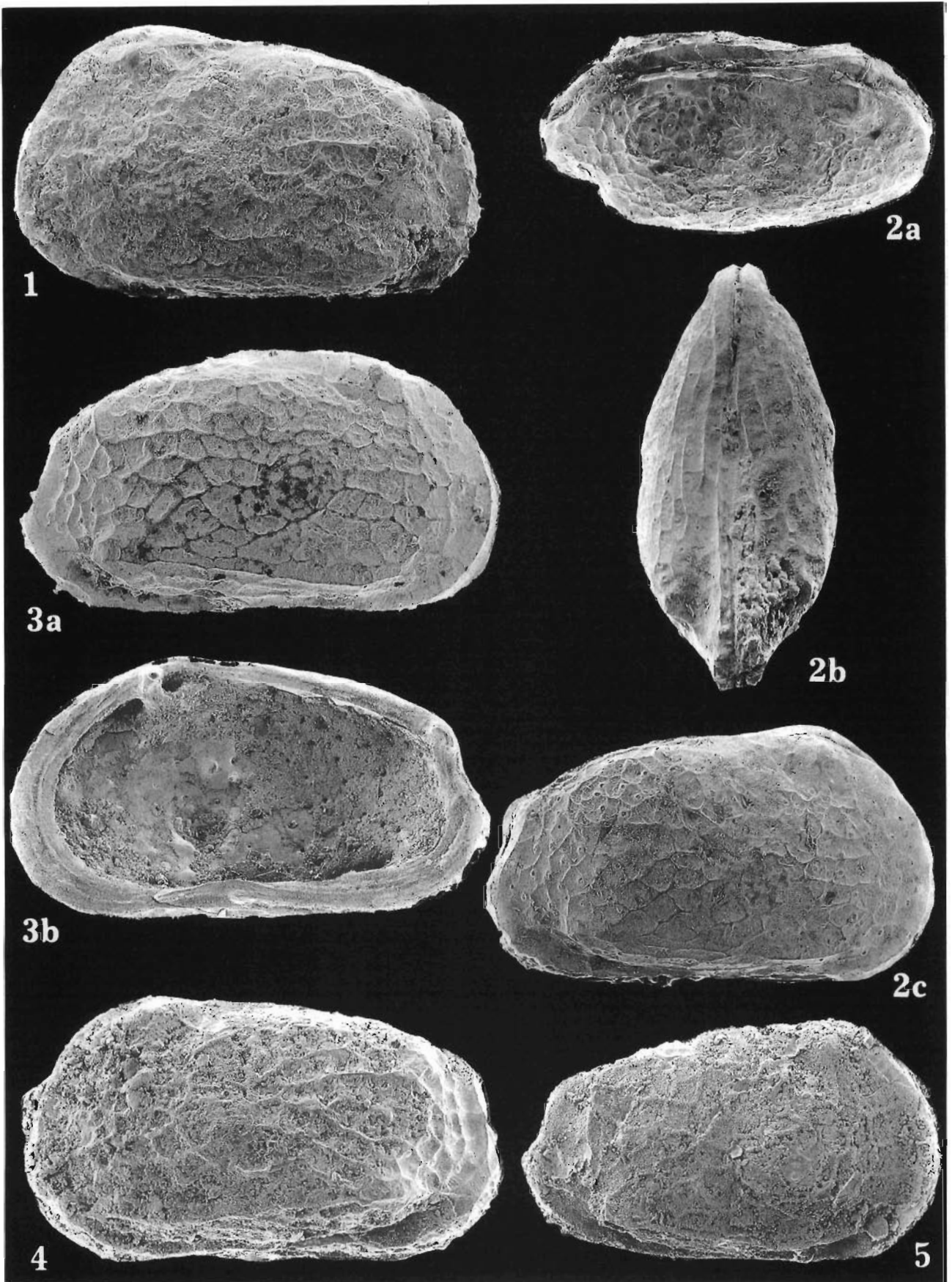
Fig. 1. aLV, seen from outside, × 77, ZPAL O.XXXVII/18.

Fig. 2. aC, a – oblique view of the right side, × 68, b – ventral view, × 74, c – right side, × 78, ZPAL O.XXXVII/2.

Fig. 3. aRV, a – seen from outside, × 77, b – seen from inside, × 77, Ar 54419.

Fig. 4. aC, left side, × 76, Ar 54418.

Fig. 5. aRV, seen from outside, × 75, Ar 54433.

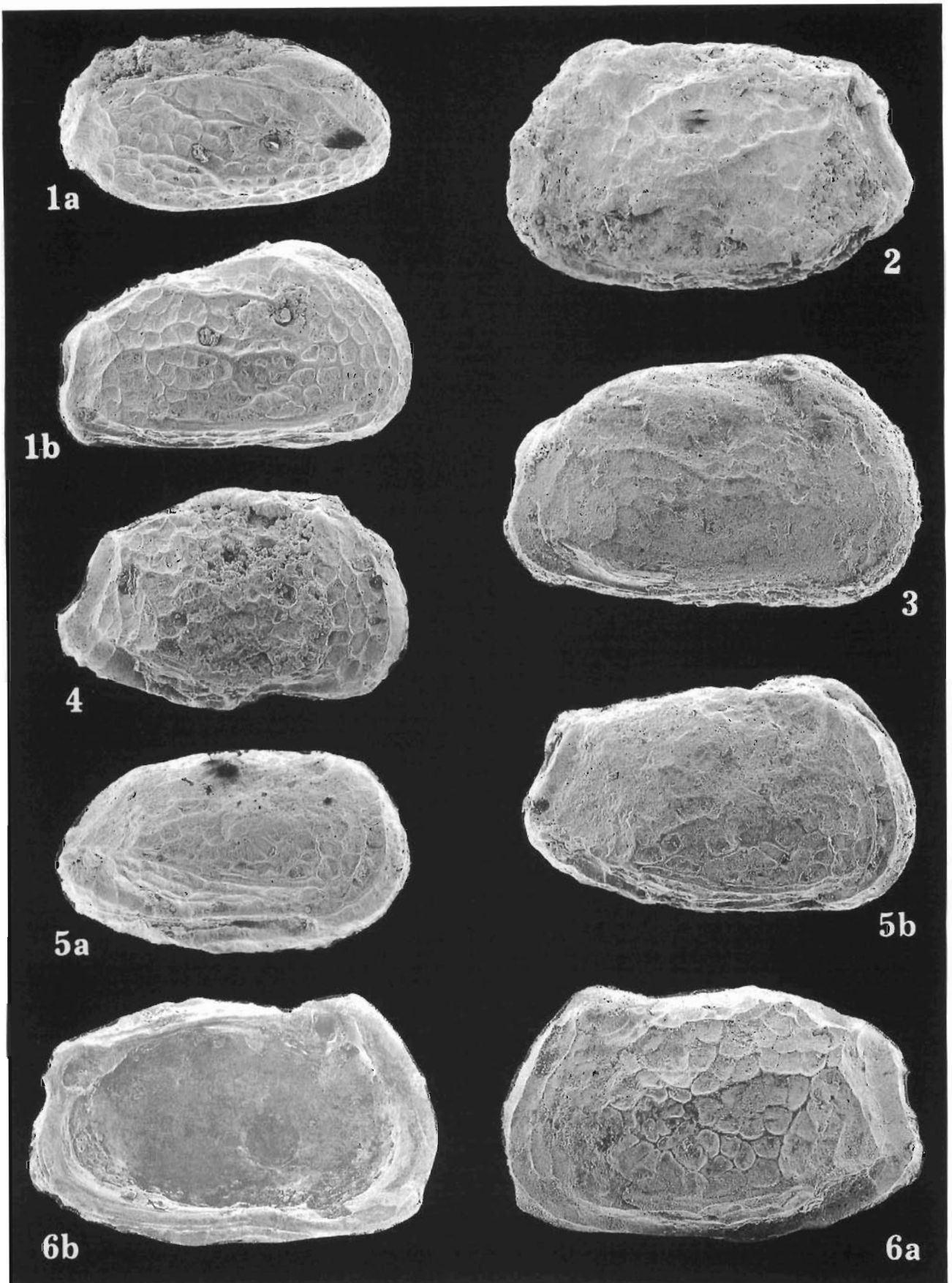


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PLATE 44

- Patagonacythere* cf. *tricostata* HARTMANN, 1962 182
Fig. 1. aC, a – oblique view of the right side, × 87, b – right side, × 94, ZPAL O.XXXVII/15.
- Patagonacythere* cf. *longiducta longiducta* (SKOGSBERG, 1928) 182
Fig. 2. aLV, seen from outside, × 62, ZPAL O.XXXVII/17.
Fig. 4. aRV, seen from outside, × 93, ZPAL, O.XXXVII/16.
Fig. 6. aLV, a – seen from outside, × 62, b – seen from inside, × 75, Ar 54425.
- ?*Patagonacythere* cf. *longiducta longiducta* (SKOGSBERG, 1928) 182
Fig. 3. aC, right side, × 60, Ar 54424.
Fig. 5. aC, a – oblique view of the right side, × 80, b – right side, × 77, ZPAL O.XXXVII/3.



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PLATE 45

?*Cytheropteron* sp. 184

Fig. 1. aC, a – oblique view of the right side, × 114, b – right side, × 117, c – right side, × 155, ZPAL O.XXXVII/19.

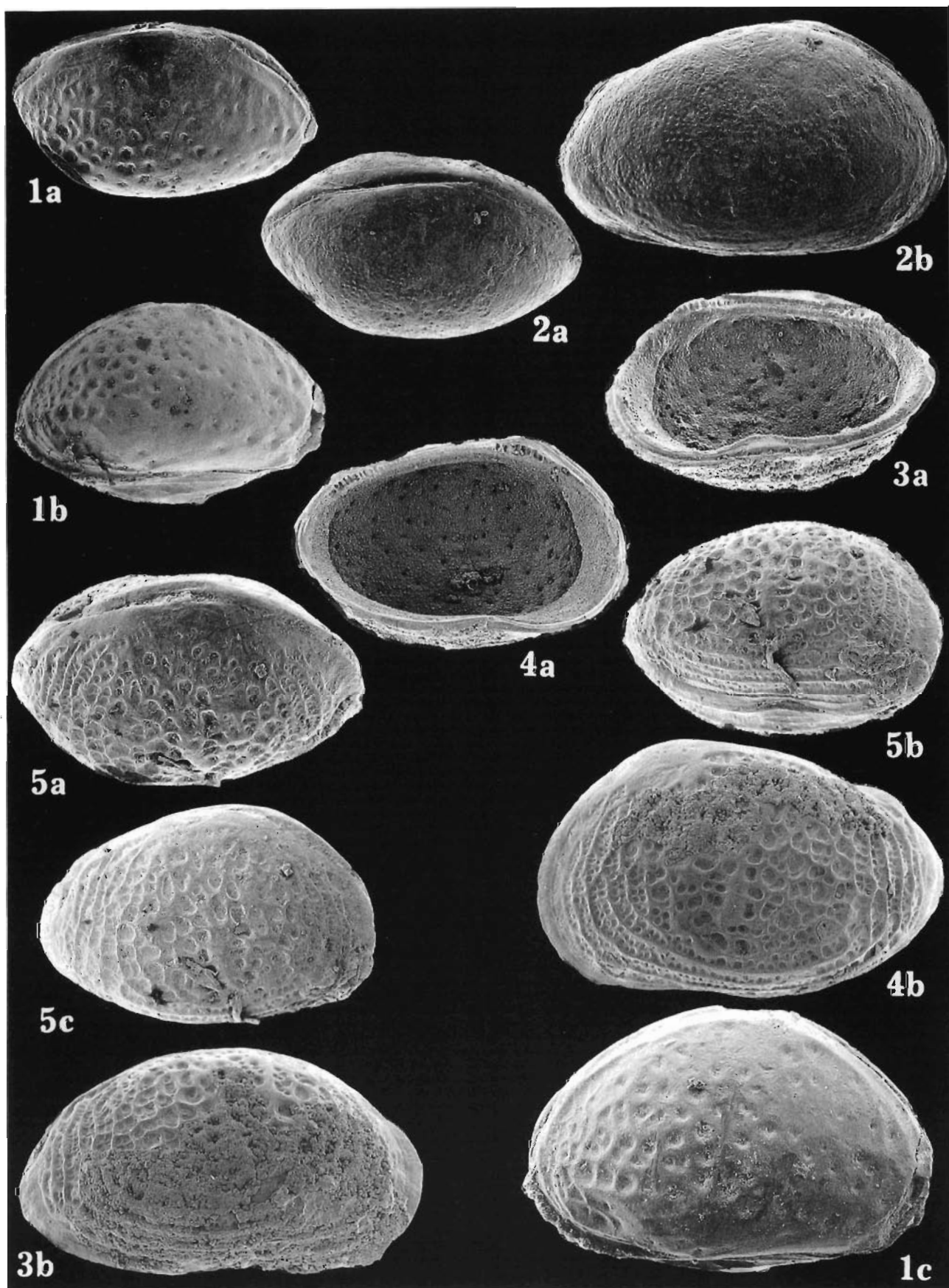
Antarctiloxoconcha frigida (NEALE, 1967) 183

Fig. 2. jC, a – oblique view of the right side, × 116, b – right side, × 138, ZPAL O.XXXVII/6.

Fig. 3. aRV, a – seen from inside, × 95, b – obliquely seen from outside, × 114, Ar 54434.

Fig. 4. aLV, a – seen from inside, × 94, b – seen from outside, × 112, Ar 54435.

Fig. 5. aC, a – oblique view of the right side, × 103, b – oblique view of the right side, × 95, c – right side, × 98,
ZPAL O.XXXVII/13.



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