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Brachiopods from the Lower Miocene of King George Island, West Antarctica

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ABSTRACT: Brachiopods are reported for the first time from the Lower Miocene Cape Melville Formation of King George Island, South Shetland Islands, West Antarctica. Two genera, *Liothyrella* Thomson and *Paraldingia* Richardson have been identified. This is the first occurrence of *Paraldingia* in Antarctica.

Key words: Antarctica, Cape Melville Formation (Lower Miocene), paleontology (Brachiopoda).

Introduction

Brachiopods from the Tertiary strata of King George Island, West Antarctica have so far only been described from the Upper Oligocene Polonez Cove and Lower Miocene Destruction Bay formations. The brachiopods from the Polonez Cove Formation are rare and in some cases too poorly preserved to be determinable, even to the generic level. They have been recorded from the lower unit of the formation, the Low Head Member (Bitner and Pisera 1984, Bitner 1997), and from the upper part, the Oberek Cliff Member (Bitner 1997, Bitner and Thomson 1999). The scanty material allows determination to the generic level of three specimens, all from the Low Head Member (Bitner and Pisera 1984, Bitner 1997); *i.e.* rhynchonellid *Cryptopora* Jeffreys, and two terebratulids *Liothyrella* Thomson and *Neothyris* Douvillé.

The brachiopod assemblage from the Destruction Bay Formation is better preserved and much richer both in taxa as well as in specimens (Biernat, Birkenmajer and Popiel-Barczyk 1985). It comprises six genera belonging to the families Discinidae and Terebratellidae.

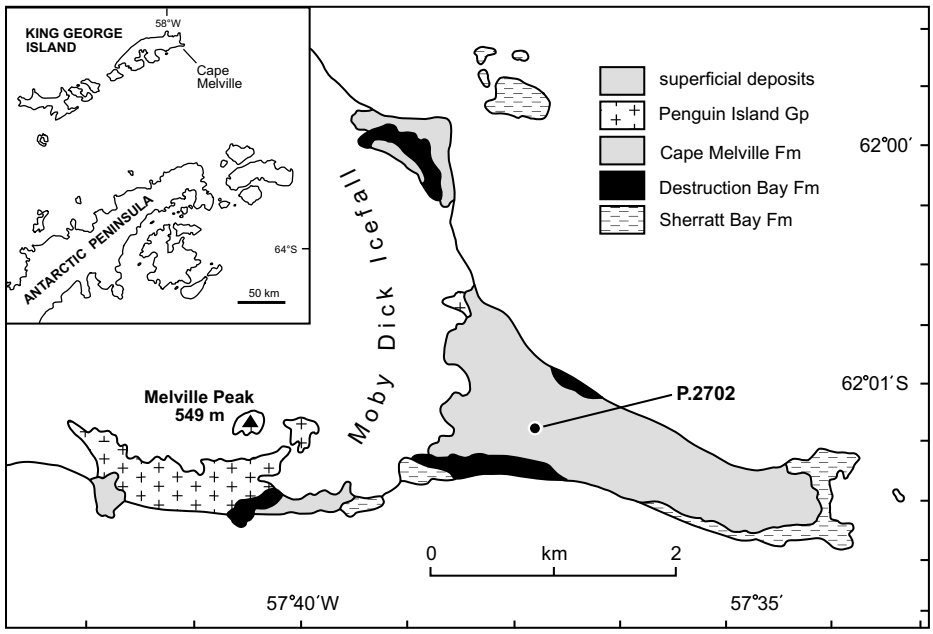

Fig.1. Locality and geological map for the Melville Peninsula, King George Island, South Shetland Islands. Based on Feldmann and Crame 1998, text-fig. 1, with permission.

Brachiopods have only recently been recorded from the Lower Miocene Cape Melville Formation, which overlies the Destruction Bay Formation, although a rich marine microfossil and invertebrate fauna was previously known. The latter is dominated by bivalves, gastropods, solitary corals and crabs (Gaździcki and Wrona 1982, Birkenmajer, Gaździcki and Wrona 1983, Feldmann and Crame 1998). The material described below was collected by one of us (JAC) in 1995 from the top of the Melville Peninsula Plateau (Figs 1–2), and consists of four specimens that represent the first record of brachiopods from this formation.

The studied material is housed in the Geological Sciences Division of the British Antarctic Survey, Cambridge under the numbers P.2702.14–15, P.2702.839–840.

Geological and stratigraphical setting

The four specimens investigated here were collected from the 150–200 m-thick Cape Melville Formation [CMF], that is exposed on the Melville Peninsula, King George Island (Figs 1–2). This unit comprises horizontal to sub-horizontally bedded mudstones and silty mudstones that are characterized by a diverse assemblage of pebble- to boulder-sized lonestones (Birkenmajer, Gaździcki and Wrona 1983). It is apparent that these clasts are in fact glacial dropstones and the entire CMF can be regarded as being of glaciomarine origin (Birkenmajer 1982, 1984, 1987;

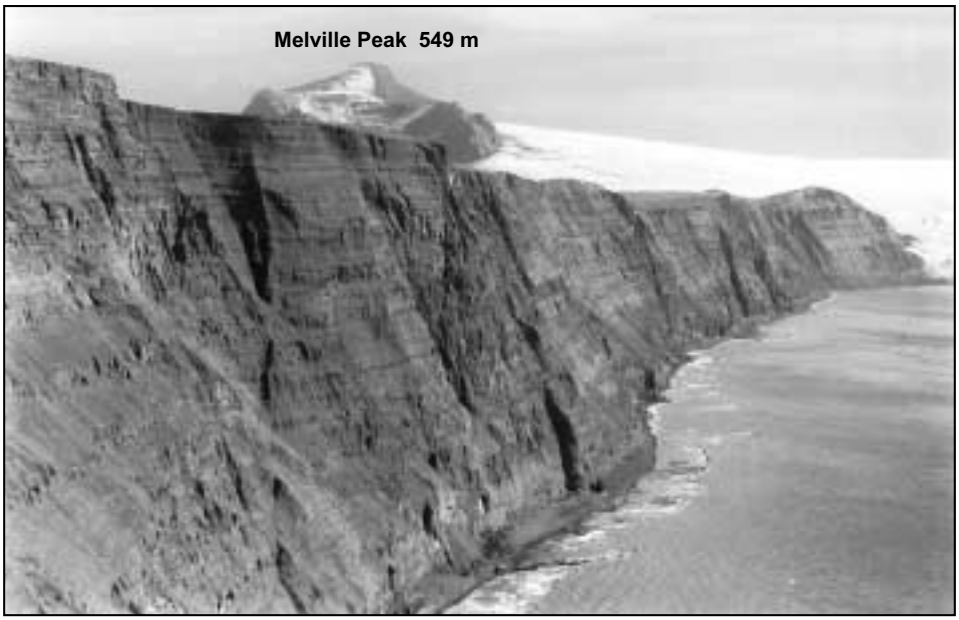

Fig. 2. The north coast of the Melville Peninsula, looking west. The high cliffs comprise typical, horizontally bedded Cape Melville Formation lithologies. Photo taken by J. A. Crame, February 1995.

Birkenmajer, Gaździcki and Wrona 1983; Wrona and Zhuravlev 1996). Further description of lithological variation within the CMF is contained in Feldmann and Crame (1998).

The CMF is cut by a series of NW-SE trending andesitic-basaltic dykes, two of which have been radiometrically dated by K-Ar at 20 Ma (Birkenmajer *et al.* 1985). A tuff from close to the base of the Destruction Bay Formation has been dated by K-Ar at 23 Ma, and both brachiopods and foraminifera from this unit have Lower Miocene affinities (Biernat, Birkenmajer and Popiel-Barczyk 1985). Strontium isotope ($^{87}Sr/^{86}Sr$) dating of bivalve fragments from the CMF has given an age of 22.6 ± 0.4 Ma (Dingle and Lavelle 1998), and overall it can be concluded that the formation is of earliest Miocene age.

The macro-benthic invertebrate assemblage is dominated by infaunal bivalve taxa, with nuculids and nuculanids being particularly prominent. There are also a comparatively large number of anomalodesmatans, several small heteroconchs and occasional limopsids. Crab remains assigned to *Antarctidromia inflata* Förster (Förster, Gaździcki and Wrona 1985, 1987) are particularly common at certain levels within the upper half of the formation, as are solitary corals *Flabellum rariseptatum* Roniewicz *et* Morycowa (Roniewicz and Morycowa 1985, 1987). Other taxa present include a range of gastropods (Karczewski 1987), echinoids (Jesionek-Szymańska 1987), scaphopods, polychaetes (Szaniawski and Wrona 1987), bryozoans (Hara 1994) and nephropid lobsters (Feld-

mann and Crame 1998); overall, the assemblage has a relatively deep-water, outer-shelf aspect (Föster, Gaździcki and Wrona 1987, Hara 1994, Feldmann and Crame 1998). It would seem that the glaciomarine sedimentary conditions can be related to both the advance of a local ice sheet across the shelf and melting from the base of large icebergs of Weddell Sea origin (A. Troedson, pers. commun. 2000).

Whereas three specimens (P.2702.14–15, P.2702.840; Fig. 3) are better preserved and have been determined to the generic level, the fourth (P.2702.839) is insufficiently preserved to allow determination. It is a mould of the ventral valve with only a fragment of the shell present; however, because of the evidence of punctae it can be determined as a terebratulid.

Systematic part

Order Terebratulida Waagen, 1883
Superfamily Terebratuloidea Gray, 1840
Family Terebratulidae Gray, 1840
Genus *Liothyrella* Thomson, 1916
Liothyrella sp.
(Fig. 3.1)

Material. — P.2702.14, one complete specimen with slightly damaged beak area and only partly preserved shell.

Dimensions: length 21.3 mm, width 15.9 mm, thickness 10.0 mm

Description. — The shell is thin, elongate-oval in outline, widest in the middle. The shell surface is smooth and densely punctate. The shell is biconvex with the ventral valve more convex than the dorsal valve. The beak is short, erect. The beak area is slightly damaged making it impossible to observe symphytium and an exact outline of foramen (but it appears to be large and circular). The beak ridges are rounded. The lateral commissures are straight, while anterior commissure is incipiently uniplicate. No interiors available.

Remarks. — Despite limited material and no available internal structures, the specimen matches the generic diagnosis of *Liothyrella* Thomson in the external features (Cooper 1983). This genus has numerous species and is very common in the Tertiary of the Southern Hemisphere (Allan 1932, 1937; Owen 1980; Lee 1986; Wiedman *et al*. 1988; MacKinnon, Beus and Lee 1993; Bitner 1996, 1997; Craig 2000, 2001). It is characterized by great morphological variation within a single species (see Foster 1974).

The species *Liothyrella* sp. from the Oligocene Polonez Cove Formation of King George Island is smaller, more elongate, and has a bigger foramen (Bitner 1997, fig. 4A–C) than the investigated specimen.

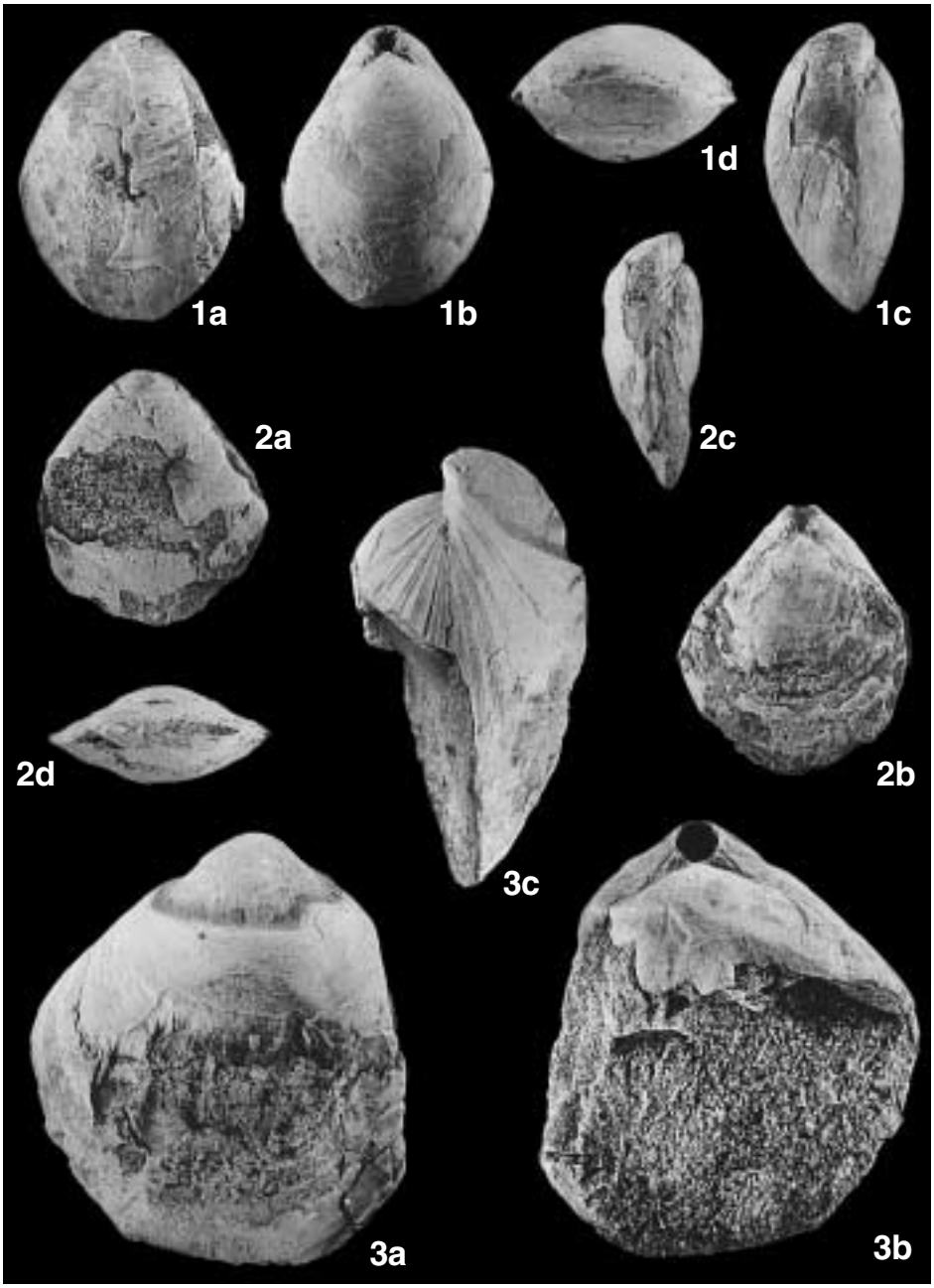

Fig. 3. 1. *Liothyrella* sp., complete specimen, P.2702.14, × 2; **a** ventral view, **b** dorsal view, **c** lateral view, **d** anterior view. 2–3. *Paraldingia* sp., complete specimens, × 2; **a** ventral view, **b** dorsal view, **c** lateral view, **d** anterior view. 2. P.2702.840; 3. P.2702.15. Cape Melville Formation (Lower Miocene), King George Island.

Occurrence. — King George Island, Cape Melville Formation (Lower Miocene). The genus *Liothyrella* is common in the Tertiary as well as Recent waters of the Southern Hemisphere.

Superfamily Terebratelloidea King, 1850
Family Laqueidae Thomson, 1927
Genus *Paraldingia* Richardson, 1973
Paraldingia sp.
(Fig. 3.2–3)

Material. — P.2702.15, P.2702.840, two poorly preserved complete specimens.
Dimensions (in mm):

	length	width	thickness
P.2702.15	30.0	–	16.5
P.2702.840	18.3	15.8	?6.9

Description. — The medium-sized shell is subpentagonal in outline, with the greatest width lying slightly anterior to mid-length. The shell surface is smooth with distinct, numerous growth lines. The shell is unequally biconvex with ventral valve deeper. The lateral and anterior commissures are straight. The beak, slightly damaged in both specimens, is short and erect. The beak ridges are well defined, especially in the bigger specimen. Foramen is rounded, moderately large, submesothyrid to mesothyrid. Deltidial plates are small, disjunct. The internal features are unknown.

Remarks. — The present material, poorly preserved with unknown internal structures, does not allow any detailed determination. External characters, such as the smooth surface, discrete and disjunct deltidial plates, and palintropes defined by rather sharp beak ridges, make the investigated specimens attributable to the genus *Paraldingia* Richardson, 1973. The genus *Paraldingia* was erected for the species occurring in the Upper Eocene–Lower Miocene of Australia that clearly differ from *Aldingia* Thomson, mostly through the possession of discrete dental plates and minute, disjunct deltidial plates (Richardson 1973). In *Aldingia*, deltidial plates are conjunct in adult forms (Richardson 1973, Craig 2001). Richardson (1973) assigned three species to *Paraldingia*. The Lower Miocene species, *P. woodsii* (Tate) differs from the specimens under study in being much smaller and having a sulcate anterior commissure, while the Upper Eocene *P. pentagonalis* (Tate) is more elongate. The specimens from the Cape Melville Formation are somewhat similar in outline and type of anterior and lateral commissures to *P. tepperi* (Tate) from the Upper Eocene of Australia (Richardson 1973).

Recently, Craig (2000) described a new species, *Paraldingia timi*, from the Upper Paleocene of Western Australia. This species differs from the investigated

specimens in having circular outline, indistinct growth lines and more weakly defined beak ridges.

Occurrence. — King George Island, Cape Melville Formation (Lower Miocene). This is the first record of this genus from Antarctica. So far, *Paraldingia* has only been noted from the Tertiary of Australia.

Discussion

Brachiopods from the Tertiary of King George Island, West Antarctica have been noted so far from the Upper Oligocene deposits of the Polonez Cove Formation (Bitner and Pisera 1984, Bitner 1997, Bitner and Thomson 1999) and from the Lower Miocene Destruction Bay Formation (Biernat, Birkenmajer and Popiel-Barczyk 1985). They are reported for the first time from the glacio-marine deposits of the successive Lower Miocene Cape Melville Formation. The brachiopod fauna described herein differs considerably from that of the Destruction Bay Formation, having no genera in common. However, one of the two genera recognised here, *Liothyrella* is known from the Tertiary strata (Owen 1980; Wiedman *et al*. 1988; Bitner 1996, 1997) and Recent waters (Foster 1974, 1989) of the Antarctic region. The second genus, *Paraldingia* is noted for the first time from the Antarctic, being previously reported only from the Tertiary of Australia (Richardson 1973, Craig 2000).

The other records of Tertiary brachiopods are from Seymour and Cockburn Islands, Antarctic Peninsula, and from fossiliferous erratics of the McMurdo Sound region, East Antarctica. The most diverse brachiopod assemblage, comprising 19 genera, comes from the shallow-marine, clastic deposits of the Eocene La Meseta Formation, which crops out on Seymour and Cockburn islands (Buckman 1910, Owen 1980, Wiedman *et al*. 1988, Bitner 1996). Of the same age are calcareous sandstone and conglomerate erratics from the McMurdo Sound region, where the rhynchonellid brachiopod *Tegulorhynchia* Chapman *et* Crespin was found (Lee and Stilwell 2000). This is the only record of Tertiary brachiopods from mainland Antarctica. The youngest Antarctic Tertiary brachiopods (Buckman 1910, Owen 1980) come from the Pliocene *Pecten* Conglomerate of Cockburn Island (= Cockburn Island Formation, Jonkers 1998).

It is also worth noting that brachiopods from the Quaternary deposits of McMurdo Sound region were mentioned by Speden (1962). Today, brachiopods form a significant part of the marine benthos in the waters around Antarctica (Foster 1974, 1989).

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