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An Oligocene record of the coral *Flabellum* from Antarctica

ABSTRACT: Solitary corals of the genus *Flabellum* are described from the Lower Oligocene glaciomarine strata of the Polonez Cove Formation of King George Island, West Antarctica. This is the oldest record of the genus from Antarctica.

Key words: Antarctica, King George Island, Oligocene, paleontology, Coelenterata (Scleractinia).

Introduction

This paper presents the first record of the Early Oligocene solitary corals of the genus *Flabellum* Lesson, 1831 in Antarctica. The corals have been found in the glacially-controlled sediments of the Low Head Member of the Polonez Cove Formation on King George Island, South Shetland Islands. The coral-bearing strata crop out in the vicinity of the Lions Rump between the Polonia and White Eagle glaciers close to the northwest margin of the White Eagle Glacier (Fig. 1, Pls 1-2).

Coral specimens were collected by A. Gaździcki during the Fourth Polish Geodynamic Expedition to West Antarctica (austral summer of 1990-91) led by Professor A. Guterch (*see* chapter Paleontology by A. Gaździcki *in* Birkenmajer 1991).

The studied corals are housed in the Institute of Paleobiology of the Polish Academy of Sciences in Warszawa, Poland under the catalogue number ZPAL H. X/1-2.

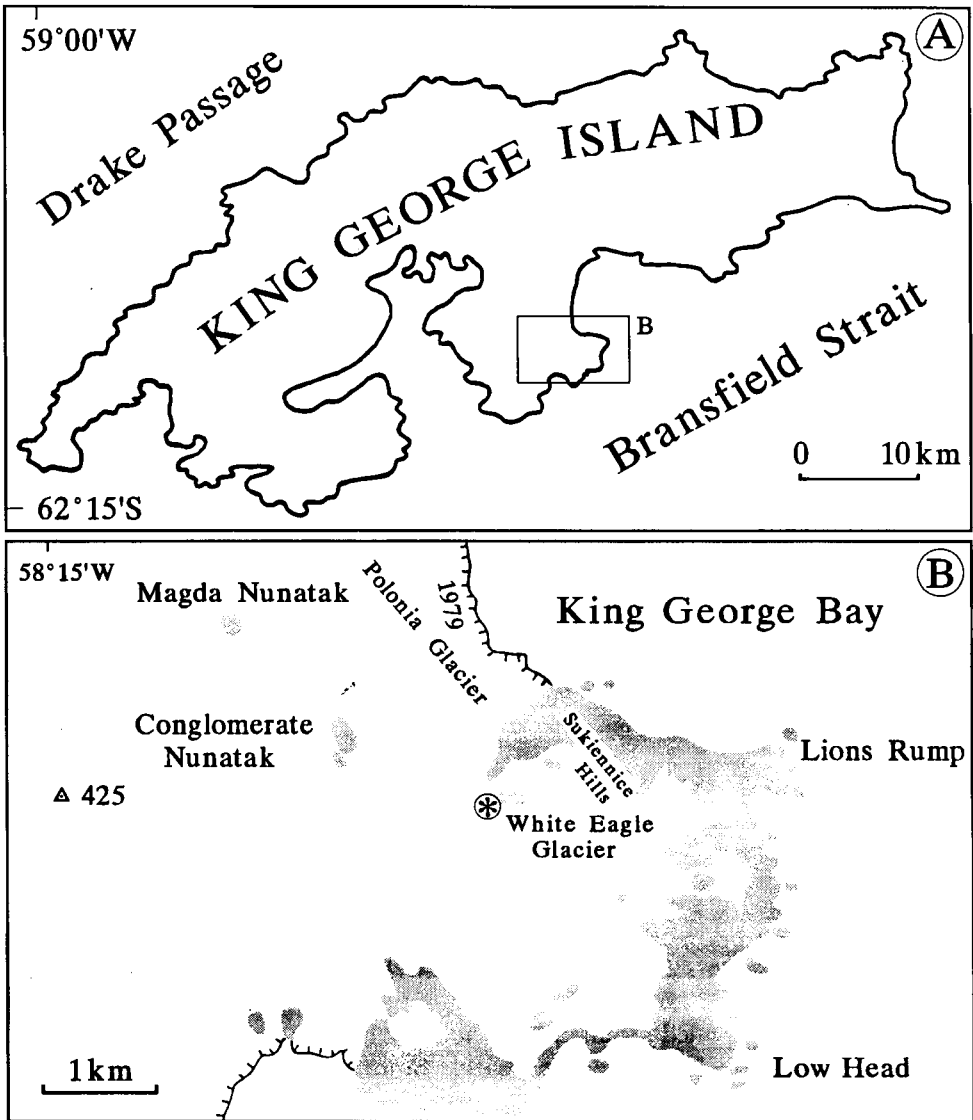


Fig. 1. Map of King George Island (A) and location of the Low Head - Lions Rump and Magda Nunatak area (B). Asterisk indicates the coral *Flabellum*-bearing strata at northwest margin of the White Eagle Glacier. Shaded areas are exposed rock.

Geological and stratigraphical setting

The glaciomarine sediments of the Low Head Member (= *Pecten* Conglomerate of Barton 1965) are the richest fossil bearing unit of the Polonez Cove Formation (Gaździcki and Pugaczewska 1984). The Low Head Member

sequence is represented by fossiliferous conglomerates with *Chlamys coquinas* and iceberg-rafted dropstones of Antarctic continent provenance as well as by siltstones, sandstones and shales over 15 m thick (Birkenmajer 1982, Gaździcki 1984, Porębski and Gradziński 1987, Birkenmajer *et al.* 1991).

In accordance with K–Ar dating of associated volcanic rocks (Birkenmajer, Soliani and Kawashita 1989) and in the light of micropaleontological data – calcareous nannoplankton (Gaździcka and Gaździcki 1985; Birkenmajer, Dudziak and Tokarski 1988) and planktonic foraminifera (Gaździcki 1989) an Early Oligocene age has been accepted for the Low Head Member as well as for the Polonez Glaciation (*see* Birkenmajer 1992).

The studied solitary corals which have been found in the lowermost part of the Low Head Member sequence at the northwest margin of the White Eagle Glacier occur with bivalves of the genus *Panopea* in particular (Pl. 2, Fig. 1). Also a few brachiopods as well as Cambrian limestone erratics (which occur as dropstones) have been collected from coral-bearing strata.

Systematic paleontology

Family *Flabellidae* Bourne, 1905

Genus *Flabellum* Lesson, 1831

Flabellum sp.

(Pl. 2, Fig. 2)

M a t e r i a l. – Two fragmentary specimens (ZPAL H. X/1–2) visible on the surface of the rock as calicular sections (Pl. 2, Fig. 1): an oblique to the edge of the calice, and a parallel section. Larger, better preserved fragment (ZPAL H. X/1; Pl. 2, Fig. 2) comprises 79 septa, the smaller and poorly preserved one has 36 septa (ZPAL H. X/2; Pl. 2, Fig. 3).

D i m e n s i o n s (in mm):

| | Number of septa | Septal density per 10 mm | Greater calicular diameter (GCD) | Lesser calicular diameter (LCD) |
|-------------|-----------------|--------------------------|----------------------------------|---------------------------------|
| ZPAL H. X/1 | e. ≥ 158 | ~13 | e. 60 | e. 30 |
| ZPAL H. X/2 | ? | ~11 | e. 40 | e. 13 |

c. – estimated

D e s c r i p t i o n. – Septa in the larger fragment (ZPAL H. X/1) represent probably over 2 complete systems. The systems are composed of septa of six orders. Between longer septa (probably of S_{1-4} cycles; in this section about 1/4 of the estimated LCD) occur triads of shorter septa (*i.e.* relatively longer one in the centre of each triad, probably of S_5 cycle, about 4 mm long, and

two shorter, about 1 mm long situated laterally, presumably of S_6 cycle). Septal density is about 13 per 10 mm. Interseptal spaces are filled with sediment. Lateral and corallum face crests are absent. Due to recrystallization original microstructure cannot be studied.

R e m a r k s. — The two available calicular sections have been interpreted as follows: one as oblique to the distal edge (estimated inclination of the section plane is about 35° ; ZPAL H. X/1) and the second one (ZPAL H. X/2) as almost parallel to the distal edge of calice — *compare* Fig. 2. Fragmentarily preserved surfaces of the wall on both sides of corallum (ZPAL H. X/1) allow to determine the angle of their inclination at about 40° . Judging from the both sections (ZPAL H. X/1–2), the outline of calice was elliptical. Shapes of the sections suggest also that the length of preserved parts of calices reaches at least half the length of greater calicular diameters (GCD). Relatively great dimensions of fragments as well as a lack of an axial structure and any stereome in the interseptal spaces evidence that the specimens represent distal parts of corallites.

Additional section made in a plane parallel to that visible on the photograph (Pl. 2, Fig. 2) revealed that the distal part of calice continues only about 8 mm inside the rock. Taking this data into account, the height of the whole corallum could be estimated as about 50 mm.

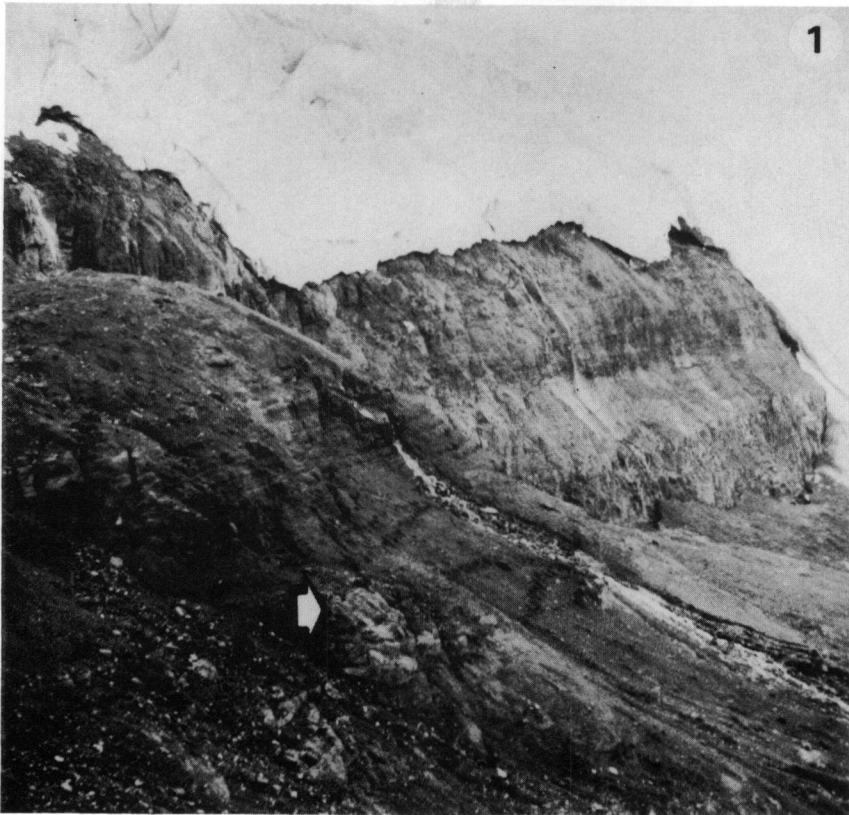
Morphological features allow for the assignment of the form considered to the *Flabellum* sp., its specific determination, however, is impossible.

O c c u r e n c e. — Northwest margin of the White Eagle Glacier, Low Head Member of the Polonez Cove Formation (Lower Oligocene). King George Island.

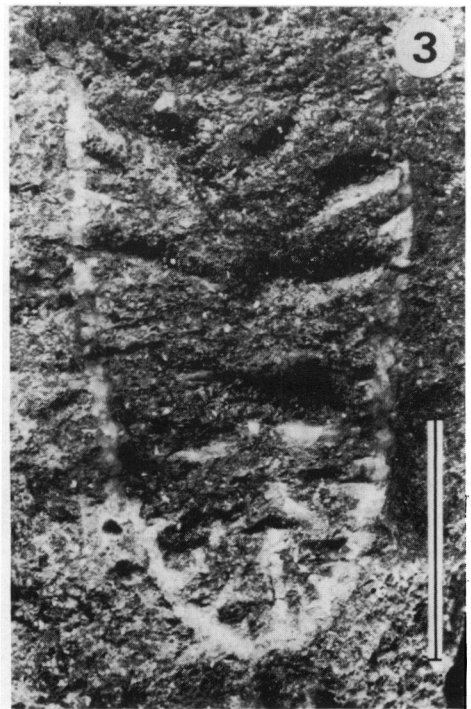
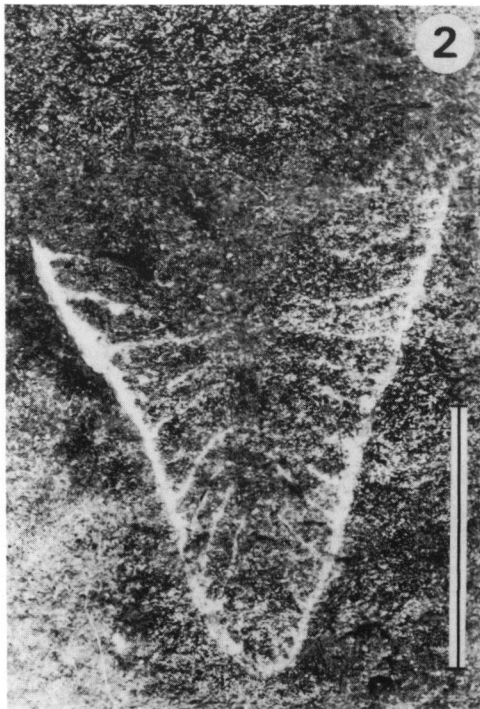
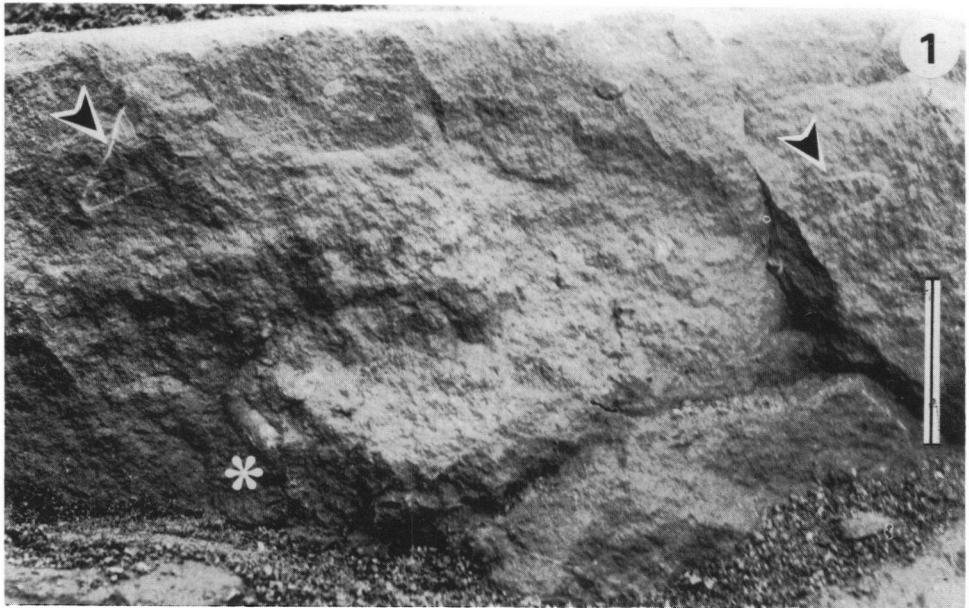
Remarks on *Flabellum* phylogeny

The oldest known species of the genus *Flabellum* (*F. fresnoense*) was described by Durham (1943) from Upper Cretaceous strata of the Pacific Coast (California, USA). Rare, early Tertiary (Paleocene) representatives of the genus (*e.g.* *F. primitivum* Kühn, 1967 from Austria; *F. groenlandicum* Floris, 1972 from Greenland; *F. conoideum* Vaughan, 1900 from Alabama, USA; *F. texense* Vaughan and Popenoe, 1933 from Texas, USA; *F. remondianum* Gabb, 1864 from California, USA) are characterized by relatively simple morphology of corallite (oval outline of calice, lack of face and lateral crests). Heights of coralla of the mentioned species do not exceed 2 cm.

The Early Oligocene specimens of *Flabellum* sp. described here are the oldest representatives of the genus from Antarctica. Similarity of septal pattern, elliptical outline of calice, estimated height as well as geographical and



1–2. Exposures of glacially–controlled marine strata of the Low Head Member (Polonez Cove Formation) at the northwest margin of White Eagle Glacier in which the solitary corals of the genus *Flabellum* have been found (arrowed).
Photos by A. Gaździcki, February 1991



1. Coral *Flabellum*—bearing stratum (cf. Pl. 1, Fig. 1). Asterisk shows bivalve of the genus *Panopea*.
Scale bar 5 cm

2. *Flabellum* sp. ZPAL H. X/1. Scale bar 2 cm

3. *Flabellum* sp. ZPAL H. X/2. Scale bar 1 cm

Photos by A. Gaździcki (1) and G. Dzięwińska (2—3)

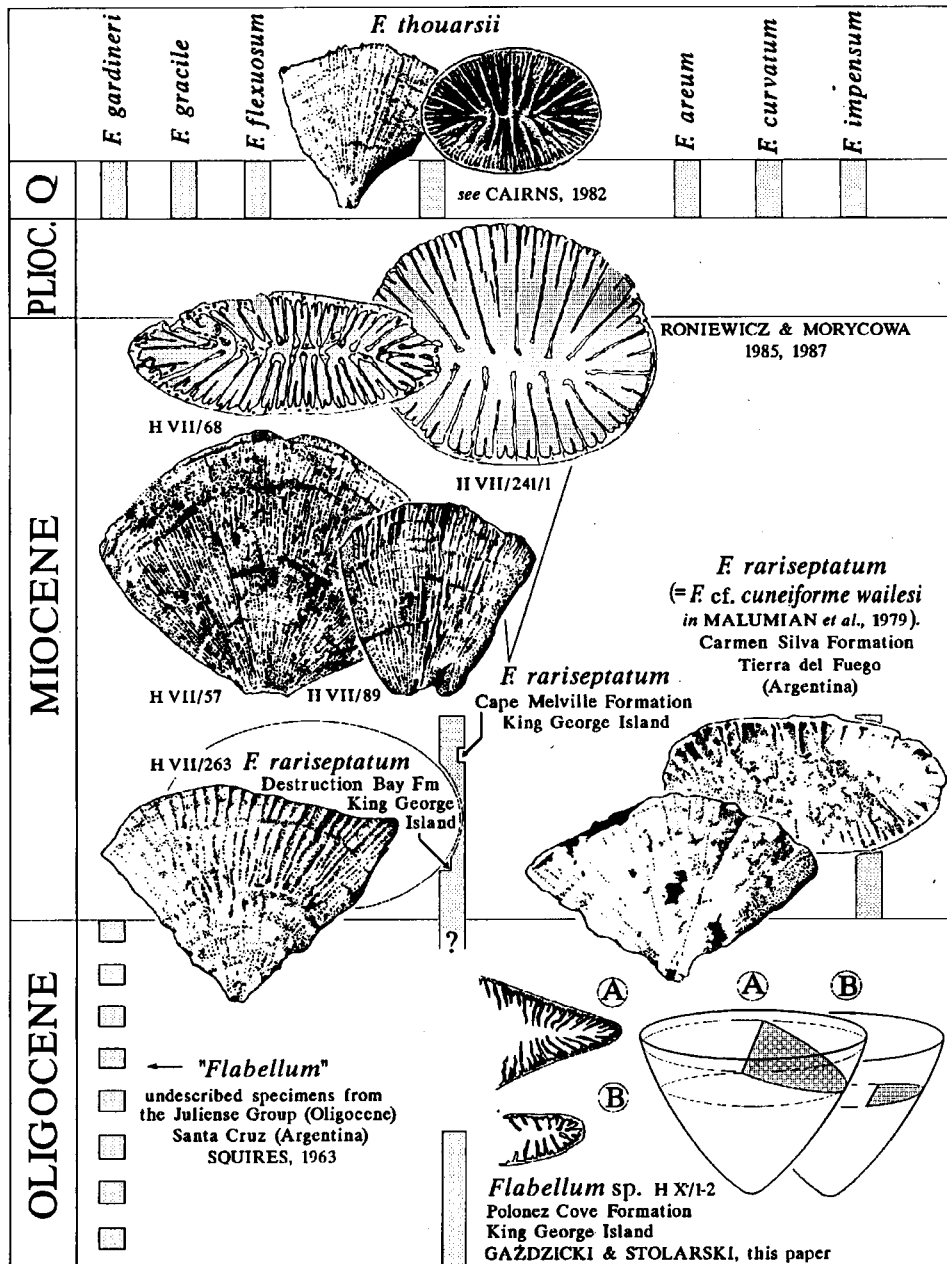


Fig. 2. Stratigraphic distribution and possible phylogenetic relationships of *Flabellum thouarsii* group of species in the Antarctic and Subantarctic regions.

stratigraphical ranges allow to presume that these forms were related to *F. thouarsii* group of species (Fig. 2). The lineage is represented by species with relatively smooth surface of corallum, at least five cycles of septa and with 12 protosepta (S1–2) on the basal plate (*see also* Roniewicz and Morycowa 1985, 1987). The oldest forms, possibly belonging to that group, were collected from the Juliense Group (Oligocene) of Santa Cruz, Argentina (Squires 1963). These undescribed specimens (stored in *Museo de La Plata*, Argentina) are, according to Squires (1963), most similar to ceratoid coralla (GCD/LCD ratio about 1.25) of Recent species *F. flexuosum* Cairns, 1982.

Most probably, the described specimens of Early Oligocene *Flabellum* sp. from the Polonez Cove Formation could be linked with the Early Miocene *F. rariseptatum* Roniewicz and Morycowa 1985. The latter species is described from the Lower Miocene (or even Upper Oligocene) sandstones and conglomerates of the Destruction Bay Formation (*see* Abreu *et al.* 1992) and the overlying Lower Miocene glaciomarine sequence of the Cape Melville Formation of King George Island (Roniewicz and Morycowa 1985, 1987) as well as from the Lower Miocene Carmen Silva Formation (Tierra del Fuego, Argentina, *see* Malumian *et al.* 1978). That species shows a large shape variability of coralla; ratio GCD/LCD in adults from about 1 to about 3 (Fig. 2), and the shape of described *Flabellum* sp. was probably comparable with its flabellate morphotypes (ratio GCD/LCD is suggested about 2–3).

In Recent coral fauna from the Antarctic and Subantarctic regions the group of *Flabellum* with 12-septal initial stage, is represented by six species and one endemic species from New Zealand *i.e.* *F. thouarsii* Milne-Edwards and Haime, 1848; *F. areum* Cairns, 1982; *F. curvatum* Moseley, 1881; *F. impensum* Squires, 1962; *F. flexuosum* Cairns, 1982; *F. gardineri* Cairns, 1982 and New Zealand's *F. gracile* (Studer, 1878) *see* Fig. 2; *compare* Cairns 1982, 1990.

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Streszczenie

Z dolnooligocenijskich utworów morsko-lodowcowych ogniwa Low Head (formacja Polonez Cove) Wyspy King George, Antarktyka Zachodnia (fig. 1, pl. 1) opisano po raz pierwszy osobnicze koralce z rodzaju *Flabellum* Lesson, 1831 (zob. fig. 2, pl. 2). Zilustrowane w pracy okazy są najstarszymi znanymi reprezentantami rodzaju *Flabellum* z Antarktyki. Formy te charakteryzują

podobieństwo morfologiczne do dolnomiocenickich przedstawicieli gatunku *Flabellum rariseptatum* Roniewicz i Morycowa 1985, opisanych z utworów formacji Cape Melville oraz Destruction Bay z Wyspy King George oraz z formacji Carmen Silva z Ziemi Ognistej (patrz Roniewicz i Morycowa 1985, 1987). Z tego powodu, najbardziej prawdopodobne wydaje się wiązanie opisanego w niniejszej pracy *Flabellum* sp. z grupą gatunków z kręgu *Flabellum thouarsii*, charakteryzujących się występowaniem 12 protoseptów na płytce podstawowej. Grupa ta reprezentowana jest we współczesnej faunie koralowcowej mórz wokółantarktycznych przez 7 taksonów (por. fig. 2).