EARLY CAMBRIAN ARCHAEOCYATHS FROM GLACIAL ERRATICS OF KING GEORGE ISLAND (SOUTH SHETLAND ISLANDS), ANTARCTICA

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Twenty six species of archaeocyaths are described (seven in open nomenclature), including *Naimarkcyathus elenae* gen. et sp. n. representing a new family Naimarkcyathidae and superfamily Naimarkcyathoidea of the order Archaeocyathida, from the Cambrian limestone erratics in the glacio-marine sediments of the Oligocene Polonez Cove and Early Miocene Cape Melville Formations on King George Island (South Shetland Islands, West Antarctica). They are accompanied by coralomorphs and calcified cyanobacteria. The archaeocyathan assemblage closely resembles allochthonous assemblages from the Weddell Sea and Whichaway Nunataks. Current reconstructions of icestream movement and iceberg drift, and similarities in species composition, suggest the Argentina Range limestones as a source of these erratics. The species *Stapicyathus stapipora, Prethmophyllum subacutum, Aporosocyathus mucroporus, "Mennericyathus" dissitus, Paranacyathus sarmaticus* and *Archaeopharetra irregularis* are added to the list of common species for Antarctica and Australia. The total list of the common Australian–Antarctic archaeocyaths now include 31 of all of the 52 well defined Antarctic species. The archaeocyaths of King George Island, and Early Cambrian Antarctic archaeocyath assemblages (except these of the Mt. Egerton in the Byrd Glacier area) are of uppermost Botomian age (*Syringocnema favus* Beds) as in South Australia. This means that archaeocyaths did not reach Antarctica until latest Botomian time. Erratic blocks containing archaeocyaths represent various reef facies similar to the Shackleton Limestone facies and those of South Australia. The occurrence of small shelly fossils (*Dailyatia ajax*, ?*Byronia* sp., *Halkieria parva, Thambetolepis delicata* and *Albrunicola bengtsoni*) which are typical of the Parara Limestone, of the *Syringocnema favus* archaeocyathan assemblage, and of *Hadimopanella antarctica* and certain brachiopods in erratics of different lithologies, suggests a very similar faunal and facies succession for Antarctica and South Australia and therefore, a comparable basin history.

Key words: Archaeocyatha, Coralomorpha, Cambrian, Antarctica, South Shetland Islands.

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INTRODUCTION

Cambrian archaeocyath-bearing limestones are widely distributed across the Antarctic continent, between Byrd Glacier and the Weddell Sea (Text-fig. 1). Archaeocyaths were first noted in a moraine near Mount Buckley in the Transantarctic Mountains during SCOTT's Expedition (SCOTT 1913). Other occurrences include allochthonous blocks derived from the Shackleton Limestone at Beardmore Glacier (TAYLOR in DAVID and PRIESTLEY 1914; HILL 1964a), the Weddell Sea floor (GORDON 1920), Whichaway Nunataks near the Shackleton Range (HILL 1965; STEPHENSON 1966), *in situ* Shackleton Limestone at Nimrod and Byrd Glaciers (LAIRD and WATERHOUSE 1962; HILL 1964b; BURGESS and LAMMERINK 1979; DEBRENNE and KRUSE 1986), *in situ* Shackleton Limestone in the Holyoake Range (REES *et al.* 1989; DEBRENNE and KRUSE 1989), allochthonous in Douglas Conglomerate, *in situ* Argentina Range limestone (KONYUSHKOV and SHULYATIN 1980), Bender Mountains in the Queen Maud Mountains (ROWELL *et al.* 1995) and erratics in the Permo–Carboniferous Whiteout Conglomerate in the Ellsworth Mountains (CRADDOCK and WEBERS 1964; DEBRENNE 1992). MAWSON's (1940) report of a probable archaeocyath from an erratic at Cape Denison, East Antarctica has not been confirmed (JAGO and OLIVER 1986). Antarctica is the only continent from which undoubted Middle and Late Cambrian archaeocyaths have been recorded (SCHMIDT *et al.* 1965; WEBERS 1966; DEBRENNE *et al.* 1984; WOOD *et al.* 1992). With these youngest exceptions, the Antarctic archaeocyathan fauna is almost conspecific with the fauna of Australia, and for this we provide further evidence in this paper.

MORYCOWA *et al.* (1982) figured and listed some Early Cambrian archaeocyaths from a Recent moraine at Three Sisters Point, King George Island. They were probably reworked from the Tertiary glacio-marine deposits. Limestone erratics containing archaeocyaths were subsequently identified in the Oligocene to Early

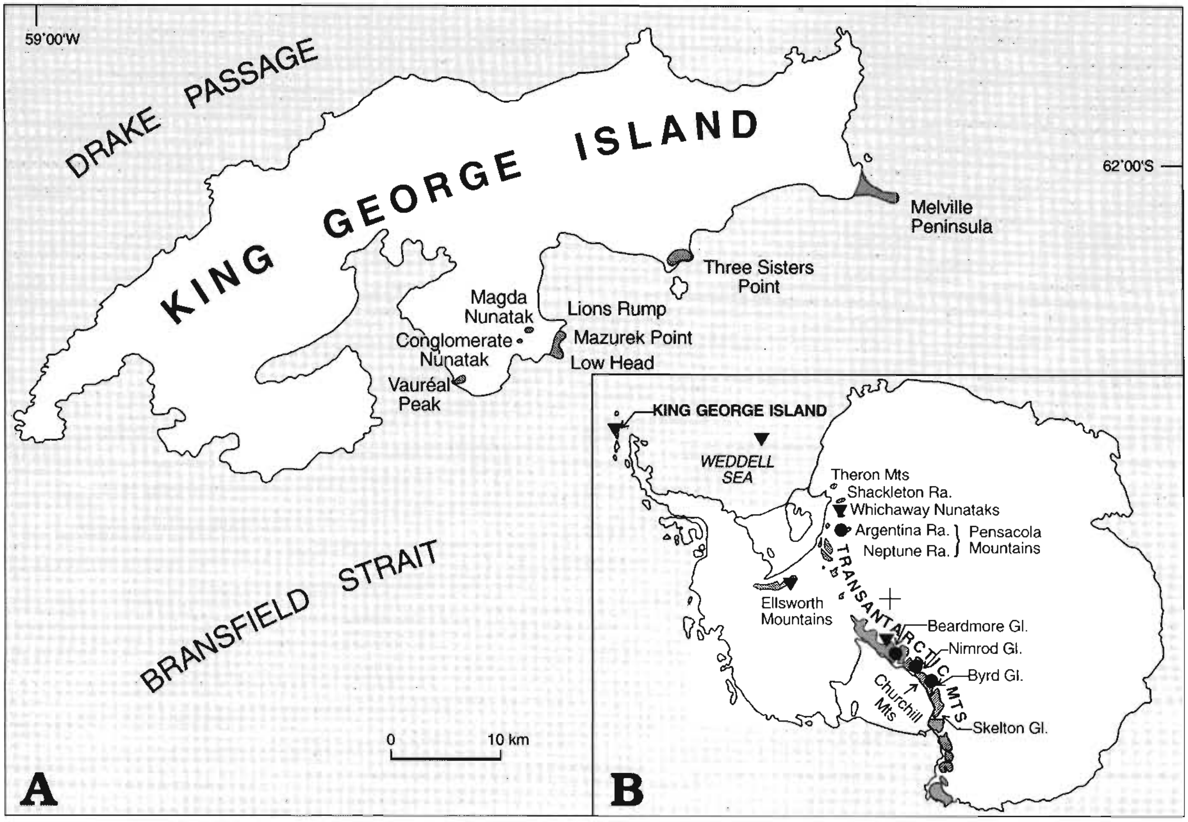

Fig. 1

Location map of King George Island in Antarctica (B) and the occurrence of glacial and glacio-marine formations (shaded) on the island (A). Dark shaded are outcrops of Cambrian rocks in Antarctica. Circles and triangles indicate autochthonous and allochthonous occurrences of Early Cambrian archaeocyaths respectively.

Miocene glacial and glacio-marine succesions of King George Island (Birkenmajer 1980, 1982b, 1987; Gaździcki and Wrona 1986; Wrona 1989, 1995). Similar erratics have been recently found on King George Island by the Cambridge Arctic Shelf Programme Expedition (Zhuravlev and Wood 1995).

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GEOGRAPHICAL AND GEOLOGICAL SETTING

Tertiary glacial and glacio-marine sediments crop out on King George Island (South Shetland Islands, West Antarctica) in the southern cliffs between Admiralty Bay and Melville Peninsula, as well as in isolated Conglomerate and Magda Nunataks in the hinterland (Text-fig. 1). Abundant and diverse erratics containing Early Cambrian fossils were collected from the Polonez Cove and Cape Melville Formations during the Polish geological and paleontological investigations in the austral summer seasons of 1980–1981 and 1985–1986.

Fig. 2
Exposures of the stratified deposits of the Early Miocene Cape Melville Formation in the cliff of the Melville Peninsula, with erratic boulders (dropstones) as residual enrichment on the top of glacio-marine sediments; February 1981.

The glacio-marine Polonez Cove Formation is exposed in cliffs between Low Head and Lions Rump (Text-fig. 1). The Oligocene age of the formation is based on the occurrence of a calcareous nannofossils (GAŹDZICKA and GAŹDZICKI 1985) and on radiometric (K-Ar) dating of the overlaying lavas (BIRKENMAJER and GAŹDZICKI 1986). The glacio-marine Cape Melville Formation is restricted to the Melville Peninsula. It contains indigenous solitary corals, calcareous and arenaceous foraminifera, diatoms, chrysomonad cysts, silicoflagellates, polychaetes and bryozoans of the Miocene age, as well as reworked Cretaceous calcareous nannofossils and belemnites (DUDZIAK 1984; GAŹDZICKI 1987). The age of the formation is determined by radiometrically (K-Ar) dated basalt lavas of the underlying Sherrat Bay Formation and transverse dikes, as well as by biostratigraphic studies, which indicates its deposition during the Early Miocene glaciation of Antarctica (BIRKENMAJER *et al.* 1983, 1985; BIERNAT *et al.* 1985; GAŹDZICKI 1987; BIRKENMAJER 1992).

Striated ice-rafted boulders, up to 2 m in size (Text-fig. 2), are scattered randomly within the sediment and have been interpreted as iceberg dropstones delivered during glacial epochs called the Polonez and Melville Glaciations of Oligocene and Early Miocene age respectively (BIRKENMAJER 1982a–b, 1989, 1995). The erratic boulders are mainly igneous, metamorphic, or siliciclastic rocks whereas limestones account for some 5% of the total number of boulders (WRONA 1989). Petrographic features of these rocks, in particular fossiliferous limestones, point to the source areas on the Antarctic continent (MORYCOWA *et al.* 1982; WRONA 1989). The most common lithologies of limestone erratics are identical to the Shackleton Limestone exposed in the central Transantarctic Mountains, but they display some similarities with certain South Australian Cambrian successions as well.

MATERIAL

The fossils, which have been identified in thin sections and after acid etching of the limestone erratics are abundant, diverse and include archaeocyath sponges and coralomorphs discussed in this paper, brachiopods described elsewhere (HOLMER *et al.* 1996 this volume), and small shelly fossils listed and partially described earlier (GAŹDZICKI and WRONA 1986; WRONA 1987, 1989).

The limestone boulders represented by several hundred samples were collected from the steep cliff between Low Head (sample acronym AE/LH) and Lions Rump (acronym AE/LR), mainly from Mazurek Point (acronym AE/M), in the type locality of the Oligocene Polonez Cove Formation. Samples AE/TS were collected from modern moraines in the vicinity of Three Sisters Point yielding erratics typical of the Polonez Cove Formation (MORYCOWA *et al.* 1982; WRONA 1989). The Early Miocene Cape Melville Formation erratics are represented by samples AE/Me from the Melville Peninsula. The collection of the studied material is housed in the Institute of Paleobiology of the Polish Academy of Sciences in Warszawa (abbreviated as ZPAL Ac.I).

ERRATICS LITHOLOGY AND FACIES INTERPRETATION

All limestone erratics fall into a limited number of lithological varieties which may originate from one succession, and may be classified under three following groups:

Group I is represented by dark packstone-wackestone and burrowed mudstones with abundant small shelly fossils. Among them, samples AE/Me32–33 and 66 represent black packstones and wackestones consisting mainly of shell hash which is interbeded with dark-grey floatstone (Pl. 1: 3, 5). Packed hyolith, mollusc, bradoriid, lingulate shells, echinoderm ossicles, trilobite fragments, diverse sclerites and sponge spicules predominate, while archaeocyath fragments are rare (Pl. 1: 5). The shells are commonly filled with phosphatic material. Bedding ranges from flaggy to nodular and bedding surfaces are burrowed. Ferroan dolomitization is common, resulting in the brown-grey weathering colour. In some floatstone interbeds, the bioclasts have been neomorphosed to ferroan calcite while ferroan bladed cement overgrows hyolith shells. Abundant framboidal pyrite indicates the activity of sulphur-reducing bacteria in the sediment. Sample AE/Me1/29, 60 and 106 show mottling due to slight burrowing of wackestone bearing hyolith and trilobite fragments (Pl. 1: 1). Sample AE/Me53 contains non-bedded homogenous mudstone with few scattered trilobite fragments and silt-size quartz grains, and sample AE/Me41 is wavy thin-bedded homogenous and cross-stratified wackestone.

A moderately deep marine environment with oscillating anaerobic (homogenous mudstone) and dysaerobic (burrowed wackestone) to aerobic (graded shelly packstone and wackestone) bottom conditions may be suggested for the sediments represented in these boulders. Consequently, calm to moderately active shelf below storm wave base or slope conditions on the carbonate platform periphery may be implied.

Group II includes a large variety of relatively shallow water reef limestones. The samples AE/Me1/2 and 174 are dolomitized cementstone with archaeocyath skeletons partly dissolved and replaced with blocky calcite and numerous cavities infilled with fibrous cement; cups are commonly covered by a microbial encrustation (Pl. 1: 6 and Pl. 2: 3). Also included are samples AE/M1/24, 16, 20; Me1/29, 37, 42, 67, 73, 160 and 176 representing floatstones which bears archaeocyaths developing massive secondary skeleton and are surrounded by a grainstone with well sorted pellets and clots of calcimicrobes (*Gordonophyton, Renalcis, Proaulopora*) and by mudstone-wackestone with trilobite, mollusc, hyolith, radiocyath and chancelloriid fragments, echinoderm ossicles and sponge spicules. Shelter porosity is conspicuous in the grainstone, archaeocyaths are commonly dissolved, and *Girvanella* oncoids starts from archaeocyathan cups (Pl. 8: 7). Samples AE/Me29 and 56 are dark-grey wackestones with archaeocyaths, sponge spicules, chancelloriid sclerites, trilobite fragments and probable large pellets. Samples AE/M1 and Me98 are grainstones containing well sorted and oriented fragments of echinoderm ossicles, *Girvanella* crusts, *Renalcis* clots and *Bija* filaments, microstromatolite fragments, hyolith conchs (Pl. 8: 2, 4) and shelter porosity. Samples AE/M10; Me2, 69, 74, 75, 169, 171, 174, 175; LH5; TS3 and 7 are dendrolites built by fine *Gordonophyton* encrusting small, rare *in situ* archaeocyaths, and by less prominent tiny *Renalcis* and by *Girvanella* crusts. The remaining cavities are rimmed with fibrous cement and occluded by sparry calcite and weakly developed micrite (Pl. 1: 4). Pockets with grainstone, geopetal structures and, in places, bioturbation are formed. Stromatactis-like structures and synsedimentary cracks joint them are observed in the latter samples all are encrusted by a thin veneer of fibrous cement and infilled with a mud on the bottom (Pl. 1: 4). Sample AE/Me42 contains a *Gordonophyton–Kordephyton* dendrolite with very rare archaeocyaths (Pl. 8: 6). Some intermediate lithologies allow us to suggest that dendrolites are enclosed by bioturbated mudstone-floatstone with toppled large *Pycnoidocyathus* cups (Pl. 4: 3) and rare hyolith debris (AE/Me1/68, 60, 70, 81, 90). More rare lithologies are represented by dolomitized intraclast packstone (AE/M1/14; Me101) with archaeocyaths and *Khasaktia* (Pl. 8: 1); thin, evenly bedded mudstone

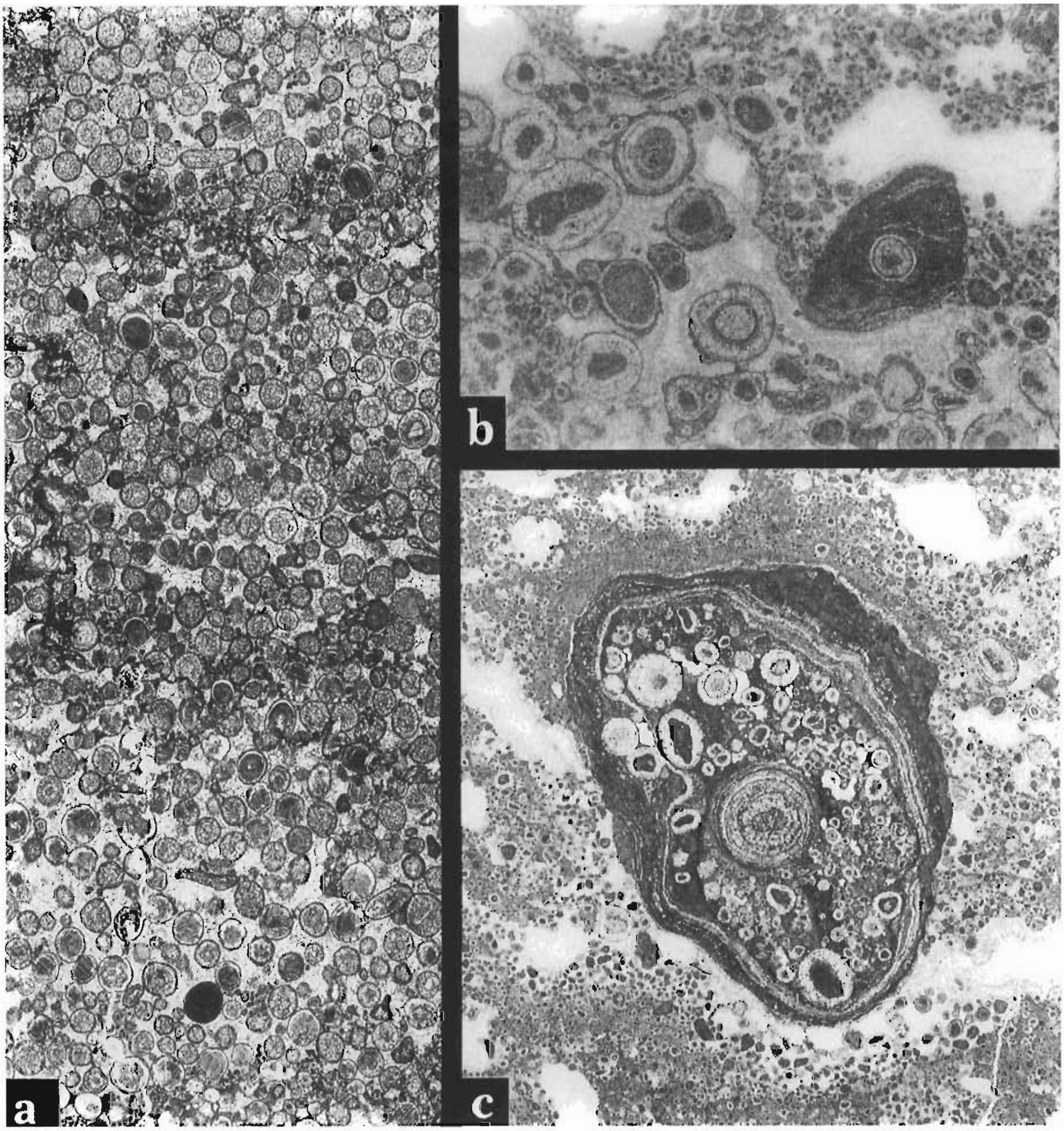

Fig. 3
a — well sorted, normaly packed ooid grainstone; AE/Me2, Melville Peninsula, × 7; b — ooid-peloid grainstone of poorly sorted pellets, ooids and radial ooids; compound oncoids and *Girvanella* crust. Fenestral porosity is infilled with fibrous and sparry cement; AE/Me156, Melville Peninsula, × 6; c — compound oncoid; AE/Me156, Melville Peninsula, × 4.

with shelter porosity and sparry cement (AE/M20; Me46, 96); and *Subtifloria*-grainstone (Pl. 8: 5) with shelter porosity infilled fibrous and equant cement, or in places, with pure fibrous cement (AE/Me1/10).

Parallel sectioning reveals obvious archaeocyathan interactions. Thus, *Metaldetes pratti–Spirocyathella cooperi–"Mennericyathus" dissitus* interactions are observed in Me1/2 sample (Pl. 5: 3; Pl. 6: 6–7). In early growth stage the *Metaldetes* cup was slightly indented and produced several successive films of vesicular tissue separating it from *Spirocyathella* and *Spirocyathella* from the environment. In turn, *Spirocyathella* encrusted *"Mennericyathus"*. Later *Metaldetes* encrusted *Spirocyathella* and invaded its intervallum as shown by the distribution of *Metaldetes* vesicular tissue. The foreign cup was probably dead by that time.

The following samples are dominated by ooid and/or oncoid textures:

— oncoid grainstone of irregular, non sorted oncoids with archaeocyath debris (AE/LR3);

— light-grey grainstone to intraclast packstone (AE/M2, 11, 18, 24; Me1–4, 1/3, 1/5, 67 and 94) with oncoids 0.3–0.8 mm in size, archaeocyath, trilobite and brachiopod fragments and *Gordonophyton* and *Renalcis* clots and *Girvanella* crusts (Pl. 8: 7);
— poorly sorted ooid-peloid grainstone composed of pelloids, ooids (including radiaxial ooids) ranging from 0.2 mm to 4.0 mm in diameter (Text-fig. 3a); compound oncoids (Text-fig. 3b, c), *Girvanella* crusts, and intergranular porosity infilled by fibrous and sparry cement. Ooids in the latter are partially replaced by sparry calcite, while some oncoids contain small pellets and possess a distinct envelope. The oncoids are irregular in shape and size (0.5–1.5 mm), and flattened (AE/Me1/23, 1/25, 34, 92, 111, 156, 158);
— well sorted (0.3–0.6 mm), densely packed, but badly preserved due to compaction and partial dissolution, ooid packstone with laminar fractionally graded layering (AE/Me1, 83, 93, 95, 173, 200), and also ooid packstone with *Proaulopora* and radiaxial ooids (AE/M1).

Quartzose sandstone (AE/Me161) consisting of angular small grains (0.4 mm) may also belong to Early Cambrian lithologies.

The Shackleton Limestone facies model developed by REES *et al.* (1989) for the Holyoake Range of the central Transantarctic Mountains may help to decipher the initial facies distribution of discussed here lithological groups. Thus, the Group II facies accumulated in conditions of variable dynamic conditions in shallow subtidal settings on a carbonate platform. Burrowed mottled lime mudstones and wackestones with thin layers of bioclastic grainstone represent shallow subtidal shelf deposits. Some transitional lithologies indicate that they were interbedded with deposits formed as ooid bars and sand sheets, together with *Gordonophyton* and archaeocyathan reefs, in a high energy environment. Peritidal deposits may be represented by half-moon ooids with collapsed internal structures (AE/Me93), that could be produced by partial dissolution in hypersaline environments embracing the oolitic bank facies (BUGGISCH and WEBERS 1982).

Our data support REES *et al.* (1989) and ROWELL *et al.* (1992) suggestion of the existence of an extensive Early Cambrian carbonate platform in Antarctica from the Churchill Mountains to Whichaway Nunataks including the Beardmore Glacier area, Argentina Range and northern Pensacola Mountains. Erratic blocks indicate that a succession comparable to that in the upper Beardmore Glacier area may have been developed as far west as Whichaway Nunataks. These regions, predominantly the Queen Maud and Thiel Mountains, constitute one or more displaced crustal blocks (ROWELL and REES 1989). The Shackleton Limestone accumulated on a broad carbonate shelf of unknown width (ROWELL *et al.* 1992). This platform probably was continuous along strike for about 1200 km from Byrd Glacier toward the Weddell Sea, where an Early Cambrian carbonate shelf margin is recognised in the Argentina Range.

Group III comprises samples AE/Me40 and 150 represented by slightly bituminous, dark-grey argillaceous lime mudstones with palaeoscolecidan sclerites and lingulate shells.

These three principal groups, namely, black skeletal wackestone-packstone, reef microfacies and dark-grey limestone, closely match those of the Parara Limestone, Koolywurtie Limestone Member and Ramsay Limestone, respectively, of the Yorke Peninsula (South Australia) succession (*cf.* TUCKER 1989; DAILY 1990; ZHURAVLEV and GRAVESTOCK 1994). The faunal assemblages from each pair of compared subdivisions are also very similar (see below).

FAUNAL ASSEMBLAGE AND STRATIGRAPHIC IMPLICATIONS

Parallel to the three lithological groups, three distinct faunal assemblages are recognised. Here we briefly revise the two small shelly fossil associations listed and figured earlier (GAŹDZICKI and WRONA 1986; WRONA 1987, 1989, 1995) and present a complete species list of archaeocyathan assemblage.

Preliminary list of small shelly fossils characteristic for group I assemblage was given by GAŹDZICKI and WRONA (1986) and WRONA (1989) from samples AE/Me32–33 and 66. Subsequent monographic studies of small shelly fossils from Australia and Antarctica (BENGTSON *et al.* 1990; EVANS and ROWELL 1990; BROCK and COOPER 1993; ZHURAVLEV and GRAVESTOCK 1994; YATES 1994) allow us to correct these preliminary identifications. The corrected list includes hexactinellide (WRONA 1989, pl. 7: 5, 7) and heteractinide (WRONA 1989, pl. 8: 6) sponge spicules. The mollusc *Pelagiella* sp. (GAŹDZICKI and WRONA 1986, fig. 7d; WRONA 1989, pl. 10: 4) may be assigned to *Pelagiella* cf. *adunca* (HE *et* PEI in HE *et al.*, 1984) as described by BROCK and COOPER (1993). Hyoliths and hyolith-like fossils include *Microcornus* cf. *petilus* BENGTSON in BENGTSON *et al.*, 1990 (GAŹDZICKI and WRONA 1986, fig. 7c; WRONA 1989, pl. 10: 1) and *Actinotheca* sp. (= *Coleolella* in WRONA 1989, pl. 7: 4). The bradoriid *Hipponicharion* sp. described by BENGTSON *et al.* (1990) from the Parara Limestone of Yorke Peninsula, South Australia has been redescribed as a new species by HINZ-SCHALLREUTER (1993). L. MELNIKOVA (personal communication) confirmed the conspecificity of these South Australian and Antarctic bradoriids (GAŹDZICKI and WRONA 1986, fig. 7f) which belong now to *Albrunnicola bengtsoni* HINZ-SCHALLREUTER, 1993. Tommotiids are represented by *Dailyatia ajax* BISCHOFF, 1976 (WRONA 1989, pl. 9: 1 and *Camenella* sp. in GAŹDZICKI and WRONA 1986, fig. 7e) and *Lapworthella fasciculata* CONWAY MORRIS *et* BENGTSON in BENGTSON *et al.*, 1990 (= mitrosagophoran sclerite in WRONA 1989, pl. 10: 3). Coeloscleritophorans are diverse and include chancelloriids *Allonnia* sp. (WRONA 1989, pl. 8: 4) and *Chancelloria* sp. (GAŹDZICKI and WRONA 1986, fig. 7a), halkieriids *Halkieria parva* CONWAY MORRIS in BENGTSON *et al.*, 1990 (= *Halkieria* sp. in WRONA 1989, pl. 8: 3) and *Thambetolepis delicata* JELL, 1981 (= *Halkieria* sp. in GAŹDZICKI and WRONA 1986, fig. 7h). *Hyolithellus filiformis* BENGTSON in BENGTSON *et al.*, 1990 (= *Hyolithellus* sp. in WRONA 1989, pl. 8: 2) and ?*Byronia* sp. (WRONA 1989, pl. 8: 1) are distinct among hyolithelminths. In addition, indistinguishable trilobite fragments, archaeocyath *Prethmophyllum* ex gr. *brunhilda* (BEDFORD *et* BEDFORD, 1937), and problematic *Mongolitubulus squamifer* MISSARZHEVSKY, 1974 are present (WRONA 1989, pl. 8: 5). Further details of the small shelly fossil assemblage will be scrutinized elsewhere (BENGTSON and WRONA in preparation).

The entire assemblage is very close to the late Atdabanian–Botomian Australian assemblages. Furthermore it is conspecific with the small shelly fossil assemblage from the Parara Limestone of Yorke Peninsula. *Albrunnicola bengtsoni* and *Mongolitubulus* sp. are not known from the Flinders Ranges (BENGTSON *et al.* 1990; YATES 1994). Rich small shelly fossils and trilobites assemblages were found in the Shackleton Limestone of the central Transantarctic Mountains. These latter assemblages, however, contains no species in common with either King George Island assemblage or Yorke Peninsula assemblage (ROWELL *et al.* 1988; EVANS and ROWELL 1990; COOPER and SHERGOLD 1991; EVANS 1992; PALMER and ROWELL 1995).

The absence of typical late Atdabanian fossils, namely *Paterimitra, Micrina* or *Eccentrotheca* (YATES 1994), allows us to further constrain the lower age limit of the small shelly fossil assemblage to the *Pararaia tatei* trilobite Zone (BENGTSON *et al.* 1990). Thus, the lower Botomian age is the most plausible because many King George Island small shelly fossils are not known above this interval (BENGTSON *et al.* 1990; ZHURAVLEV and GRAVESTOCK 1994; YATES 1994).

Group II lithologies contain diverse archaeocyaths and some other reef organisms which are listed below. The most distinctive elements of the assemblage are described in the systematic part.

Archaeocyaths: *Dokidocyathus* sp., *Stapicyathus stapipora* (TAYLOR, 1910), *S. incisus* (HILL, 1965), *Ajacicyathus ajax* (TAYLOR, 1910), *Prethmophyllum subacutum* (BEDFORD *et* BEDFORD, 1934), *Aporosocyathus mucroporus* KRUSE, 1978, *"Mennericyathus" dissitus* KRUSE, 1982, *Erugatocyathus scutatus* (HILL, 1965), *E. gravestocki* (DEBRENNE *et* KRUSE, 1986), *Veronicacyathus* sp., *Putapacyathus excavatus* HILL, 1965, *Archaeopharetra irregularis* (TAYLOR, 1910), *Naimarkcyathus elenae* gen. et sp. n., *Thalamocyathus trachealis* (TAYLOR, 1910), *Thalamocyathus* sp., *Diplocyathellus* sp., *Thalamocyathus* ex gr. *trachealis* (TAYLOR, 1910) ?*Anaptyctocyathus* sp., *Spirocyathella cooperi* (DEBRENNE, 1975), *Metaldetes pratti* (HILL, 1965), *Pseudosyringocnema uniserialis* (HILL, 1965), *Kruseicnema gracilis* (GORDON, 1920), *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD, 1934), ?*Aporosocyathus* sp., *Pycnoidocyathus latiloculatus* (HILL, 1964), *Leptosocyathus* sp., *Paranacyathus sarmaticus* DEBRENNE, 1974b, ?*Chabakovicyathus* sp., *Syringocnema favus* TAYLOR, 1910, *Erismacoscinus stephensoni* (HILL, 1965), *Bractocyathus labiosus* KRUSE, 1978. Radiocyaths: *Radiocyathus minor* (BEDFORD *et* BEDFORD, 1934). Problematic sponge: *Acanthinocyathus apertus* (BEDFORD *et* BEDFORD, 1934). Calcarean sponges: *Gravestockia* sp. (Pl. 4: 5). Heteractinide sponges. Coralomorph: *Khasaktia* sp. (Pl. 8: 1). Calcified cyanobacteria: *Proaulopora* sp., *Gordonophyton grande* (GORDON, 1920) KORDE 1973, *Renalcis* sp. (Pl. 2: 3), *Razumovskia* sp. (Pl. 8: 3), *Kordephyton* sp. (Pl. 8: 6), *Bija* sp. (Pl. 8: 2, 4).

Despite differences in the archaeocyathan composition of the studied samples, all of them contain common elements with the *Syringocnema favus* Beds assemblage of South Australia which is correlated by ZHURAVLEV and GRAVESTOCK (1994) with the latest Botomian. Similar elements have been identified in the King George Island erratics found by the Cambridge Arctic Shelf Program Expedition. They include *Tumuliolynthus irregularis, Dokidocyathus* sp., *Ladaecyathus* sp., *Bractocyathus labiosus, Archaeopharetra* sp., *Pycnoidocyathus latiloculatus, Metacyathellus lairdi* (HILL 1964) and *Kruseicnema gracilis* (ZHURAVLEV *et* WOOD, 1995). Earlier, DEBRENNE and KRUSE (1989) identified and partly figured *Ajacicyathus* sp., *A. ajax, Stapicyathus incisus, Thalamocyathus trachealis, Cyathocricus tracheodentatus* (BEDFORD *et* BEDFORD, 1934), ?*Kiwicyathus* sp., *Erugatocyathus scutatus* and ?*Veronicacyathus* sp. from the Polonez

Cove Formation erratics collected by MORYCOWA *et al.* (1982). The most typical of the *Syringocnema favus* Beds assemblage among the King George Island archaeocyaths are *Stapicyathus stapipora, Prethmophyllum subacutum, Aporosocyathus mucroporus, Mennericyathus dissitus, Paranacyathus sarmaticus* and *Archaeopharetra irregularis* identified in Antarctica for the first time. In addition, such noticeable species of the *Syringocnema favus* Beds as *Tumuliolynthus irregularis, Thalamocyathus trachealis, Erugatocyathus scutatus, Pycnoidocyathus latiloculatus, Syringocnema favus, Kruseicnema gracilis* and the problematic sponge *Acanthinocyathus apertus* are present. The determination of *Spirocyathella cooperi* in Antarctica further supports the Antarctic origin of South African Carboniferous tillites containing archaeocyaths (DEBRENNE 1975).

Group III fauna is represented by extremely rich and well preserved larval and adult brachiopod shells, sponge spicules, chancelloriid sclerites, mollusc and hyolith conchs and trilobite carapaces (HOLMER *et al.* 1996 this volume). Lingulate brachiopods *Eoobolus* aff. *E. elatus* (PELMAN in PELMAN and PERELADOV, 1986) [= *Lingulella* sp. in BROCK and COOPER (1993)], *Karathele napuru* (KRUSE, 1990), and *Vandalotreta djagoran* (KRUSE, 1990) [= *Hadrotreta primaeva* in BROCK and COOPER (1993)] from the sample AE/Me52 are identical to brachiopod assemblages described from the Toyonian Wirrealpa Limestone of the Flinders Ranges, Ramsay Limestone of the Yorke Peninsula, South Australia, and Tindall Limestone of the Daly Basin, Northern Territory (KRUSE 1990; BROCK and COOPER 1993; HOLMER *et al.* 1996 this volume; see also Text-fig. 4). *Hadimopanella antarctica* WRONA, 1987, both in morphology and size, closely resembles elements of the tuberculate ornaments on *Chalasiocranos exquisitum* BROCK *et* COOPER, 1993 sclerites from the Ramsay Limestone of the Yorke Peninsula, South Australia (BROCK and COOPER 1993). It is possible that *H. antarctica* represents intermediate smaller sclerites of the same animal that bears *C. exquisitum* sclerites, similarly to other Cambrian–Silurian animals of the palaeoscolecidan-lobopodian group possessing sclerites of different kinds (see KRAFT and MERGL 1989; MÜLLER and HINZ-SCHALLREUTER 1993), or is even a resultant of *C. exquisitum* sclerite disruption. On the whole, this assemblage belongs to the middle Toyonian *Archaeocyathus abacus* Beds (ZHURAVLEV and GRAVESTOCK 1994).

PROVENANCE OF LIMESTONE ERRATIC BOULDERS

The provenance of the King George Island glacial erratics is unknown, but generally they are believed to have derived from locations near the Ellsworth Mountains or along the Weddell Sea coast and from the Transantarctic Mountains (WRONA 1989; EVANS and ROWELL 1990). BIRKENMAJER (1980, 1982a–b), BIRKENMAJER and BUTKIEWICZ (1988) suggested that the main sources of igneous erratics may be (1) Antarctic Peninsula, (2) Ellsworth Mountains, (3) Pensacola and Theron Mountains, which provide the entire diversity of dropstone lithologies (Text-fig. 1). However, only the latter two occurences yield the Cambrian rocks. The dropstones occurring in marly shales of the Cape Melville Formation were delivered to the Miocene basin by drifting icebergs derived from the margin of ice shelves. Such icebergs also dropped Cambrian erratics, which contain an almost identical Cambrian fauna, in particular *Ajacicyathus ajax, Stapicyathus incisus, Thalamocyathus trachealis, Erugatocyathus scutatus, Spirocyathella cooperi, Naimarkcyathus elenae*, and *Kruseicnema gracilis* (DEBRENNE and KRUSE 1989; see also this paper), into the Weddell Sea. Of this list, two species are present only in the King George Island and Weddell Sea erratics. The Whichaway Nunataks contain *Stapicyathus incisus, Thalamocyathus trachealis, Aporosocyathus mucroporus, Erismacoscinus stephensoni, Erugatocyathus scutatus, Putapacyathus excavatus, Pycnoidocyathus latiloculatus, Metaldetes pratti, Pseudosyringocnema uniserialis*, and *Syringocnema favus* (DEBRENNE and KRUSE 1989; see also this paper). Five of these species are common with the King George Island archaeocyaths.

We may suggest that archaeocyathan assemblages of these three allochthonous occurrences were derived from the same source. The Carboniferous–Permian conglomerates from the Ellsworth Mountains could not be the source of the erratic blocks because their archaeocyathan assemblage is very different (DEBRENNE 1992). The archaeocyath-bearing limestone occuring in the upper part of the Ross Supergroup in the Ross Orogen, at least the region between Nimrod Glacier and Theron Mountains, could be the source area for both the archaeocyath-bearing erratics collected from glacigenic deposits of King George Island and those dredged from the Weddell Sea floor. Taking into account the present and late Tertiary flow patterns of Antarctic icesheets (MAYEWSKI 1975; DREWRY 1983), it seems that the source area of archaeocyath-bearing erratics was most probably somewhere between the Argentina Range and Theron

Mountains. The Argentina Range (in Pensacola Mountains) is the nearest locality containing *in situ* archaeocyaths (Text-fig. 1). Unfortunately, the Argentina Range archaeocyaths were listed only, but never figured (KONYUSHKOV and SHULYATIN 1980).

Erratic boulders bearing small shelly fossils are the most puzzling as they closely resemble the Early Cambrian rocks of South Australia (Parara and Ramsay Limestones) but lack analogues in Antarctica. Two Antarctic localities containing small shelly fossils are known. These are the autochthonous Shackleton Limestone in the Churchill Mountains (mainly Holyoake Range) between Nimrod and Byrd Glaciers and in the southeast of Mount Bowers (ROWELL *et al.* 1988), and Early Cambrian boulders at Mount Provender, Shackleton Range yielding molluscs compared with *Helcionella* and *Mellopegma* (CLARKSON *et al.* 1979). Neither locality contains species in common with the King George Island erratics.

DISCUSSION

Lithological and faunal features of the studied erratics reveal their close similarity with South Australian Early Cambrian sequences, the most striking with Yorke Peninsula succession (Text-fig. 4). Both lithologically and paleontologically, King George Island erratic groups I, II and III resemble the Parara

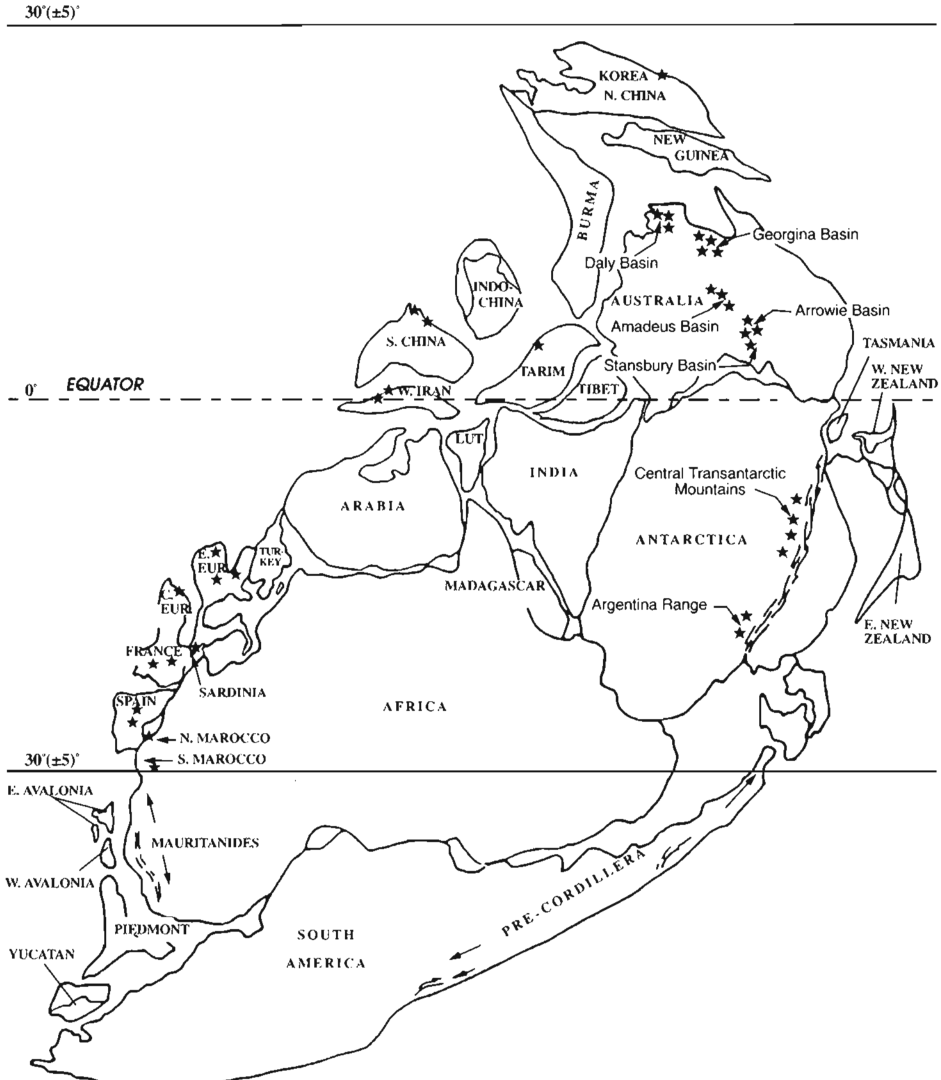

Fig. 4

Paleogeographical map of the significant Early Cambrian basins and shelf areas of Australia and Antarctica. Asterisked are archeocyath occurrences (modified after COURJAULT-RADÉ *et al.* 1992).

Limestone, Koolywurtie Member and Ramsay Limestone respectively. Only the Minlaton Formation Red Bed and evaporite lithologies (DAILY 1990) are not evidenced in the erratics. This may be due to the absence of distinct fossils in the latter formation or to a selective preservation of different lithologies in glacial erratic boulders (WRONA 1989). Some, but not so obvious similarities are observed between the studied material and the Flinders Ranges (Arrowie Basin) rocks, in particular: Mernmerna Formation, upper Wilkawillina Limestone and Wirrealpa Limestone respectively.

The provenance of the King George Island erratic boulders is somewhere in the Weddell Sea vicinity (see above). Thus, surprisingly, the closest similarities are observed between the Stansbury Basin of South Australia and the most remote part of Antarctica (*e.g.* DALZIEL 1992: figs 2–3). There are two possible explanations. First, the Stansbury Basin was an Australian basin proximal to the continuous East Antarctic shelf along which the fauna freely migrated (Text-fig. 4). The Antarctic Early Cambrian trilobite fauna, however, differs conspicuously from the Australian one and has only few elements in common (COOPER and SHERGOLD 1991; PALMER and ROWELL 1995). The small shelly fossils found in the Churchill Mountains are not very similar to the South Australian and King George Island fauna despite their intermediate paleogeographic location (ROWELL *et al.* 1988; EVANS and ROWELL 1990; EVANS 1992). The second is that several more or less isolated basins might have existed along the East Antarctic craton. Those basins might have ben connected only during the most prominent transgressions, thus allowing faunal exchange. Transgressive tracts are indeed suggested for the early Botomian, late Botomian and middle Toyonian times based on the sequence stratigraphy of South Australian basins (GRAVESTOCK *et al.* 1990; GRAVESTOCK and HIBBURT 1991; GRAVESTOCK and SHERGOLD in press). These are the horizons that contain very similar fossil assemblages. For example, of the total 52 well defined archaeocyath species which are now known from Antarctica, 31 species (60%) are common with Australia. All of them belong to the *Syringocnema favus* assemblage, but some species could have appeared a little earlier. Significantly, not one species belonging to older Australian archaeocyathan zones has been found in Antarctica.

SYSTEMATIC PALEONTOLOGY

The archaeocyathan descriptions are based on the systematics by DEBRENNE, ZHURAVLEV and ROZANOV (1989), and DEBRENNE and ZHURAVLEV (1992). In addition a representative of coralomorphs, an informal entity of calcareous sessile Cambrian fossils which may be cnidarians (JELL 1984; ZHURAVLEV *et al.* 1993), is described.

Class **Archaeocyatha** BORNEMANN, 1884
Order **Monocyathida** OKULITCH, 1935
Family **Tumuliolynthidae** ROZANOV in ROZANOV and MISSARZHEVSKY, 1966
Genus *Tumuliolynthus* ZHURAVLEVA, 1963
Tumuliolynthus irregularis (R. BEDFORD *et* W.R. BEDFORD, 1934)
(Pl. 3: 1)

1934. *Monocyathus irregularis* n. sp.; R. BEDFORD and W.R. BEDFORD, p. 2, pl. 1: 2.
1939. *Monocyathus irregularis* BEDFORD *et* BEDFORD; R. BEDFORD and J. BEDFORD, p. 68, pl. 42: 160.
1963. *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD); ZHURAVLEVA, p. 110, text-fig. 58.
1969. *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD); DEBRENNE, pp. 304–305, pl. 1: 1.
1974a. *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD); DEBRENNE, p. 100, pl. 19: 7.
1982. *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD); KRUSE, pp. 144–145, text-figs 6, 8A–E.
1995. *Tumuliolynthus irregularis* (BEDFORD *et* BEDFORD); ZHURAVLEV and WOOD, fig. 2A (top).

Material. — Two thin sections ZPAL Ac.I/Me1/14 and Me74.

Description. — One-walled cup 1 mm diameter. The wall is 0.08 mm thick and bears scarce tumuli up to 0.14 mm in height and up to 0.16 mm in diameter. Pores are of irregular size and spacing.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Ajax Limestone, Flinders Ranges (BEDFORD and BEDFORD 1934) and Cymbric Vale Formation, New South Wales, Australia (KRUSE 1982), and King George Island erratics, Antarctica (ZHURAVLEV and WOOD 1995). The King George Island erratics are the only occurrence of this Australian species in Antarctica.

Order **Ajacicyathida** R. BEDFORD *et* J. BEDFORD, 1939
Suborder **Ajacicyathina** R. BEDFORD *et* J. BEDFORD, 1939
Superfamily **Bronchocyathoidea** R. BEDFORD *et* J. BEDFORD, 1936
Family **Ajacicyathidae** R. BEDFORD *et* J. BEDFORD, 1939
Genus *Stapicyathus* DEBRENNE, 1964
Stapicyathus stapipora (TAYLOR, 1910)
(Pl. 1: 6)

1910. *Archaeocyathus stapipora* n. sp.; TAYLOR, p. 118, pl. 3: 10, pl. 7: 37–38.
1939. *Ajacicyathus stapipora* (TAYLOR); R. BEDFORD and J. BEDFORD, p. 75.
1964. *Ajacicyathus (Stapicyathus) stapipora* (TAYLOR); DEBRENNE, p. 124.
1965. *Robustocyathus stapipora* (TAYLOR); HILL, pp. 61, 64.
1969. *Archaeocyathellus (Stapicyathus) stapipora* (TAYLOR); DEBRENNE, p. 309, pl. 1: 5.
1974a. *Stapicyathus stapipora* (TAYLOR); DEBRENNE, pp. 118–119, pl. 24: 1, 3–4.
1989. *Stapicyathus stapipora* (TAYLOR); DEBRENNE, ZHURAVLEV and ROZANOV, pl. 3: 3, pl. 5: 5.
1990. *Stapicyathus stapipora* (TAYLOR); DEBRENNE, ROZANOV and ZHURAVLEV, pl. 3: 3, pl. 5: 5.

Material. — Two thin sections ZPAL Ac.I/M10 and Me73.

Description. — The cup is up to 2.5 mm in diameter and the intervallum is 0.6 mm wide. The outer wall is simple, slightly bulged over intersepts and pierced by 3 to 4 pore rows per intersept, two of which are arranged alongside the wall-septum junction. Pores are 0.10–0.12 mm in diameter, interpore lintels are 0.07 mm wide, the wall thickness is 0.05 mm. The inner wall is simple, penetrated by stirrup pores only. It is 0.07–0.08 mm in thickness. Pores are 0.2 mm in diameter with interpore lintels 0.1 mm wide. The intervallum contains septa with a single stirrup pore row alongside the inner wall. Septa are 0.05 mm thick.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Ajax Limestone, Flinders Ranges, South Australia (TAYLOR 1910) and King George Island erratics, Antarctica. This is the first known occurrence of this species in Antarctica.

Family **Leptosocyathidae** VOLOGDIN, 1961
Genus *Leptosocyathus* VOLOGDIN, 1937
Leptosocyathus sp.
(Pl. 3: 2)

Material. — One thin section ZPAL Ac.I/Me74.

Description. — Cup is 5.0 mm in diameter with a relatively narrow, 0.9 mm wide, intervallum. Outer wall is simply porous, pierced by 3, rarely 2, pore rows per intersept. Pores are constricted by flat diaphragms, and 0.12–0.14 mm in diameter, lintel width is 0.07 mm, and the wall thickness 0.02 mm. The inner wall is pierced by stirrup pores only (diameter 0.15 mm). The wall bears spiny scales and has a total thickness of 0.06 mm. The intervallum is traversed by scattered porous septa with a single stirrup pore row alongside the inner wall.

Remarks. — Undoubtful *Leptosocyatus* has been recognized for the first time in the entire Australian–Antarctic shelf. ?*Leptosocyathus* sp. from the Koolywurtie Member, Yorke Peninsula, South Australia differs in having much more frequent septa and less defined scales on the inner wall (ZHURAVLEV and GRAVESTOCK 1994).

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Family **Bronchocyathidae** R. BEDFORD *et* J. BEDFORD, 1936
Genus *Thalamocyathus* GORDON, 1920
Thalamocyathus trachealis (TAYLOR, 1910)
(Pl. 3: 3)

1910. *Archaeocyathus trachealis* n. sp. (*pars*); TAYLOR, p. 125, pl. 1: 11n–p, pl. 2: 6, pl. 3: 11a, pl. 5: 27i–30i, pl. 6: 31 *pars*, pl. 8: 45–46, 47/7, text-fig. 22.
1994. *Thalamocyathus trachealis* (TAYLOR); ZHURAVLEV and GRAVESTOCK, p. 22, fig. 8A, E, F (*cum syn.*).

Material. — Four thin sections ZPAL Ac.I/Me94.

Description. — The cup is up to 5.0 mm in diameter and the intervallum width is up to 1.0 mm. The simple outer wall possesses 2–4 rows per intersept of rounded-angular, slightly compressed pores. The pore diameter is 0.03–0.06 mm, lintels are from 0.01 mm to 0.03 mm wide at the base, and the wall is 0.075 mm in thickness. Pores are covered with flat diaphragms. The inner wall lintels support massive V-shaped annuli with a solid carina at the junction of annular limbs. Fixed limb is shorter than free limb. Inner wall openings are about 0.25 mm in size when the total wall thickness is 0.25 mm. The intervallum is filled with sparsely porous septa pierced by rounded small pores, 0.04 mm in diameter.

Occurrence. — From the late Botomian *Syringocnema favus* Beds of the Ajax Limestone, Flinders Ranges (TAYLOR 1910; GRAVESTOCK 1984), the Koolywurtie Member, Yorke Peninsula, South Australia (ZHURAVLEV and GRAVESTOCK 1994), the Shackleton Limestone, northern Holyoake Range, Nimrod Glacier (DEBRENNE and KRUSE 1986), and allochthonous blocks from Weddell Sea and King George Island (GORDON 1920; MORYCOWA *et al.* 1982) and Whichaway Nunataks, Antarctica (HILL 1965), as well as the Permo–Carboniferous Dwyka Tillite, South Africa (DEBRENNE 1975).

Thalamocyathus ex gr. *trachealis* (TAYLOR, 1910)
(Pl. 3: 6–7)

Material. — Three thin sections ZPAL Ac.I/Me1/2.

Description. — Outer wall pierced by 2 alternating pore rows per intersept. Pores are rounded, 0.1–0.12 mm in diameter, interpore lintels are 0.06–0.08 mm wide. Inner wall bears one pore row per intersept covered by annuli with downward-inward directed spines on the intervallum side. The annulus width is 0.16 mm. Septa are pierced by pores scattered in the middle part of the intervallum. Pores are rounded, 0.14–0.16 mm in diameter.

Remarks. — The present species is intermediate between *T. trachealis* and *T. tectus* DEBRENNE, 1973 in number of pores per intersept and in convexity of pore diaphragms of the outer wall. It is possible that all of them represent only a continuous set of intraspecific variability.

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Thalamocyathus sp.
(Pl. 3: 4)

Material. — One thin section ZPAL Ac.I/Me67.

Description. — Cup diameter is 2.5 mm, intervallum is 0.8 mm wide. The outer wall is simple with 3 pore rows per intersept. Pores are hexagonal in outline and constricted by flat diaphragms (pore diameter 0.07 mm, lintel width 0.02 mm, wall thickness 0.06 mm). Annuli on the inner wall are V-shaped in longitudinal section and bear carina. The total inner wall thickness reaches 0.25 mm, pore diameter is 0.13 mm, interpore space is 0.1 mm. The intervallum contains sparsely porous septa with pores 0.1 mm in diameter.

Remarks. — Flat diaphragms on the outer wall and a simple structure of inner wall annuli differentiate this species from other *Thalamocyathus* species. Incomplete preservation prevents its assignment to species level.

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Family **Densocyathidae** VOLOGDIN, 1937
Genus *Prethmophyllum* DEBRENNE, 1974b
Prethmophyllum subacutum (R. BEDFORD *et* W.R. BEDFORD, 1934)
(Pl. 3: 5)

1934. *Archaeocyathus subacutus* n. sp.; R. BEDFORD and W.R. BEDFORD, p. 2, pl. 1: 3a–c.
1937. *Archaeocyathus acutus* BORNEMANN; TING, p. 358, pl. 9: 1–2.
1937. *Archaeocyathus subacutus* BEDFORD *et* BEDFORD; R. BEDFORD and J. BEDFORD, p. 35, pl. 37: 145A–D.
1960. *Ajacicyathus walliseri* n. sp.; DEBRENNE and DEBRENNE, pp. 696–697, pl. 19: 3.
1969. *Robustocyathus subacutus* (BEDFORD *et* BEDFORD); DEBRENNE, pp. 312–314, pl. 3: 6–7, text-fig. 4.
1974b. *Prethmophyllum subacutus* (BEDFORD *et* BEDFORD); DEBRENNE, pp. 174–175, pl. 22: 1, 3.
1982. *Prethmophyllum subacutum* (BEDFORD *et* BEDFORD); KRUSE, pp. 164–165, text-fig. 14C–D, G–I.

Material. — Two thin sections ZPAL Ac.I/M10.

Description. — The cup exceeds 10 mm in diameter with the intervallum 1.3 mm wide. Outer wall is pierced by a single pore row per intersept. Pores are well-rounded, 0.10–0.12 mm in size, with convex diaphragms; lintel width is 0.08 mm. The inner wall is 0,3 mm thick and pierced by one pore row per intersept. Pores are hexagonal in outline due to septal margin undulation; the pore is 0.20–0.22 mm in diameter; lintel is 0.12 mm width. Septa are thin (0.03 mm), frequent, almost non-porous. Septal pores are arranged in a single row alongside the outer wall; pores are elongated, 0.10–0.16 mm in width and 0.25–0.32 mm in height.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Ajax Limestone, Flinders Ranges (BEDFORD and BEDFORD 1934), the Cymbric Vale Formation, New South Wales, Australia (KRUSE 1982); and allochthonous Early Cambrian boulders, King George Island, Antarctica. This is the first occurrence of this species outside Australia.

Prethmophyllum ex gr. *brunhilda* (R. BEDFORD *et* W.R. BEDFORD, 1937)
(Pl. 1: 5)

Material. — One thin section ZPAL Ac.I/Me33.

Description. — The cup is 2.5 mm in diameter, with outer wall pierced by several rows of pores including stirrup pores covered with diaphragms. The wall thickness is 0.06 mm, pore diameter is 0.1 mm. The inner wall bears a single row of short straight canals per intersept. The wall thickness is 0.18 mm, canal diameter is 0.18 mm. Septa are undulating, 0.03 mm in thickness, with stirrup pores alongside the outer wall and scattered pores elsewhere.

Remarks. — An incomplete cup does not allow specific attributions. The outer wall features (several pore rows per intersept) indicate that the closest species is *P. brunhilda*.

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Superfamily **Ethmophylloidea** OKULITCH, 1937
Family **Kijacyathidae** ZHURAVLEVA in REPINA *et al*., 1964
Genus *Aporosocyathus* KRUSE, 1978
Aporosocyathus mucroporus KRUSE, 1978
(Pl. 4: 2, 4)

1978. *Aporosocyathus mucroporus* n. sp.; KRUSE, p. 32, figs 4, 5A.
1982. *Aporosocyathus mucroporus* KRUSE; KRUSE, pp. 179–180, text-fig. 16F–H.

Material. — Four thin sections ZPAL Ac.I/M10, M20, Me1/2, and Me176.

Description. — Cup diameter is up to 6 mm with intervallum up to 1 mm in width. Outer wall has 2, rarely 3, rows of inverted V-shaped canals per intersept. Wall is 0.125 mm thick, and canal is 0.100–0.125 mm in diameter, canal wall is 0.05 mm thick. Inner wall is 0.25 mm in width, bearing upright V-shaped annuli and pierced by one row of openings per intersept. Free limb of each annulus is broader than the fixed limb and curved upward. A short, tapered carina extends downward and inward from the lower surface of each annulus. The wall is 0.4 mm thick in total and pore is 0.125 mm in diameter. Intervallum contains almost non-porous septa except for a single pore row adjacent to the outer wall. The septal pore is 0.125 mm in diameter.

Ontogeny. — At the cup diameter 1.0 mm, the species already possess the entire set of generic features. The outer wall thickness and pore diameter are each 0.05 mm, inner wall is 0.1 mm thick.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the upper Wilkawillina Limestone, Flinders Ranges and the Cymbric Vale Formation, New South Wales, Australia (KRUSE 1982), and Early Cambrian erratics, King George Island, Antarctica. This is the first occurrence of this species in Antarctica although the genus has already been recorded in the allochthonous locality of Whichaway Nunataks (DEBRENNE and KRUSE 1989).

?*Aporosocyathus* sp.
(Pl. 4: 1)

Material. — One thin section ZPAL Ac.I/Me67.

Description. — The outer wall is penetrated by 4 rounded pores with bracts or spines bent upward per intersept. The wall is 0.1 mm thick, and pore is 0.075–0.125 mm in diameter, lintel is 0.02 mm width. The inner wall is pierced by 1 pore per intersept which is covered with annuli or scales. The total wall thickness is 0.25 mm and pore is 0.2 mm in diameter. The intervallum contains sparsely porous septa with pores 0.02 mm in size.

Remarks. — The specimen, that was figured by HILL (1964a: fig. 2) as *Thalamocyathus trachealis* may be conspecific with the studied specimen. The number of pores per outer wall intersept differentiates this species from all known representatives of *Aporosocyathus*. On the other hand, the preservation is not complete enough, and the possibility of affinity with *Flexanulus* exists.

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Suborder **Erismacoscinina** DEBRENNE, ROZANOV *et* ZHURAVLEV in DEBRENNE, ZHURAVLEV and ROZANOV, 1989

Superfamily **Salairocyathoidea** ZHURAVLEVA, 1956

Family **Asterocyathidae** VOLOGDIN, 1956

Genus *Erismacoscinus* DEBRENNE, 1958

Erismacoscinus stephensoni (HILL, 1965)

(Pl. 4: 5)

1965. *Coscinocyathus stephensoni* n. sp.; HILL, p. 101, 104; pl. 7: 17–18.

1965. *Coscinocyathus ?stephensoni* n. sp.; HILL, pl. 7: 19.

1989. *Erismacoscinus stephensoni* (HILL); DEBRENNE, ZHURAVLEV and ROZANOV, p. 66.

Material. — Three thin sections ZPAL Ac.I/Me 94 and Me176.

Description. — Cup is 8 mm in diameter with the intervallum 1.2 mm in width. The outer wall is simply porous, pierced by 4 pore rows per intersept. Pores are covered by flat thin diaphragms (diameter 0.125–0.150 mm, lintel 0.1 mm wide, wall 0.075 mm thick). The inner wall is simple, bears small bracts, penetrated by 2–3 pore rows per intersept (diameter 0.15 mm, lintel width 0.13 mm, wall thickness 0.18–0.20 mm). The intervallum contains sparsely porous septa and scarce netlike plate tabulae. Septum pore diameter is 0.08 mm, tabula pore diameter is 0.1–0. 2 mm (lintel width 0.025 mm).

Remarks. — The species was provisionally determined as *Erismacoscinus* by DEBRENNE *et al.* (1989). It is here redescribed and assigned to the same genus.

Occurrence. — Allochthonous Early Cambrian blocks, Whichaway Nunataks (HILL 1965) and King George Island, Antarctica.

Superfamily ?**Mrassocyathoidea** VOLOGDIN, 1960

Family ?**Polycoscinidae** DEBRENNE, 1964

Genus ?*Mennericyathus* DEBRENNE *et* ROZANOV, 1974

"Mennericyathus" dissitus KRUSE, 1982

(Pl. 2: 2, Pl. 5: 1, 3, 5)

1982. *Mennericyathus dissitus* n. sp.; KRUSE, pp. 191–193, pl. 12: 7–11, pl. 13: 1–7.

non 1984. *Mennericyathus dissitus* KRUSE; GRAVESTOCK, pp. 93–94, figs 11A–C, 43A–E.

1989. *Erugatocyathus*; WRONA, p. 540, pl. 6: 2.

non 1990. *Mennericyathus dissitus* KRUSE; DEBRENNE and GRAVESTOCK, p. 303, fig. 7c–d.

Material. — Four thin sections ZPAL Ac.I/M10 and Me1/2.

Description. — Cup is up to 6 mm in diameter. Outer wall covered by an independent microporous sheath and pierced by 2–3, rarely one framework pore row per intersept. Pore diameter is 0.10–0.12 mm, lintel width and wall thickness are 0.08 mm. Microporous sheath is 0.015 mm thick, pierced by 2–3 pores per framework pore section. The inner wall is 0.1 mm thick, pierced by 2–3 pore rows per intersept covered by small tapering triangular bracts curved downward. Bracts are decorated by spines. Pores are stirrup-like, elliptical to rounded, from 0.08 mm to 0.14 mm in size; interpore lintels are 0.06 mm in width. Intervallum contains infrequently porous septa and netlike plate tabulae. Septal pores are rounded, arranged in 4–6 vertical rows 0.06 mm in diameter. The distance between pores exceeds their diameter. Tabular pores are 0.04–0.10 mm in size, lintels between them are 0.02 mm wide.

Ontogeny. — The early stages of skeleton development of this species differs from those known among other Erismacoscinina. At cup diameter 0.3 mm, rudimentary septa are grown from the outer wall (Pl. 5: 1); at cup diameter 0.5 mm, the inner wall or septa are not yet distinct. First tabula is observed at cup diameter 0.8 mm, before inner wall development. All generic features including a microporous sheath are formed by cup diameter 2 mm. Hollow outgrowths are developed at the same time. They contain rudimentary septa similar to these in young cups. Outgrowths possess a lamellar wall (Pl. 2: 2).

Remarks. — The species cup development is not typical of either of the orders Ajacicyathida or Coscinocyathida. Similar features are observed in certain species of Tabulacyathida (see below).

Specimens of *Mennericyathus dissitus* described by GRAVESTOCK (1984) from the lower Ajax Limestone of the Flinders Ranges and by DEBRENNE and GRAVESTOCK (1990) from the Sellick HILL Formation and Fork Tree Limestone of the Fleurieu Peninsula, South Australia differ from Australian type material (KRUSE 1982) in the absence of inner wall bracts and in their numerical features.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Cymbric Vale Formation, New South Wales, Australia (KRUSE 1982), and Early Cambrian erratics, King George Island, Antarctica. Recorded outside Australia for the first time.

Superfamily **Anaptyctocyathoidea** DEBRENNE, 1970
Family **Anaptyctocyathidae** DEBRENNE, 1970
Genus *Erugatocyathus* DEBRENNE, 1969
Erugatocyathus scutatus (HILL, 1965)
(Pl. 5: 7)

1965. *Torgaschinocyathus scutatus* n. sp.; HILL, pp. 104–105, pl. 8: 1–3.
non 1975. *Erugatocyathus scutatus* (HILL); DEBRENNE, pp. 340, 342, fig. 5a–b.
1986. *Erugatocyathus scutatus* (HILL); DEBRENNE and KRUSE, p. 262, figs 25, 35.
1989. *Erugatocyathus scutatus* (HILL); DEBRENNE and KRUSE, fig. 4F.
1994. *Erugatocyathus scutatus* (HILL); ZHURAVLEV and GRAVESTOCK, p. 27, fig. 9B.

Material. — One thin section ZPAL Ac.I/M10.

Description. — Cup is up to 11 mm in diameter with intervallum 1.5 mm in width. Outer wall has 3–4 pore rows per intersept in framework (pore diameter 0.14 mm, wall thickness 0.1 mm). The microporous sheath is non-independent and continuous. The inner wall is pierced by 2 pore rows per intersept, 0.06 mm thick (0.18 mm thick with bracts). Pores are elliptical, 0.2 mm in diameter; lintel width is 0.06 mm. Cuplike bracts curve downward from the upper edge of each pore and are covered with spines on the upper surface; one spine per each bract. Moderately porous septa and plate netlike tabulae are present in the intervallum. Septal pores are oval, 0.04–0.12 mm in diameter, distance between pores is 0.12–0.14 mm and exceeds pore diameter. Tabular pores are 0.06–0.08 mm in size, lintel width is 0.04 mm.

Remarks. — South African specimens ascribed to *E. scutatus* were assigned by DEBRENNE and KRUSE (1986) to other species because of a difference in the inner wall structure.

Occurrence. — Late Botomian of the upper Wilkawillina Limestone, Flinders Ranges and the Koolywurtie Member, Yorke Peninsula, South Australia (ZHURAVLEV and GRAVESTOCK 1994), Shackleton Limestone, northern Holyoake Range, Nimrod Glacier, Antarctica (DEBRENNE and KRUSE 1986). Allochthonous occurrences include Whichaway Nunatacks (HILL 1965), Weddell Sea and King George Island, Antarctica (DEBRENNE and KRUSE 1989).

Erugatocyathus gravestocki (DEBRENNE *et* KRUSE, 1986)
(Pl. 4: 6)

1986. ?*Veronicacyathus gravestocki* n. sp.; DEBRENNE and KRUSE, pp. 263–264, fig. 26.

Material. — One thin section ZPAL Ac.I/M10.

Description. — Cup is up to 11 mm in diameter with the intervallum 1.5 mm in width. The outer wall consists of a framework and a discontinuous microporous sheath. The framework is pierced by 2–4 rows of pores per intersept, pores elliptical in outline and funnel-like. The wall is 0.1 mm thick, pores are 0.15–0.25 mm in diameter, lintels are 0.1 mm wide. The inner wall has 2 pore rows per intersept. Pores are 0.17–0.20 mm in diameter (lintels 0.05 mm wide) and are covered by bracts S-shaped in longitudinal section with downward curved spines along the outer margin. Bracts are directed upward into the central cavity and possess a carina on the lower surface. The wall is 0.05 mm thick and up to 0.2 mm thick including bracts. The intervallum contains sparsely porous septa and remote netlike plate tabulae. Septa are 0.05 mm thick, pierced by scarce small rounded pores of 0.05–0.075 mm diameter; interpore space is from 0.05 mm to 0.075 mm. Tabular pores are angular, 0.05–0.07 mm in diameter with 0.02–0.03 mm wide lintels between.

Remarks. — By its combination of inner wall features, this species deserves to be placed in the genus *Erugatocyathus* rather than in *Veronicacyathus*. The latter is characterised by the presence of more or less complete screens on the inner wall openings.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Shackleton Limestone, northern Holyoake Range, Nimrod Glacier (DEBRENNE and KRUSE 1986) and Early Cambrian King George Island erratics, Antarctica.

Genus *Veronicacyathus* DEBRENNE, 1973
Veronicacyathus sp.
(Pl. 5: 6)

Material. — One longitudinal thin section ZPAL Ac.I/M10.

Description. — Intervallum is 3 mm wide. Outer wall framework is pierced by funnel-like pores 0.15–0.20 mm in diameter. The wall is 0.1 mm thick. The inner wall is penetrated by elliptical pores 0.40–0.45 mm in diameter (lintels 0.1 mm wide; wall thickness 0.15 mm). Each pore is covered by a microporous screen formed by spines (spine thickness 0.02 mm, micropore size 0.07 mm). The intervallum contains sparsely porous septa and netlike plate tabulae. Septa are pierced by scarce elongate-rounded pores 0.15–0.20 mm in diameter.

Remarks. — Generic assignment of the specimen follows from the combination of the inner wall features.

Occurrence. — Early Cambrian King George Island erratics, Antarctica.

Suborder **Tabulacyathina** VOLOGDIN, 1956

Superfamily ?**Alphacyathoidea** R. BEDFORD *et* J. BEDFORD, 1939
Family **Putapacyathidae** R. BEDFORD *et* J. BEDFORD, 1936
Putapacyathus R. BEDFORD *et* J. BEDFORD, 1936
Genus *Putapacyathus excavatus* HILL, 1965
(Pl. 5: 2)

1965. *Putapacyathus excavatus* n. sp.; HILL, pp. 111–112, pl. 8: 8.

Material. — Four thin sections ZPAL Ac.I/M10.

Description. — Intervallum is 0.7 mm and 1 mm in width for cup diameters 3 mm and 4.5 mm respectively. Outer wall bears a discontinuous sheath, about 0.15 mm in thickness, formed by spines. Pore diameter 0.12 mm, pores are funnel-like, lintel width 0.2 mm; sheath thickness 0.08 mm. Inner wall 0.08 mm in thickness, bearing pores of 0.12–0.16 mm diameter and spinose bracts.

Remarks. — *P. excavatus* bears an additional sheath on the outer wall. This feature is unknown in the type species of the genus, *P. regularis* BEDFORD *et* BEDFORD, 1936. Therefore, the present taxonomic position of the species and genus is a matter of convention.

Type species of *Putapacyathus* probably possesses septa when mature (DEBRENNE *et al.* 1989: pl. 32: 12). Thus, affinities of the species with Erismacoscinina cannot be excluded. On the other hand, such regular archaeocyaths may represent the third way of achievement of an intervallar tabulate structure. Similar stages of cup development are observed in *"Mennericyathus" dissitus* (see above) and ?*Chabakovicyathus* sp. (see below).

Occurrence. — Early Cambrian erratics of the Whichaway Nunataks (HILL 1965) and King George Island, Antarctica.

Superfamily ?**Chabakovicyathoidea** ROZANOV, 1973
Family ?**Chabakovicyathidae** ROZANOV, 1973
Genus ?*Chabakovicyathus* KONYUSHKOV in ZHURAVLEVA *et al.*, 1964
?*Chabakovicyathus* sp.
(Pl. 5: 4)

Material. — Three thin sections ZPAL Ac.I/Me73.

Description. — Cup diameter is 3 mm. Outer wall bears pustuli or convex diaphragms, 0.04 mm thick. Pustuli are 0.1 mm in height, diameter of subtetragonal pores is 0.10–0.12 mm, distance between pores is 0.08–0.10 mm. Inner wall simple, 0.08 mm thick. Pore diameter is 0.12–0.14 mm, lintels 0.06–0.08 mm.

Porous septa and rare netlike plate tabulae are present in the intervallum. Tabular pores are 0.025–0.050 mm in diameter, lintels are 0.02 mm in width.

Ontogeny. — Tabula are present at the cup diameter of 0.9 mm; septa are observed at cup diameter of 3.8 mm.

Remarks. — Young cups of the species (Pl. 5: 4) possess features of *Chabakovicyathus* although septa have never been recorded for the type species of *Chabakovicyathus* from the South Urals. The latter, however, is known only from a few fragments.

Occurrence. — Early Cambrian erratics, King George Island, Antarctica.

Order **Archaeocyathida** Okulitch, 1935
Suborder **Loculicyathina** Zhuravleva, 1954 nom.
Superfamily **Loculicyathoidea** Zhuravleva, 1954 nom.
Family **Loculicyathidae** Zhuravleva, 1954
Genus *Paranacyathus* R. Bedford *et* J. Bedford, 1937
Paranacyathus sarmaticus Debrenne, 1974b
(Pl. 6: 1–2)

1937. *Paranacyathus parvus* n. sp. (*pars*); R. Bedford and J. Bedford, p. 34, pl. 35: 137A–B.
1974b. *Paranacyathus sarmaticus* n. sp.; Debrenne, p. 171, pl. 19: 5–7.

Material. — Three thin sections ZPAL Ac.I/Me171.

Description. — Sheetlike modular form. Intervallum up to 2 mm width. Outer wall is simple, of the *Cambrocyathellus*-type, 0.06 mm thick, pierced by 1–2 rows of irregular-rounded pores. Pores are from 0.1 mm (rounded) to 0.24 × 0.18 mm (elliptical) in size; interpore lintels are 0.08–0.14 mm wide. The wall is slightly bulged over pores producing diaphragms. Inner wall is 0.06 mm thick, bearing one, rarely two pore rows per intersept. Pores are elliptical or rounded, from 0.16 mm to 0.28 × 0.16 mm in size; interpore lintels are from 0.10 to 0.24 mm in width. Horizontal lintels are on average wider than vertical lintels. Pseudosepta are evenly porous with elongated pores 0.06–0.08 mm in size and lintels 0.10–0.14 mm wide.

Remarks. — Abundant vesicles occupy the intervallum and shelters underneath cups. *P. sarmaticus* forms boundstones through binding by a secondary calcareous skeleton of platelike to domelike cups (Pl. 6: 2).

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Ajax Limestone, Flinders Ranges, South Australia (R. Bedford and J. Bedford 1937) and Early Cambrian erratics, King George Island, Antarctica. This is the first find of the species outside South Australia.

Suborder **Archaeocyathina** Okulitch, 1935
Superfamily **Archaeocyathoidea** Hinde, 1889
Family **Archaeopharetridae** R. Bedford *et* J. Bedford, 1936
Genus *Archaeopharetra* R. Bedford *et* J. Bedford, 1936
Archaeopharetra irregularis (Taylor, 1910)
(Pl. 6: 3–4)

1910. *Dictyocyathus irregularis* n. sp.; Taylor, p. 145, pl. 12: 66.
1994. *Archaeopharetra irregularis* (Taylor); Zhuravlev and Gravestock, pp. 36–39, figs 10A–I, 11 (*cum syn.*).

Material. — Twelve thin sections ZPAL Ac.I/M10, Me1/2, Me 67, Me74, and Me94.

Description. — The cup is up to 15 mm in diameter, the intervallum is up to 6 mm in width. The outer wall is pierced by centripetally arranged pores. The simple inner wall is penetrated by pores 0.3–0.4 mm in size, divided by 0.12 mm wide lintels. The intervallum is infilled with coarsely porous pseudotaeniae linked by sparse synapticulae. Radial elements are 0.16–0.18 mm thick and synapticulae are 0.16 mm thick. Radial elements occur 0.8–1.2 mm apart and synapticulae are 0.7–1.6 mm apart.

Remarks. — Specimens from erratics in the Dwyka Tillite, assigned to *Archaeopharetra* cf. *typica* Bedford *et* Bedford (Debrenne, 1975: fig. 8a) and *Protopharetra grandicaveata* Vologdin (Debrenne 1975: fig. 9b) may be reassigned to *A. irregularis* on the basis of new material.

Occurrence. — Late Botomian of the Ajax Limestone and Moorowie Formation, Flinders Ranges and the Koolywurtie Member, Yorke Peninsula, South Australia (Taylor 1910; Lafuste *et al.* 1991;

ZHURAVLEV and GRAVESTOCK 1994); allochthonous settings: Whichaway Nunataks (HILL 1965), King George Island, Antarctica and tillites of the Dwyka Subgroup, South Africa (DEBRENNE 1975).

Genus *Spirocyathella* VOLOGDIN, 1939
Spirocyathella cooperi (DEBRENNE, 1975)
(Pl. 6: 6–7, Pl. 7: 1)

1920. *Protopharetra radiata* BORNEMANN; GORDON, pp. 696–697, pl. 3: 35, pl. 7: 72–74.
1975. *Andalusicyathus cooperi* n. sp.; DEBRENNE, pp. 352, 354, fig. 10.
1992. *Spirocyathella cooperi* (DEBRENNE); DEBRENNE and ZHURAVLEV, p. 131.

Material. — Seven thin sections ZPAL Ac.I/Me1/2 and TS3.

Description. — The cup is up to 20 mm in diameter with the intervallum up to 4 mm in width. The outer wall is centripetal, the inner wall is simple with 2–3 pore rows per intersept. The inner wall is 0.05 mm thick with pores 0.05 mm in size. Long spinule-bearing spines of 0.5 mm length cover inner wall. In the intervallum there is a pseudoseptal network. Thickness of radial elements in the intervallum increases from 0.1 to 0.2 mm outward. Tangential elements are 0.1–015 mm thick. The distance between radial and tangential elements is 0.45–1.0 mm and 0.25–1.0 mm respectively.

Remarks. — The finely porous inner wall is distinct in *P. radiata* figured by GORDON (1920: pl. 3: 35 and pl. 7: 73–74). Thus, this species is conspecific with *Spirocyathella cooperi* rather then *Archaeocyathus pauciseptatus* GORDON 1920 as DEBRENNE and KRUSE (1989) suggested. The latter may be a *Metaldetes* or a *Metacyathellus*, judging from the taenial features (GORDON 1920: pl. 6: 63–64).

Occurrence. — Early Cambrian allochthonous block in the Permo–Carboniferous Dwyka Tillite, South Africa (DEBRENNE 1975), and the Weddell Sea and King George Island, Antarctica.

Family **Archaeocyathidae** HINDE, 1889
Genus *Pycnoidocyathus* TAYLOR, 1910
Pycnoidocyathus latiloculatus (HILL, 1964b)
(Pl. 4: 3)

1964b. *Flindersicyathus latiloculatus* n. sp.; HILL, p. 143, pl. 2: 6–7.
1965. *Flindersicyathus latiloculatus* HILL; HILL, pp. 125–126, pl. 11: 3–5.
1986. *Pycnoidocyathus latiloculatus* (HILL); DEBRENNE and KRUSE, pp. 269–270, fig. 32.
1994. *Pycnoidocyathus latiloculatus* (HILL); ZHURAVLEV and GRAVESTOCK, p. 41, fig. 12F.
1995. *Pycnoidocyathus latiloculatus* (HILL); ZHURAVLEV and WOOD, fig. 2A (top).

Material. — Three thin sections ZPAL Ac.I/Me60, Me176 and LR3.

Description. — Cup often has transverse bulges of the outer wall in mature stages, diameter is over 30 mm with intervallum up to 4 mm in width at the level of a constriction. The outer wall is of the centripetal type with pores restricted to loculi between intervallar elements. Inner wall has one row of rounded to slightly elliptical openings per intersept (diameter 0.35–0.50 mm, lintels 0.125 mm). Openings continue into canals, directed steeply upward into the central cavity. Canal length is 1.5 mm, total wall thickness is 1 mm. Porous taeniae (0.07–0.08 mm thick) and synapticulae (0.10–0.12 mm thick) are present in the intervallum. In mature cups, synapticulae are very scarce; distance between taeniae is 0.5–0.7 mm. Most cup elements are obscure because of secondary thickening.

Occurrence. — Late Botomian *Syringocnema favus* Beds of the Koolywurtie Member, Yorke Peninsula, South Australia (ZHURAVLEV and GRAVESTOCK 1994), the Shackleton Limestone at Crackling Cwm and Mt. Hamilton, Byrd Glacier and northern Holyoake Range, Nimrod Glacier (HILL 1964b; DEBRENNE and KRUSE 1986). Allochthonous occurrences: Whichaway Nunataks (HILL 1965) and King George Island, Antarctica (ZHURAVLEV and WOOD 1995).

Superfamily **Naimarkcyathoidea** superfam. n.

Diagnosis. — An archaeocyathine sponge with pustular outer wall.

Remarks. — This is the third archaeocyathide possessing a pustular outer wall in addition to earlier described *Sakhacyathus* and *Kruseicnema* (DEBRENNE and ZHURAVLEV 1990). Thus, almost all suborders of the Order Archaeocyathida, *i.e.* Loculicyathina, Archaeocyathina and Syringocnemidina, include genera characterised by this feature. The Anthomorphina is the only exception now.

Family **Naimarkcyathidae** fam. n.

Type genus: *Naimarkcyathus* gen. et sp. n.

Diagnosis. — The outer wall bears pustulae; inner wall is pierced by pore tubes.

Genus *Naimarkcyathus* gen. n.

Type species: *Naimarkcyathus elenae* gen. et sp. n.

Derivation of name: Genus name dedicated to the biologist Dr. Elena B. NAIMARK from Paleontological Institute, Moscow.

Diagnosis. — The outer wall bears pustulae; inner wall is pierced by one row of steep, upwardly directed pore tubes per intersept. In the intervallum, there are synapticulae and coarsely porous pseudotaeniae.

Remarks. — To date, the new genus is represented only by the type species.

Naimarkcyathus elenae gen. et sp. n.
(Pl. 7: 2, 5)

1920. *Spirocyathus atlanticus* (BILLINGS); GORDON, pp. 693–695, pl. 3: 32, pl. 4: 39–42.

Holotype: ZPAL Ac.I/M10DI; figured in Pl. 7: 2.

Type horizon: Lower Cambrian, Botomian Stage, probably *Syringocnema favus* Beds.

Type locality: Antarctica, South Shetland Islands, King George Island, erratic boulder collected from cliffs between Low Head and Lions Rump in the type locality of the Oligocene Polonez Cove Formation.

Derivation of name: Species named after forename of the biologist Dr. Elena B. NAIMARK from Paleontological Institute, Moscow.

Diagnosis. — The outer and inner walls are thin. The outer wall openings (one per intersept) are covered by pustulae. The inner wall bears a single row of slightly elevated pore tubes upwardly directed per intersept. Pore tubes are 0.30–0.34 mm in diameter. Pseudotaenial pores are from 0.20 × 0.16 mm to 0.36 × 0.30 mm in size; interpore lintels are 0.12–0.20 mm in width in a horizontal row and 0.08–0.10 mm in a vertical row.

Material. — Six thin sections ZPAL Ac.I/M10.

Description. — Narrow conical cup up to 10 mm in diameter. Intervallum up to 4 mm in width. Outer wall is 0.08 mm thick. The wall bears pustulae up to 0.4 mm in height and 0.25 mm in diameter. Inner wall is 0.08 mm thick with a single pore row per intersept. Slightly elevated pore tubes are initiated from the inner wall and are directed steeply upward into the central cavity. Pore tubes are 0.30–0.34 mm in diameter, tube wall thickness is 0.08 mm. Synapticulae are 0.10–0.12 mm thick and spaced 0.3 mm apart. Pseudotaenial pores are from 0.20 × 0.16 mm to 0.36 × 0.30 mm in size; interpore lintels are 0.12–0.20 mm in width in a horizontal row and 0.08–0.10 mm in a vertical row.

Remarks. — Pustular outer wall is figured by GORDON (1920: pl. 3: 32) in the specimens ascribed by him to *Spirocyathus atlanticus* (BILLINGS).

Occurrence. — Allochthonous blocks in the Weddell Sea and on the King George Island, Antarctica.

Superfamily **Metacyathoidea** R. BEDFORD *et* W.R. BEDFORD, 1934
Family **Metacyathidae** R. BEDFORD *et* W.R. BEDFORD, 1934
Genus *Metaldetes* TAYLOR, 1910
Metaldetes pratti (HILL, 1965)
(Pl. 6: 5–7)

1965. *Ladaecyathus pratti* n. sp.; HILL, pp. 86–87, pl. 5: 3a–f.

1986. ?*Metaldetes lairdi* (HILL); DEBRENNE and KRUSE, pp. 266–267, fig. 30.

1989. *Metaldetes pratti* (HILL); DEBRENNE and KRUSE, p. 26.

Material. — Three thin sections ZPAL Ac.I/Me1/2.

Description. — Cup is up to 10 mm in diameter with intervallum up to 2 mm in width. Outer and inner walls are compound, pierced by 1–3 rows of rounded to irregular pores per intersept (diameter 0.275–0.375 mm, lintels 0.125 mm) and 0.25–0.30 mm thick. Pores are subdivided into smaller openings (3–5 micropores per pore section) by interpore spines (0.05 mm in thickness). Micropores are 0.075 mm in diameter. Intervallum contains straight taeniae with 5–6 rows of rare rounded pores (diameter 0.3–0.5 mm). Synapticulae are conspicuous, 0.25–0. 30 mm thick.

Remarks. — Vesicles were abundant in places where the cup came into close contact with a foreign cup (*"Mennericyathus"*, *Spirocyathella*), and probably played a protective role against foreign soft tissue (Pl. 6: 6–7).

The inner wall structure is compound in specimens from Byrd Glacier as in *Metaldetes*, whereas it is simple in the genus *Metacyathellus*, to which true *M. lairdi* is assigned (DEBRENNE and ZHURAVLEV 1992).

Occurrence. — Shackleton Limestone, Crackling Cwm, Byrd Glacier, Antarctica (DEBRENNE and KRUSE 1986) and King George Island erratics.

Suborder **Syringocnemidina** OKULITCH, 1935

Superfamily **Syringocnemidoidea** TAYLOR, 1910

Family **Syringocnemididae** TAYLOR, 1910

Genus *Syringocnema* TAYLOR, 1910

Syringocnema favus TAYLOR, 1910

(Pl. 7: 6)

1910. *Syringocnema favus* n. sp.; TAYLOR, p. 153, pl. 14: 78–83, text-fig. 40.
1965. *Syringocnema gracilis* GORDON; HILL, pp. 136–137, pl. 11: 17–18.
1982. *Syringocnema favus* TAYLOR; KRUSE, p. 198, pl. 16: 1–5 (*cum syn.*).
1986. *Syringocnema favus* TAYLOR; DEBRENNE and KRUSE, pp. 271–273, fig. 34.
1989. *Syringocnema favus* TAYLOR; DEBRENNE and KRUSE, fig. 4B.
1992. *Syringocnema favus* TAYLOR; DEBRENNE and ZHURAVLEV, pl. 30: 3–6, pl. 31: 1–2, 5–6, pl. 32: 3–4.
1994. *Syringocnema favus* TAYLOR; ZHURAVLEV and GRAVESTOCK, p. 47, fig. 13D.

Material. — One thin section ZPAL Ac.I/Me73.

Description. — Cup is 11 mm in diameter and intervallum is 1.5 mm wide. Pores are arranged centripetally across the outer wall openings. The wall is 0.07 mm thick. Inner wall possesses one S-shaped canal per syrinx. The total wall thickness is 0.4 mm, canal diameter is 0.25 mm. The intervallum bears hexagonal syringes, nested in honeycomb pattern, each facet of which is pierced by several rows of rounded pores. Syrinx section is 0.5–0.8 mm in size, pores are 0.13–0.15 mm in diameter, lintels are 0.13 mm wide.

Remarks. — *Syringocnema gracilis* of HILL (1965: pl. 11: 17–18) does not show outer wall pustulae and thus should be assigned to *S. favus*.

Occurrence. — The species is widespread in the late Botomian *Syringocnema favus* Beds: Ajax Limestone and Moorowie Formation, Flinders Ranges (TAYLOR 1910; DEBRENNE and ZHURAVLEV 1992), Cymbric Vale Formation, New South Wales (KRUSE 1982), Koolywurtie Member, Yorke Peninsula (ZHURAVLEV and GRAVESTOCK 1994), Australia and Shackleton Limestone, northern Holyoake Range, Nimrod Glacier, Antarctica (DEBRENNE and KRUSE 1986). Allochthonous blocks: Whichaway Nunataks (HILL 1965) and King George Island, Antarctica.

Genus *Pseudosyringocnema* HANDFIELD, 1971

Pseudosyringocnema uniserialis HILL, 1965

(Pl. 7: 3a–b)

1965. *Flindersicyathus uniserialis* n. sp.; HILL, pp. 123–124, pl. 11: 1–2.
1989. *Pseudosyringocnema uniserialis* (HILL), DEBRENNE and KRUSE, p. 27.

Material. — One thin section ZPAL Ac.I/Me1/2.

Description. — The cup is up to 11 mm in diameter and the intervallum width is up to 4 mm. The thin outer wall is centripetal, 0.05 mm in thickness. Syrinx openings are 0.25–0.40 mm in size. The inner wall bears S-shaped canals, one per syrinx. The wall thickness is 0.5 mm, canal diameter is 0.25–0.35 mm. The intervallum bears subhorizontal radial syringes with a hexagonal section and 1–2 pore row per facet. Syrinx section is 0.25–0.40 mm, pores are 0.10–0.12 mm in size, lintels are 0.08 mm in width.

Occurrence. — Allochthonous blocks: Whichaway Nunataks (HILL 1965) and King George Island, Antarctica.

Superfamily **Kruseicnemidoidea** DEBRENNE *et* ZHURAVLEV, 1990
Family **Kruseicnemididae** DEBRENNE *et* ZHURAVLEV, 1990
Genus *Kruseicnema* DEBRENNE, GRAVESTOCK *et* ZHURAVLEV in DEBRENNE and ZHURAVLEV, 1990
Kruseicnema gracilis (GORDON, 1920)
(Pl. 7: 4)

1920. *Syringocnema gracilis* n. sp.; GORDON, pp. 699–701, pl. 4: 43–48, pl. 5: 49, text-fig. 1b–d.
non 1965. *Syringocnema gracilis* GORDON; HILL, pp. 136–137, pl. 11: 17–18.
1975. *Pseudosyringocnema* cf. *gracilis* (GORDON); DEBRENNE, p. 356, fig. 11a.
1982. *Pseudosyringocnema gracilis* (GORDON); KRUSE, p. 199, pl. 15: 1–3.
1986. *Pseudosyringocnema gracilis* (GORDON); DEBRENNE and KRUSE, p. 273, *non* fig. 35.
1987. *Pseudosyringocnema gracilis* (GORDON); DEBRENNE and KRUSE, p. 13, fig. 35.
1989. *Pseudosyringocnema* sp.; DEBRENNE and KRUSE, fig. 3A.
1990. *Kruseicnema gracilis* (GORDON); DEBRENNE, GRAVESTOCK and ZHURAVLEV in DEBRENNE and ZHURAVLEV, p. 301.
1992. *Kruseicnema gracilis* (GORDON); DEBRENNE and ZHURAVLEV, pl. 32: 2, 5.
1994. *Kruseicnema gracilis* (GORDON); ZHURAVLEV and GRAVESTOCK, p. 48, fig. 13E–G.

Material. — Six thin sections ZPAL Ac.I/Me1/2.

Description. — The cup is narrowly conical, up to 4.5 mm in diameter with the intervallum up to 1.5 mm thick. The outer wall is pustular. Pustulae 0.25 mm in height and are 0.25 mm in diameter at the base. The inner wall bears 1 S-shaped canal per syrinx. Canals are 0.15 mm in diameter, canal wall thickness is 0.02 mm. There are syringes hexagonal in cross section in the intervallum. Facets of syringes are pierced by several pore rows (pore diameter 0.05 mm).

Remarks. — See remarks for *Syringocnema favus*.

Occurrence. — Late Botomian *Syringocnema favus* Beds: Ajax Limestone, Flinders Ranges, (TAYLOR 1910; DEBRENNE and ZHURAVLEV 1992), Cymbric Vale Formation, New South Wales (KRUSE 1982), Koolywurtie Member, Yorke Peninsula (ZHURAVLEV and GRAVESTOCK 1994), Australia and Shackleton Limestone, northern Holyoake Range, Nimrod Glacier, Antarctica (DEBRENNE and KRUSE 1986), and probably unnamed unit in the Argentina Range (KONYUSHKOV and SHULYATIN 1980). Allochthonous blocks: Weddell Sea (GORDON 1920) and King George Island, Antarctica and the Permo–Carboniferous Dwyka Tillite, South Africa (DEBRENNE 1975).

Group **Coralomorpha** JELL, 1984
Family **Tannuolaiidae** VOLOGDIN, 1967
Genus *Khasaktia* SAYUTINA, 1980
Khasaktia sp.
(Pl. 8: 1)

1995. *Khasaktia*-like organism; ZHURAVLEV and WOOD, text-fig. 2.

Material. — One thin section ZPAL Ac.I/Me1/14.

Description. — Prostrate blanket-like, thick calcareous skeleton with smooth upper surface and undulating lower surface. The total thickness is 1.2 mm. The skeleton consists of a very frequent alternation of dark discontinuous and transparent continuous lamellae forming loosely to densely packied partitions about 0.25 mm thick. A single transparent lamella is 0.02 mm thick, while a dark lamella is 0.03 mm thick.

Remarks. — The species differs from the Atdabanian *Khasaktia vesicularis* SAYUTINA, 1980 from the Siberian Platform and Atdabanian–Botomian *K. intermedia* SAYUTINA, 1980 from Mongolia in its denser skeleton with less expressed lamellar undulation.

The Family Khasaktiidae was established by SAYUTINA (1980), who included *Edelsteinia* VOLOGDIN, 1940, *Rackovskia* VOLOGDIN, 1940, *Vittia* SAYUTINA, 1980 and *Drosdovia* SAYUTINA, 1980 in the family, in addition to the type genus. ROZANOV and ZHURAVLEV (1992: p. 230) recognised *Tannuolaia* VOLOGDIN, 1967 as a junior synonym of *Edelsteinia*. Thus, the Family Khasaktiidae should be considered as a junior synonym of the Family Tannuolaiidae established by VOLOGDIN (1967).

The only closely comparable group of fossils is Carboniferous to Jurassic *Shamovella* RAUZER-CHERNOUSOVA, 1950 (= *Tubiphytes* MASLOV, 1956). This fossil was assigned to algae, sponges, cnidarians, and a combination of non-preserved soft organisms and cyanobacteria (BABCOCK 1986; RIDING and GUO 1992; RIDING 1993; SENOWBARI-DARYAN and FLÜGEL 1993). Similarly to *Shamovella*, Tannuolaiidae include forms with an inner cavity of a different shape that may resemble astrorhizae (*Edelsteinia*) or contain tabulalike structures (*Drosdovia*). Any independent organisms, which may serve as a primary substrate for encrustation by the Tannuolaiidae, have not been observed in the reefs. Thus, the entire set of inner structures are indeed the inner cavities of Tannuolaiidae. Microstructural features are also similar in Tannuolaiidae and *Shamovella* and its synonyms (*cf.* DEBRENNE *et al.* 1990: pl. 5: 2; SENOWBARI-DARYAN and FLÜGEL 1993: pl. 4: 8, pl. 7: 5).

Occurrence. — King George Island erratics, Antarctica (ZHURAVLEV and WOOD 1995).

CONCLUSIONS

The described archaeocyathan assemblage of twenty six species from King George Island erratics contains distinct elements of the late Botomian *Syringocnema favus* Beds established by ZHURAVLEV and GRAVESTOCK (1994) in Australia. Further species are added to the list of common Australian–Antarctic species which now includes 31 of the total 52 well defined Antarctic archaeocyaths. But more specifically, the King George Island archaeocyathan assemblage closely resembles allochthonous assemblages from the Weddell Sea and Whichaway Nunataks. Existing reconstructions of icestream movement and iceberg drift, together with species-level similarities, suggest the Argentina Range limestone (Shackleton Limestone equivalents) in the Argentina Range as the most probable source of these erratics.

Facies and paleontological analyses indicate the presence of three distinct Early Cambrian fossil assemblages which may be compared with the early Botomian (*Pararaia tatei* Zone), late Botomian (*Syringocnema favus* Beds) and middle Toyonian (*Archaeocyathus abacus* Beds) assemblages of South Australia. Several relatively isolated shelves might have existed along the East Antarctic craton margin which might have been connected during transgressions, allowing faunal exchange (Text-fig. 4). Such transgressive tracts have been suggested for early Botomian, late Botomian, and middle Toyonian times based on South Australian sequence stratigraphy (GRAVESTOCK *et al.* 1990; GRAVESTOCK and HIBBURT 1991; GRAVESTOCK and SHERGOLD in press).

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PLATE 1

Fig. 1. Trilobite wackestone; AE/Me1/29, Melville Peninsula, × 5.
Fig. 2. Peloid-bioclast grainstone; AE/M20B, cliff between Low Head and Lions Rump, × 5.
Fig. 3. Packstone-wackestone and burrowed mudstone alternation; AE/Me33, Melville Peninsula, × 6.
Fig. 4. *Gordonophyton* dendrolite framestone; ZPAL Ac.I/TS3, Three Sisters Point, × 7.

Prethmophyllum ex gr. *brunhilda* (R. BEDFORD *et* W.R. BEDFORD, 1937) . . 23

Fig. 5. Packstone-wackestone and burrowed mudstone alternation with archaeocyath *Prethmophyllum* ex gr. *brunhilda* (R. BEDFORD *et* W.R. BEDFORD, 1937) in the top left corner; ZPAL Ac.I/Me33, longitudinal section, Melville Peninsula, × 7.

Stapicyathus stapipora (TAYLOR, 1910) 27

Fig. 6. Reef cementstone with archaeocyaths Archaeocyathina gen. *et* sp. indet. covered by microbial encrustation (bottom) and *Stapicyathus stapipora* (TAYLOR, 1910) cup (top); ZPAL Ac.I/Me73, transverse section, Melville Peninsula, × 10.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

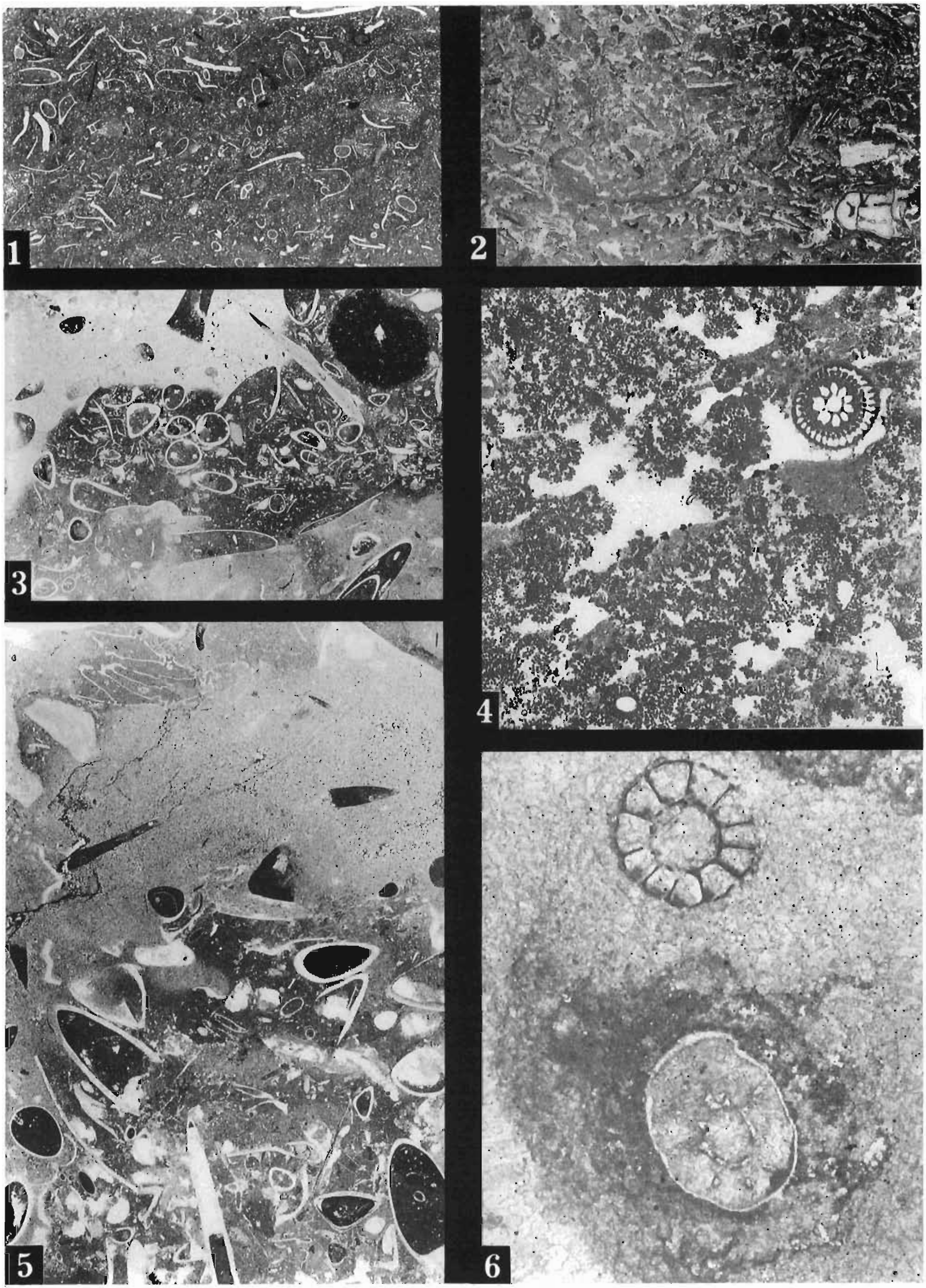

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PLATE 2

Fig. 1. Floatstone with *Erugatocyathus* sp. (bottom left) graded into fine peloid grainstone with well sorted clots of calcimicrobes; ZPAL Ac.I/Me16a, Melville Peninsula, × 3.

Fig. 3. Calcimicrobial-archaeocyathan framestone, archaeocyath fragment with microbial encrustations and dark saccate and chambered clots of *Renalcis*; ZPAL Ac.I/M10C2, Mazurek Point, cliff between Low Head and Lions Rump, × 26.

"Mennericyathus" dissitus KRUSE, 1982 24

Fig. 2. Calcimicrobial-archaeocyathan framestone with Archaeocyathida gen. *et* sp. indet. (top left), *Dokidocyathus* sp. (top right), *"Mennericyathus" dissitus* KRUSE, 1982 (numerous cups) and calcimicrobe filaments and bushes in oblique section of *Gordonophyton grande* (GORDON, 1920) KORDE, 1973 (bottom left) and *Renalcis* sp. (dark clots and chambers); ZPAL Ac.I/M20A, Mazurek Point, cliff between Low Head and Lions Rump, × 10.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

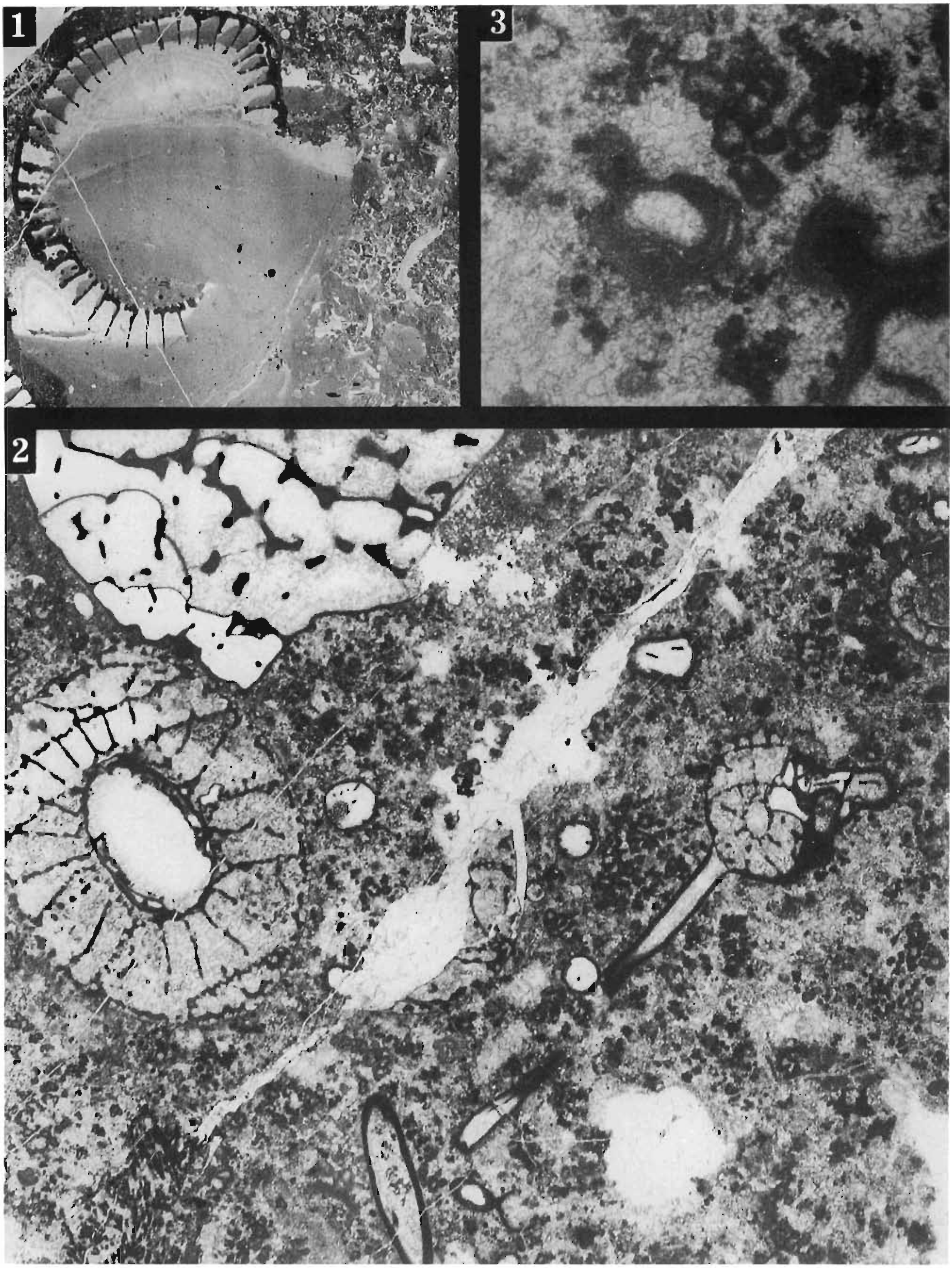

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PLATE 3

Tumuliolynthus irregularis (R. BEDFORD *et* W.R. BEDFORD, 1934) 20

Fig. 1. Longitudinal section of cup; ZPAL Ac.I/Me74, Melville Peninsula, × 24.

Leptosocyathus sp. 21

Fig. 2. Transverse section of cup; ZPAL Ac.I/Me74, Melville Peninsula, × 10.

Thalamocyathus trachealis (TAYLOR, 1910) 21

Fig. 3. Oblique longitudinal section of cup; ZPAL Ac.I/Me94, Melville Peninsula, × 10.

Thalamocyathus sp. 22

Fig. 4. Oblique transverse section of cup; ZPAL Ac.I/Me67, Melville Peninsula, × 20.

Prethmophyllum subacutum (R. BEDFORD *et* W.R. BEDFORD, 1934) . . . 22

Fig. 5. Oblique longitudinal section of cup; ZPAL Ac.I/M10B, cliff between Low Head and Lions Rump, × 10.

Thalamocyathus ex gr. *trachealis* (TAYLOR, 1910) 22

Fig. 6. Longitudinal section of cup; ZPAL Ac.I/Me1/2, Melville Peninsula, × 15.
Fig. 7. Oblique transverse section of cup; ZPAL Ac.I/Me1/2, Melville Peninsula, × 10.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

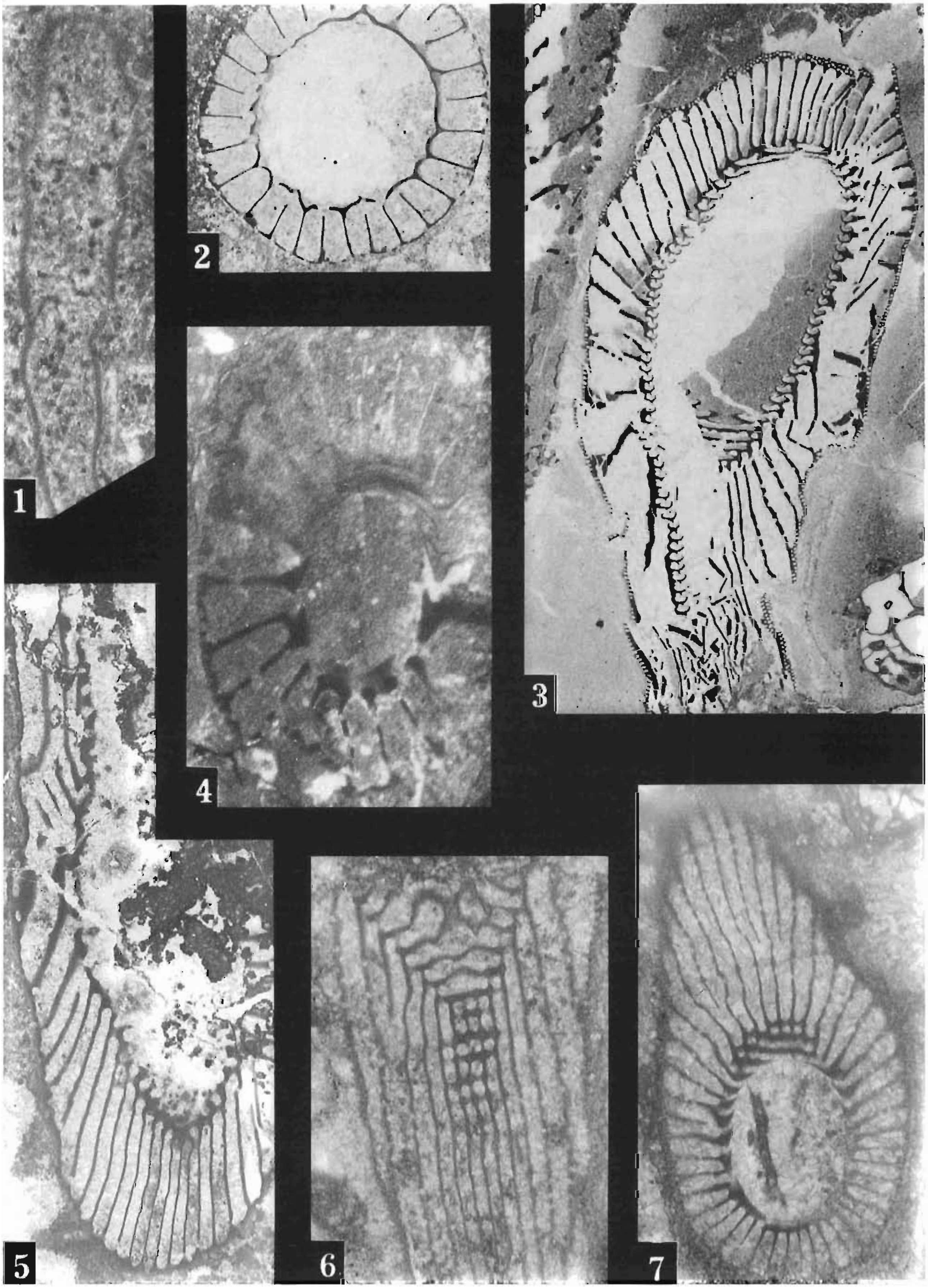

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PLATE 4

?Aporosocyathus sp. 23

Fig. 1. Transverse section of cup; ZPAL Ac.I/Me67A, Melville Peninsula, × 5.

Aporosocyathus mucroporus KRUSE, 1978 23

Fig. 2. Transverse section of cup; ZPAL Ac.I/M20A, cliff between Low Head and Lions Rump, × 50.
Fig. 4. Oblique longitudinal section of cup; ZPAL Ac.I/Me1/2A, Melville Peninsula, × 10.

Pycnoidocyathus latiloculatus (HILL, 1964) 28

Fig. 3. Detail of tangential section of cup; ZPAL Ac.I/Me60, Melville Peninsula, × 5.

Erismacoscinus stephensoni (HILL, 1965) 24

Fig. 5. Oblique transverse section of cup; ZPAL Ac.I/Me94, Melville Peninsula, × 10.

Erugatocyathus gravestocki (DEBRENNE *et* KRUSE, 1986) 25

Fig. 6. Oblique longitudinal section of cup; ZPAL Ac.I/M10D, cliff between Low Head and Lions Rump, × 7.5.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

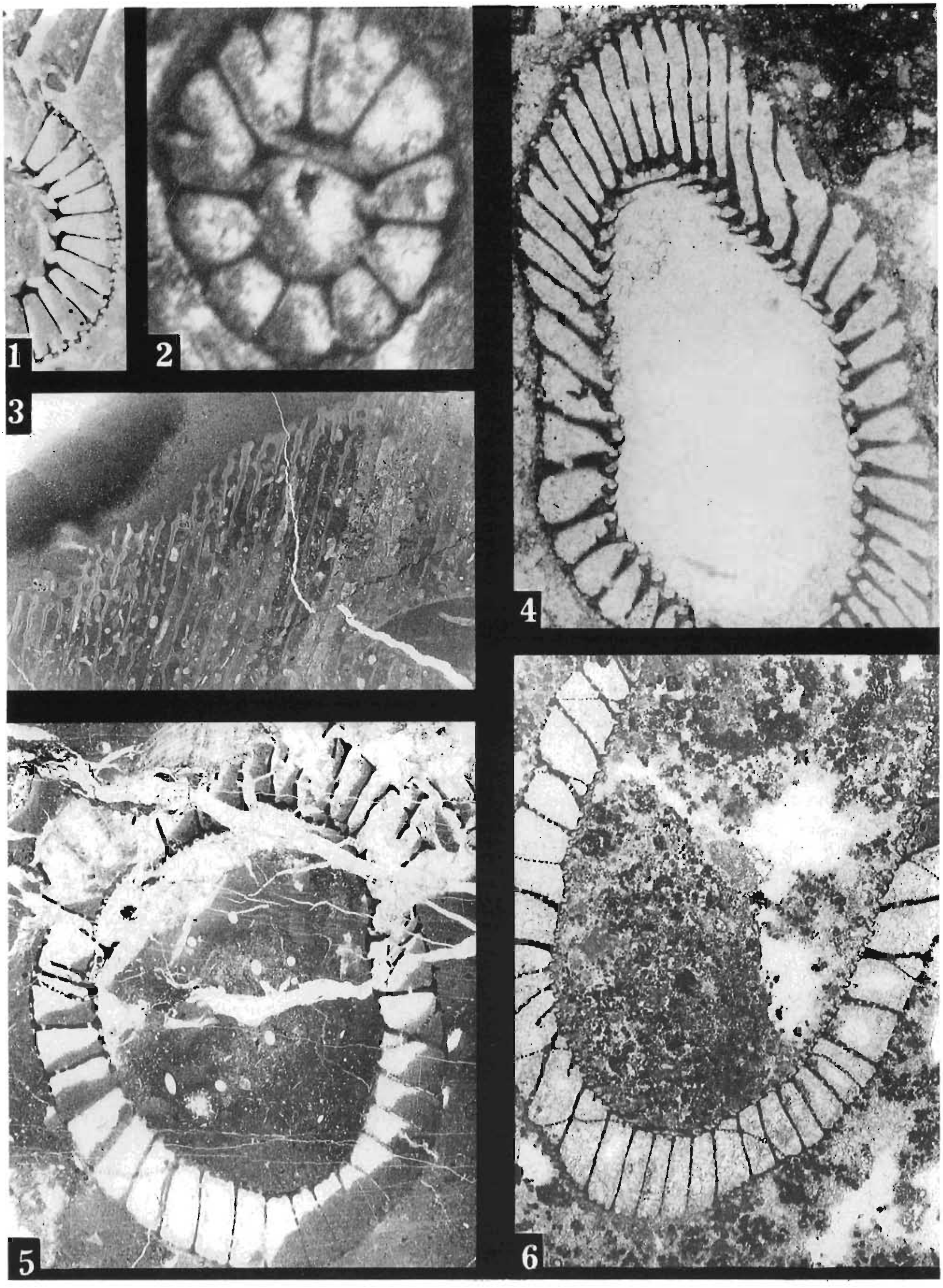

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PLATE 5

"Mennericyathus" dissitus KRUSE, 1982 24

Fig. 1. Transverse section of juvenile cup; ZPAL Ac.I/M10A, cliff between Low Head and Lions Rump, × 30.
Fig. 5. Oblique transverse section of cup; ZPAL Ac.I/M10A, cliff between Low Head and Lions Rump, × 10.

Putapacyathus excavatus (HILL, 1965) 26

Fig. 2. Transverse section of cup; ZPAL Ac.I/M10C, cliff between Low Head and Lions Rump, × 10.

Spirocyathella cooperi (DEBRENNE, 1975) 28

Fig. 3. Transverse section of *"Mennericyathus" dissitus* KRUSE, 1982 and fragment of *Spirocyathella cooperi* (DEBRENNE, 1975) cup (right); ZPAL Ac.I/Me1/2E, Melville Peninsula, × 10.

?*Chabakovicyathus* sp. 26

Fig. 4. Oblique longitudinal (top) and transverse (bottom) sections of juvenile cups; ZPAL Ac.I/Me73, Melville Peninsula, × 10.

Veronicacyathus sp. 26

Fig. 6. Detail of longitudinal section of cup (inner wall to right); ZPAL Ac.I/M10CII, cliff between Low Head and Lions Rump, × 5.

Erugatocyathus scutatus (HILL, 1965) 25

Fig. 7. Oblique longitudinal section of cup; ZPAL Ac.I/M10D, cliff between Low Head and Lions Rump, × 10.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

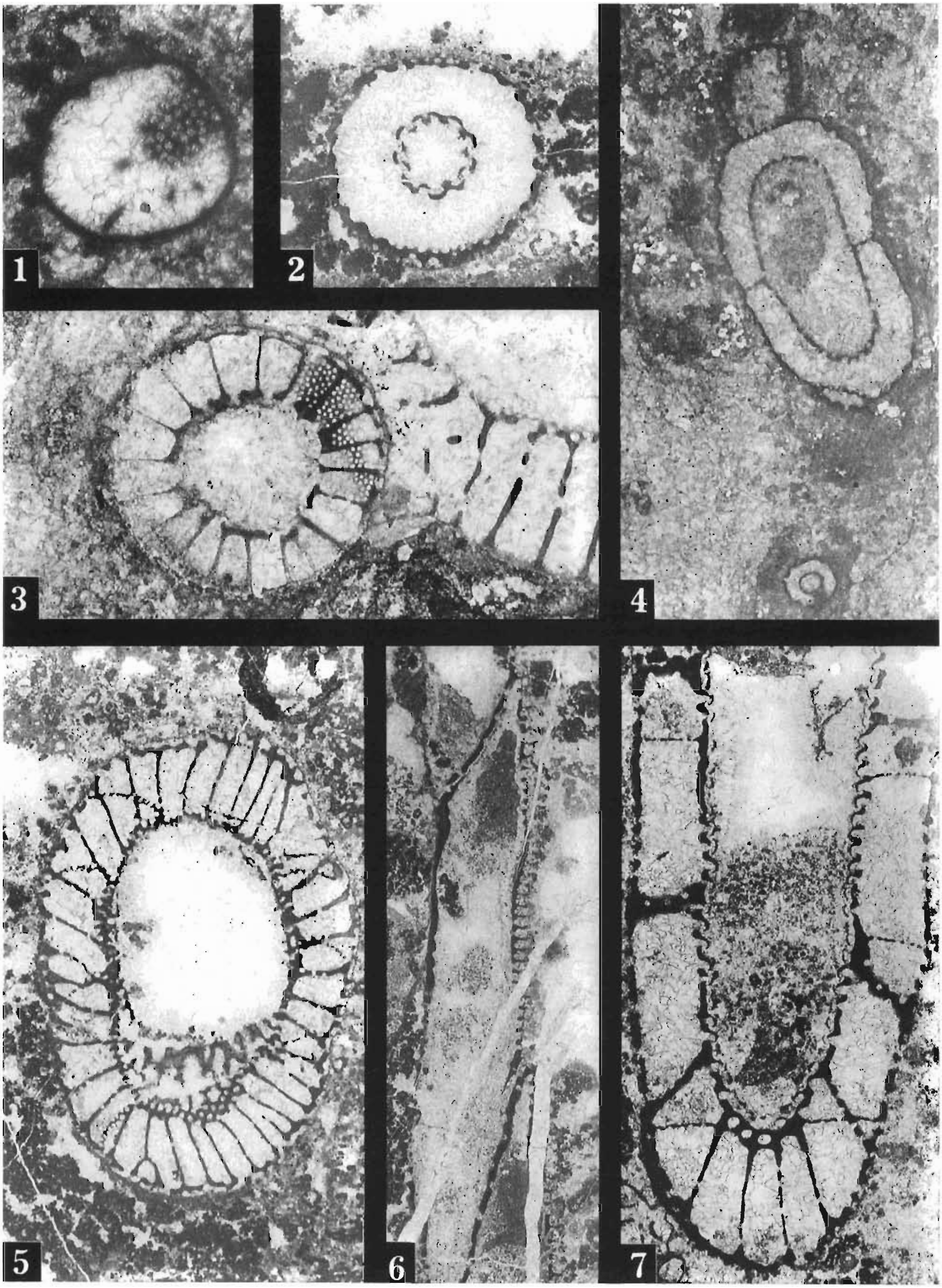

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PLATE 6

Paranacyathus sarmaticus DEBRENNE, 1974 27

Fig. 1. Oblique longitudinal section of platy modular form; ZPAL Ac.I/Me171, cliff between Low Head and Lions Rump, × 10.

Fig. 2. Oblique longitudinal section of platy modular form; ZPAL Ac.I/Me171, cliff between Low Head and Lions Rump, × 5.

Archaeopharetra irregularis (TAYLOR, 1910) 27

Fig. 3. Transverse section of cup; ZPAL Ac.I/Me1/2G, Melville Peninsula, × 5.

Fig. 4. Transverse section of cup; ZPAL Ac.I/Me94, Melville Peninsula, × 8.

Metaldetes pratti (HILL, 1965) 29

Fig. 5. Fragment of transverse section of cup; ZPAL Ac.I/Me1/2, Melville Peninsula, × 10.

Spirocyathella cooperi (DEBRENNE, 1975) 28

Fig. 6. Interactions of *Metaldetes pratti* (HILL, 1965) at the top and *Spirocyathella cooperi* (DEBRENNE, 1975) at the bottom. Transverse section of cups; ZPAL Ac.I/Me1/2F, Melville Peninsula, × 5.

Fig. 7. Section parallel to the section pictured on Fig. 6.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

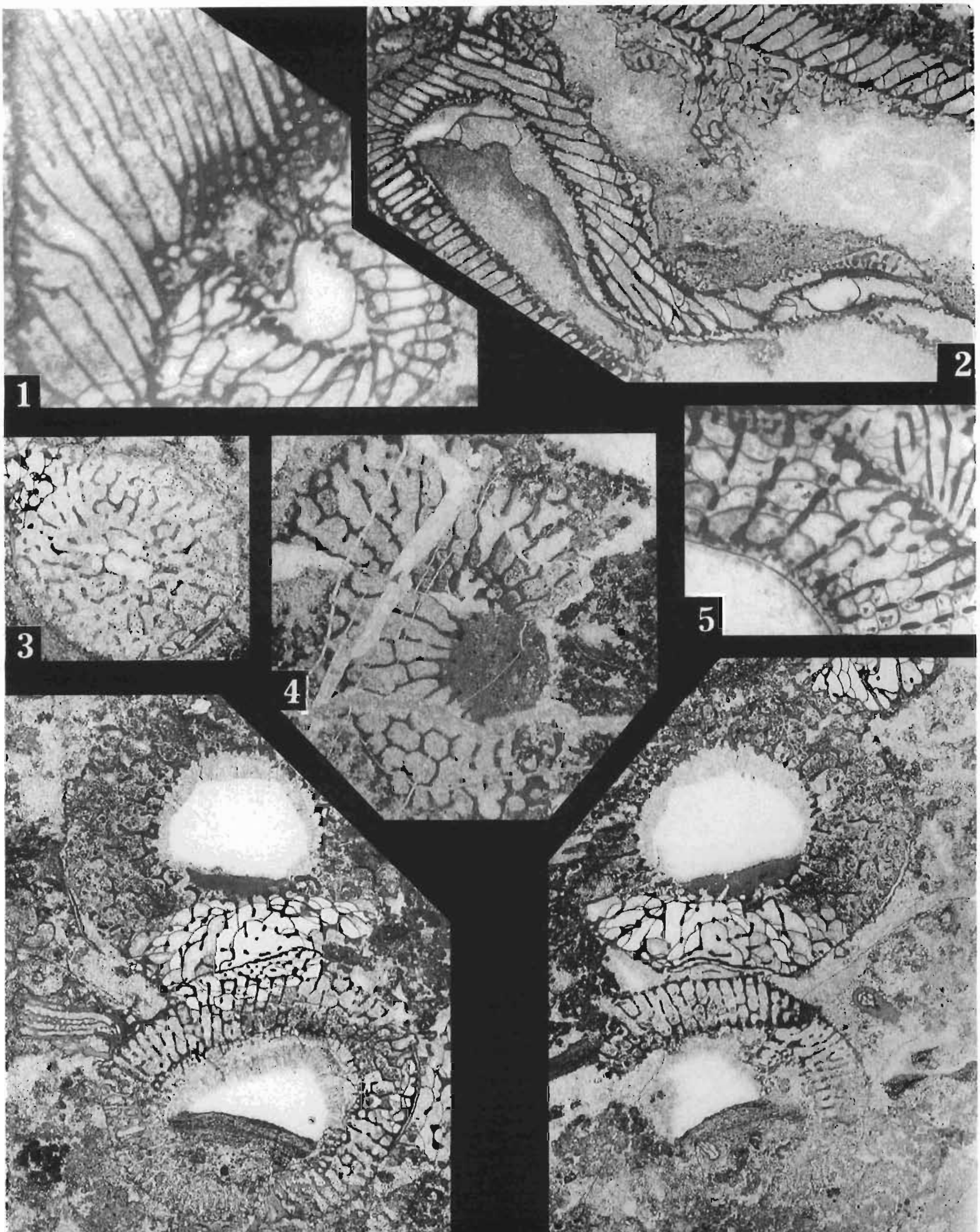

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PLATE 7

Spirocyathella cooperi (DEBRENNE, 1975) 28

Fig. 1. Transverse section of cup; ZPAL Ac.I/Me1/2C, Melville Peninsula, × 4.

Naimarkcyathus elenae, gen. et sp. nov. 29

Fig. 2. Transverse section of cup; holotype ZPAL Ac.I/M10D1, Mazurek Point, cliff between Low Head and Lions Rump, × 8.

Fig. 5. Longitudinal section of cup; paratype ZPAL Ac.I/M10C1, Mazurek Point, cliff between Low Head and Lions Rump, × 5.

Pseudosyringocnema uniserialis (HILL, 1965) 30

Fig. 3. a – oblique transverse section of cup, × 6; b – detail of Fig. 2a, ZPAL Ac.I/Me1/2, Melville Peninsula, × 18.

Kruseicnema gracilis (GORDON, 1920) 31

Fig. 4. Transverse section of cup; ZPAL Ac.I/Me1/2, Melville Peninsula, × 13.

Syringocnema favus TAYLOR, 1910 30

Fig. 6. Transverse section of cup; ZPAL Ac.I/Me73, Melville Peninsula, × 10.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.

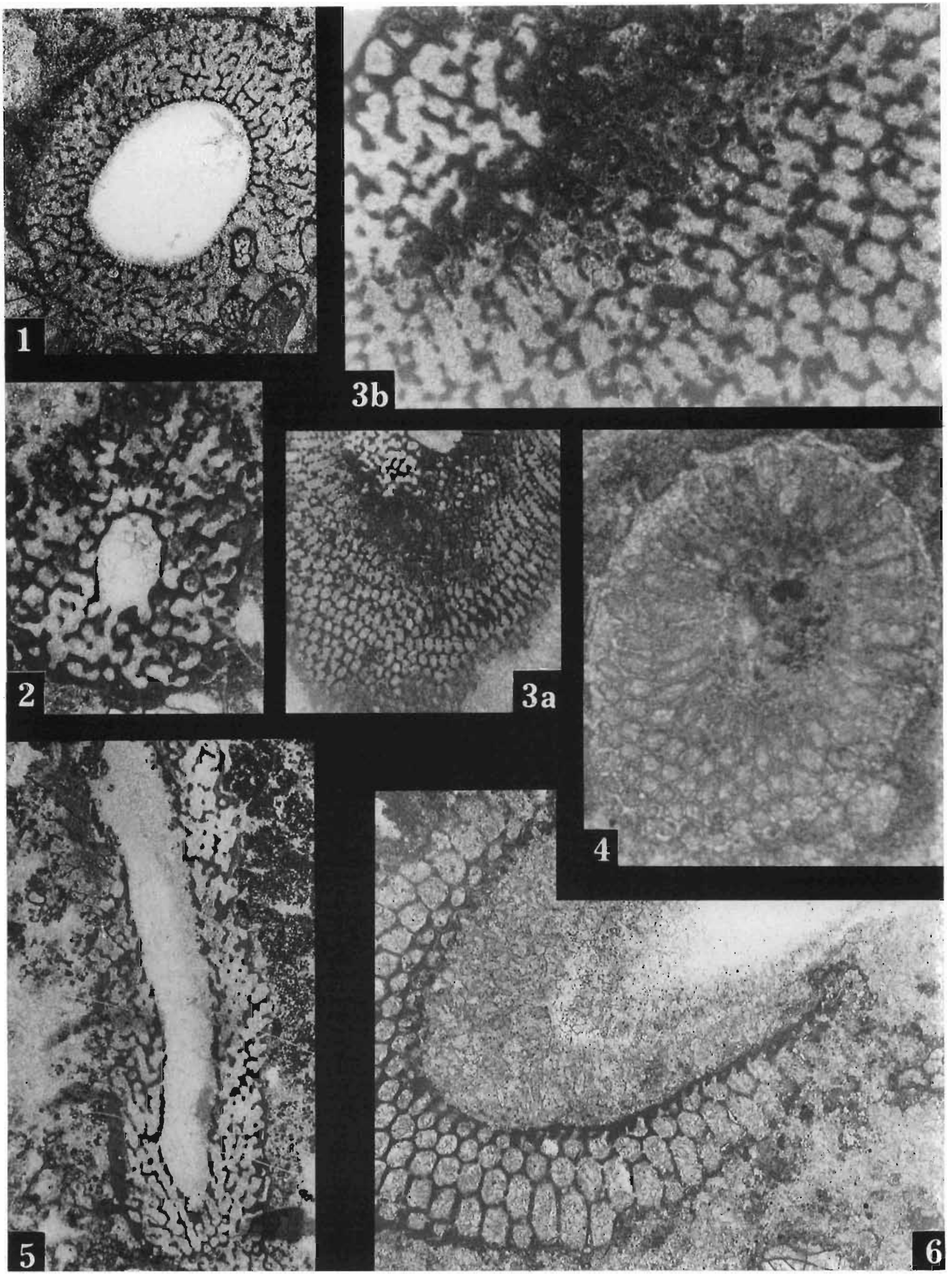

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PLATE 8

Khasaktia sp. 31

Fig. 1. Longitudinal section of platy skeleton; ZPAL Ac.I/M1/14, Mazurek Point, cliff between Low Head and Lions Rump, × 10.

Bija sp. 17

Fig. 2. Calcified tubes detail of the same section as on Fig 4; ZPAL Ac.I/Me98A, × 14.

Fig. 4. Peloid grainstone with microstromatolite fragment (bottom), numerous scattered *Renalcis* clots and *Bija* bush (top left, arrowed); ZPAL Ac.I/Me98A, Melville Peninsula, × 4.

Gordonophyton grande (GORDON, 1920) KORDE, 1973 17

Fig. 3. Longitudinal section of calcified skeleton, note septate branches; ZPAL Ac.I/M10C2, Mazurek Point, cliff between Low Head and Lions Rump, × 180.

Subtifloria sp. . . . .

Fig. 5. Transverse and longitudinal sections of calcified aggregated threads; ZPAL Ac.I/Me1/10, Melville Peninsula, × 200.

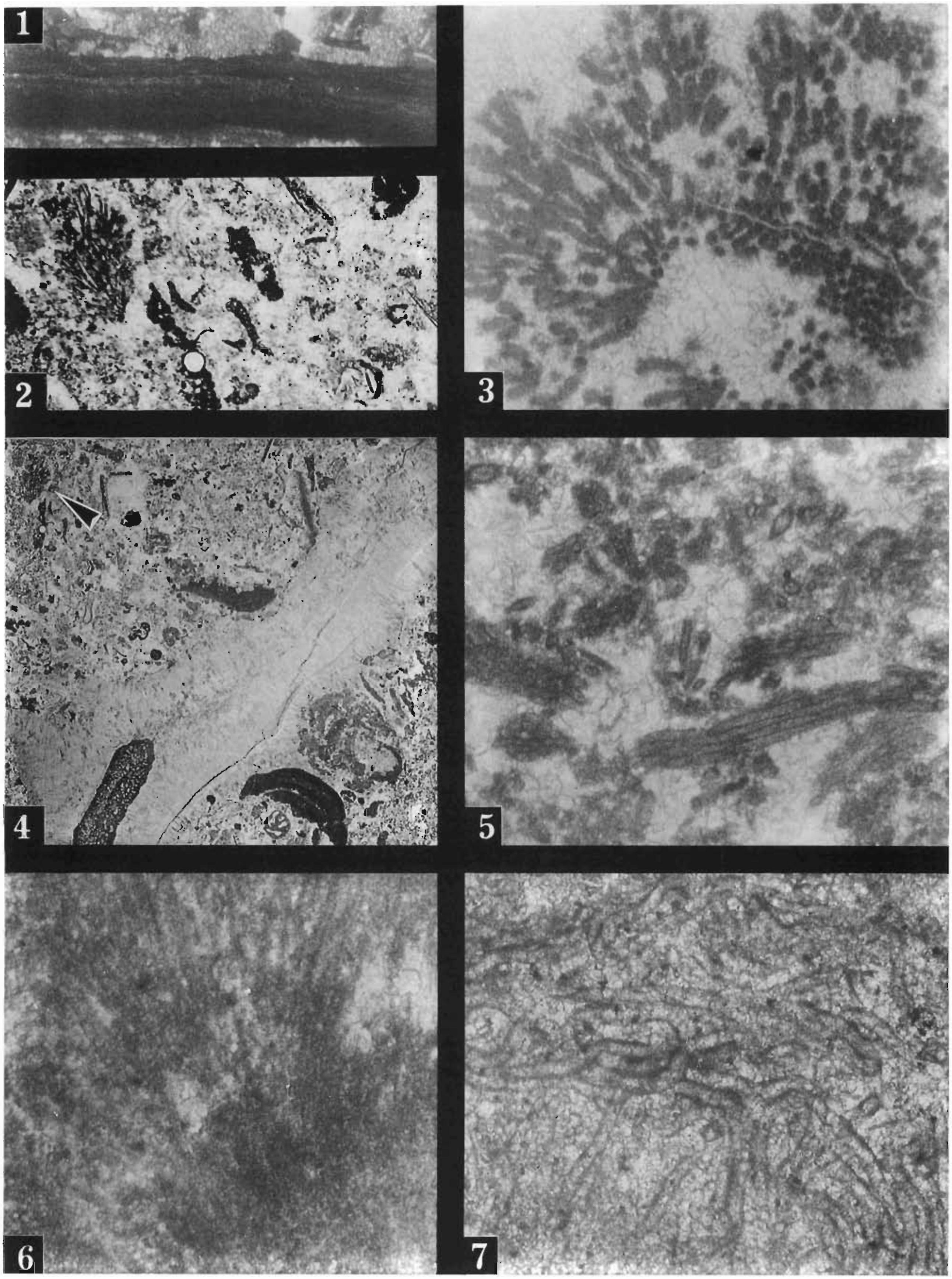
Kordephyton sp. 17

Fig. 6. Longitudinal section of calcified skeleton; ZPAL Ac.I/Me42, Melville Peninsula, × 180.

Girvanella sp. 16

Fig. 7. Transverse section of *Girvanella* oncoid, showing distinct filaments; ZPAL Ac.I/M11, Mazurek Point, cliff between Low Head and Lions Rump, × 150.

All thin sections of erratic boulders from glacial and glacio-marine Tertiary sediments of King George Island, West Antarctica.



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