LATE PLIOCENE TO QUATERNARY SEDIMENTATION ON THE SOUTH ORKNEY SHELF

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ABSTRACT. Seven gravity cores from 650 m to 1540 m water depth on the South Orkney shelf contain diatoms ranging in age from late Pliocene to late Pleistocene/Recent. The sediments are diatomaceous muddy sands with abundant ice-rafted debris. Modal sand size is coarser at more exposed sites, reflecting action by bottom currents. The assemblages of planktonic and benthic foraminifera in the core tops differ from those further downcore, and indicate a more corrosive water mass today than in the past. Grain-size and the composition of the terrigenous fraction are rather uniform downcore, indicating that source areas and transport processes (bottom currents and ice-rafting) have not varied greatly during the time represented. The sedimentary record is however incomplete, with most of the Pleistocene missing in at least one core.

INTRODUCTION

We report on diatom stratigraphy, sedimentology, and foraminiferal content of seven gravity cores from the south-eastern part of the South Orkney shelf (Table I). These cores, and three multichannel seismic reflection profiles in the area, were collected during RRS *Discovery* cruise 154 in the 1984–5 season. Previously existing data included bathymetric and single-channel reflection profiles collected mainly from RRS *Bransfield* and *Shackleton*. A new bathymetric chart has been compiled for the area 61° 10′ S to 62° 40′ S, 40° 00′ W to 44° 30′ W. The *Discovery* multichannel profiles constitute a site survey for ODP Leg 113, sites W7 and W8.

Tectonic setting

The South Orkney Microcontinent (SOM; King and Barker, in press) is the largest of the continental fragments forming the South Scotia Ridge (Fig. 1). This ridge contains a strike-slip boundary between the Scotia Plate to the north and Antarctic Plate to the south: today, east–west sinistral motion takes place along the northern margin of the SOM (Tectonic Map 1985). The whole microcontinent has been affected by north–south normal faults related to Oligocene back-arc extension and rifting; the opening of Powell and Jane Basins to either side of the SOM was complete by about 20 Ma ago (King and Barker, in press).

The SOM measures 250 × 350 km, but only 0.7% of its area lies above sea level (Fig. 1). Much of the shelf lies at 200–500 m depth, but to the south-east a very gentle gradient extends down to 1500 m (Fig. 2). King and Barker (in press) believe the margins of the SOM to have been starved of sediment since their formation. Seismic

Table I. Station list for gravity cores (GC) and expendable bathythermographs (XBT). Depths are in corrected metres. XBTs come in standard lengths of 900 or 2000 m. XBT 105 failed part-way down.

Station	*Lat.*	*Long.*	*Water depth* (m)	*Core length* (m)
845 GC 019	62° 15.3′ S	43° 14.9′ W	1176	2.4
GC 020	61° 53.4′ S	42° 57.2′ W	651	1.6
GC 021	61° 52.4′ S	42° 55.5′ W	654	0.8
GC 022	61° 34.8′ S	42° 38.5′ W	823	2.6
GC 023	61° 35.6′ S	42° 28.6′ W	712	1.8
GC 024	61° 36.1′ S	41° 55.9′ W	873	0.8
GC 025	61° 40.6′ S	41° 23.8′ W	1539	
				Cast length (m)
XBT 85	63° 16.8′ S	44° 14.0′ W	3704	900
XBT 100	62° 29.0′ S	43° 35.3′ W	1598	900
XBT 101	61° 49.8′ S	43° 27.5′ W	665	900
XBT 103	61° 45.5′ S	42° 42.5′ W	778	900
XBT 104	62° 35.3′ S	43° 41.8′ W	2380	900
XBT 105	61° 13.0′ S	41° 47.0′ W	718	520
XBT 138	62° 13.3′ S	40° 58.0′ W	3392	2000

reflection profiles across the study area indicate that only some 500 m of sediment has accumulated above the Oligocene break-up unconformity, a net sedimentation rate of about 14 m/Ma.

Oceanographic and glacial setting

The South Scotia Ridge is a crucial barrier to present-day water masses, as it constrains Antarctic Bottom Water (AABW) flowing north-eastwards out of the Weddell Sea. Some AABW can flow north at intermediate depths through such gaps as Jane Basin (3200 m) and the one at 33° W (2900 m) but the densest Weddell Sea Bottom Water must continue to flow east to the South Sandwich Trench and beyond (Fig. 1). No direct current measurements are available for the study area but it is likely that AABW behaves as a western boundary undercurrent, flowing north-east past the SOM and turning west round its northern edge.

Hydrographic sections presented by Foster and Middleton (1979) show that the core of Warm Deep Water in the northern Weddell Sea does not extend on to the South Orkney shelf. Water immediately overlying the shelf and southern slope is colder, less saline, higher in oxygen and lower in silica than water at similar depths 100 km or more south of the slope. Temperature–depth sections obtained during cruise D154 (Table I, Fig. 3) show a surface maximum of about +0.5°C and a Winter Water minimum of about −1.5°C at 100 m depth. Below this the warm deep layer attains +0.3°C to the south and north of the SOM, +0.2°C on the slope and only −0.1°C on the shelf. Bottom temperatures on the shelf and slope range from −0.1° to −0.8°C.

The great depth of the SOM shelf means that reworking of sediment by normal shallow marine processes can only be of limited importance. Little information is available on near-surface currents. There is a permanent east-going current of 0.5–1.5 kts (0.25–0.75 m/s) along the north side of the islands, and local tidal streams between the islands may attain 4 kts (2m/s; Marr, 1935). The tidal range is 2–3 m and the tidal cycle has been reported as semi-diurnal to irregular (Powell, in Marr, 1935).

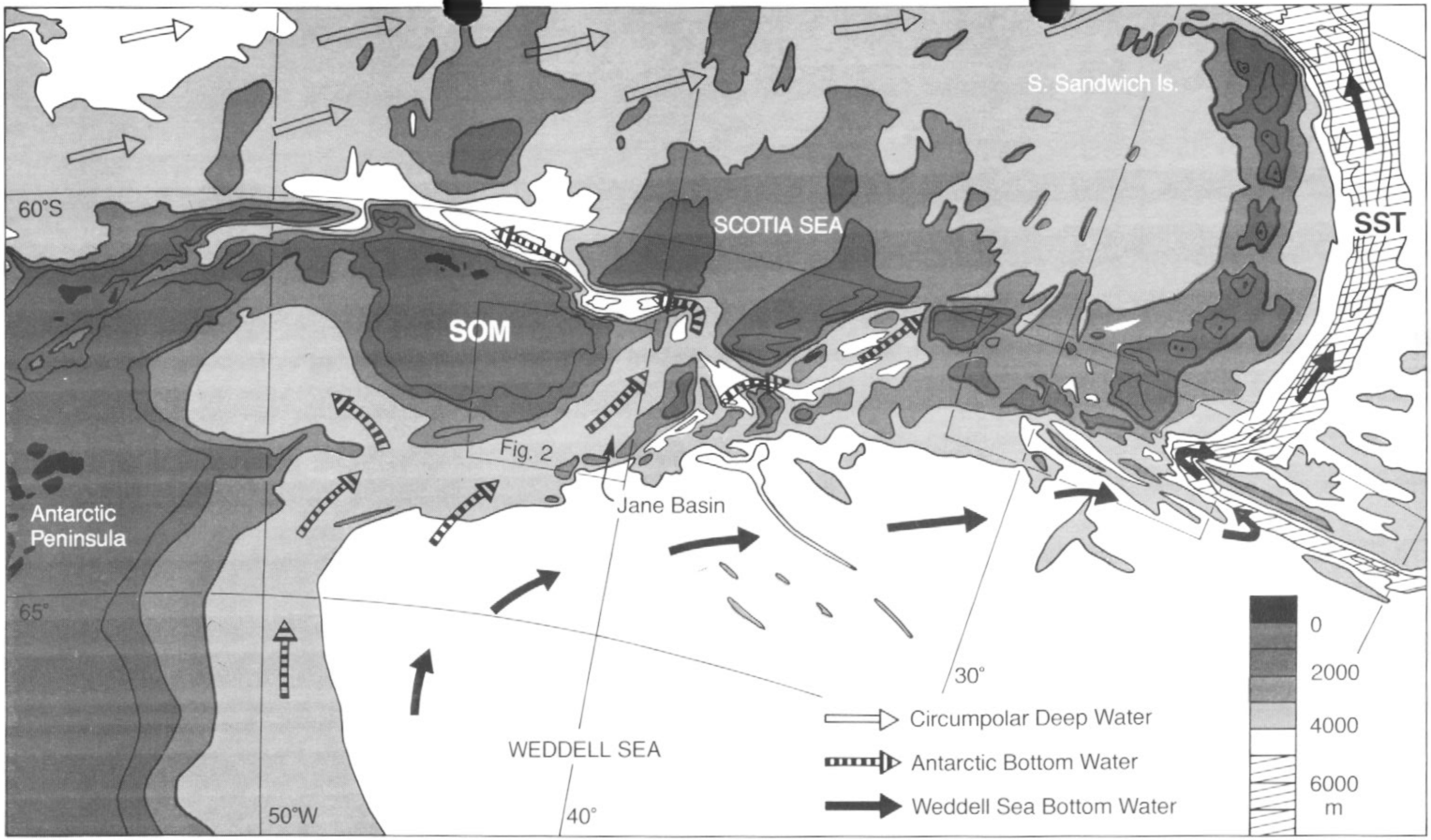


Fig. 1. Location map with potential pathways for deep-water flow. The South Scotia Ridge extends from the tip of the Antarctic Peninsula to the South Sandwich Islands. SOM, South Orkney Microcontinent; SST, South Sandwich Trench. Bathymetry from Tectonic Map (1985) revised in area of Fig. 2 (this paper) and southern end of South Sandwich Is. (I. W. Hamilton, pers. comm.). Most of the mixing to form AABW and WSBW takes place south of the area of this figure. Powell Basin to the south-west of the SOM is not open to the north.

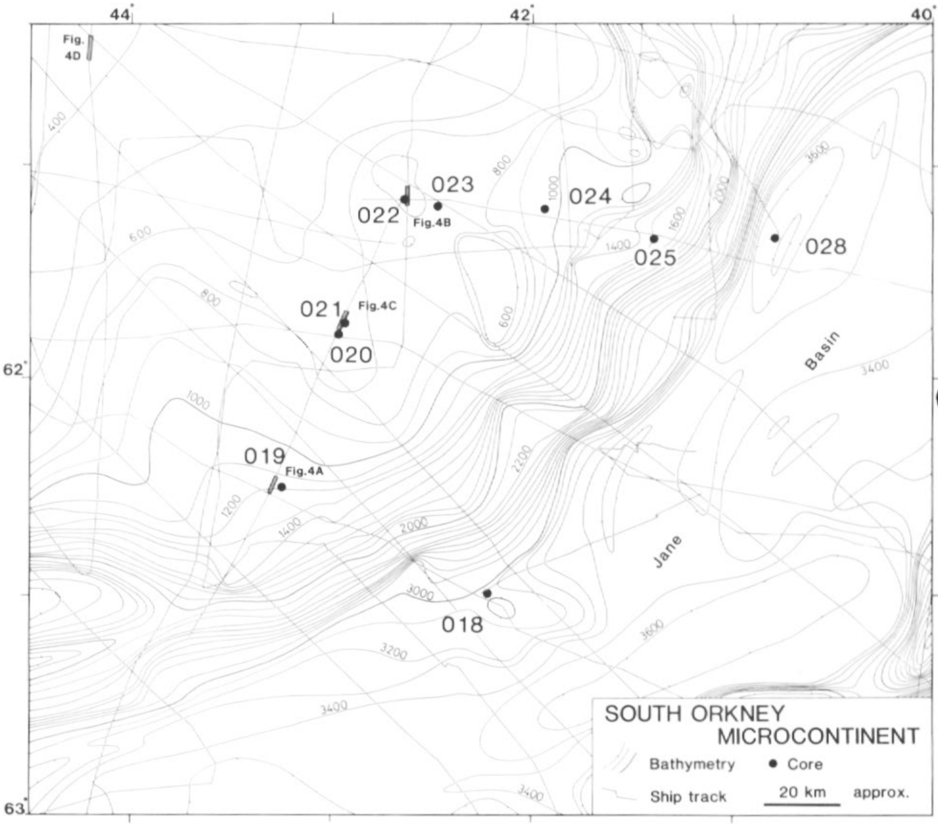


Fig. 2. Bathymetry and core locations. Contoured at 100 m intervals from 1984–5 tracks and pre-existing data. Mercator projection; scale is correct only at 62° S. Positions of Figs 4A, B, C and D shown by double lines.

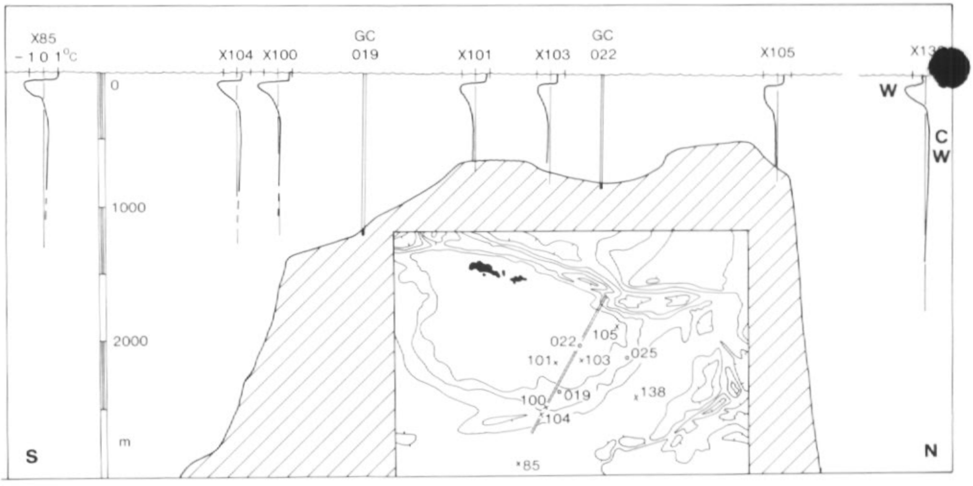


Fig. 3. Cross-section of SOM (inset map shows location) with temperature–depth (XBT) sections. Temperature scale, shown on X85, is the same for each. W = Winter Water, CW = core of Warm Deep Water (Foster and Middleton, 1979). Cores 019 and 022 lie on this line and 020 and 021 are near station X101.

Prevailing winds are from the west and south-west, and blow strongly throughout the year.

The study area is covered by fast pack ice for approximately 3 months each year, and during a further 4 months ice cover is patchy (Zwally and others, 1983). Large icebergs derived from the ice shelves in the southern and western Weddell Sea drift north-east across the South Orkney shelf and frequently ground at about 200 m depth. Abundant small icebergs observed in some years are believed to result from the break-up of larger bergs, the contribution from local valley glaciers and ice cliffs being small (Marr, 1935). Although the islands themselves are largely snow- and ice-covered, the ice formations were reported by Pirie (1913) to be static or even retreating slightly. We infer glacial and subaerial erosion to be unimportant at present, although the islands' topography suggests a heavier and more extensive glaciation in the past. Modern icebergs appear as clean as those elsewhere in the Antarctic (Anderson and others, 1980).

METHODS

Underway geophysics

Navigation. Satellite navigation was used throughout.

Echo sounding. Continuous 12 kHz and 3.5 kHz profiles were obtained in 1984–85 and the latter proved a useful guide to sediment type. They can show up to 80 m penetration in soft sediments but none in hard. Shape and continuity of the sub-bottom reflectors are related to sedimentation mechanisms (see below).

Seismic reflection profiles. Multichannel profiles were obtained in 1984–85 and single-channel profiles in previous years (King and Barker, in press). They do not resolve the top few metres of sediment so are of little relevance to the present study, except to indicate the overall style of sedimentation and the absence of large near-surface unconformities.

Side-scan Sonar. RRS *Discovery* had a hull-mounted sonar unit on the starboard side only. Its maximum useful depth is 700 m and the record is poor below 500 m (less in rough weather). It provides a map of surface features over a swath up to 2 km wide.

Sedimentology

The cores were split and described on board ship and a rough estimate made of diatom and foraminiferal abundance and the amount of ice-rafted debris. A few palaeomagnetic samples were taken but the results were poor (low magnetic intensities and low inclinations), so are not further discussed.

Grain-size. Samples of 2–5 g were wet-sieved at 63 μm (4ϕ). The sand fraction was then dry-sieved at 1ϕ intervals. The silt + clay fraction was analysed on a Sedigraph. This instrument measures equivalent settling diameter, and this should be borne in mind when considering results for a diatomaceous sediment. A diatom 30 μm across will behave hydrodynamically like a quartz grain of smaller but unknown diameter. Each Sedigraph cumulative curve was digitized to calculate a frequency curve.

Composition. Carbonate content was measured for those samples in which planktonic forams were visible, by hydrochloric acid leach. Biogenic silica was measured by sodium carbonate leach (Eggimann and others, 1980). Because the sediments are so poorly sorted, compositional estimates made from smear slides may be unreliable (smear slides, unlike thin sections, are not of uniform thickness). We prefer to use bulk X-ray diffraction estimates of composition for the major components quartz, feldspar, chlorite and amphibole. Before fine grinding of each sample, any large (> 1 mm) lithic grains were removed. The mineralogy of the < 2 μm fraction was also determined by X-ray diffraction. A few heavy mineral separations have been carried out using tetrabromoethane.

Biostratigraphy

Diatoms. Smear slides were prepared of samples at 20 cm intervals using the technique described by Ciesielski (1983), and examined with a binocular microscope.

Foraminifera. Samples of about 4 cm^3 were taken at 20 cm intervals. They were washed on a 63 μm sieve, but only the > 125 μm fraction was examined. Some samples had only rare individuals, but where possible assemblage counts of at least 100 benthic individuals were made. The planktonic: benthic ratio has been determined from a count of > 200 individuals where possible.

Results

Acoustic character

From about 700 m to 1500 m depth on the South Orkney shelf the seabed is firm, with little or no penetration by the 3.5 kHz profiler (Fig. 4A). Only locally are there 'ponds' in the lee of surrounding topography, where softer sediments show up to 25 m penetration (Fig. 4B). Most of the slope below 1500 m is too steep for accurate echo-sounder imaging. A level platform at 650 m exhibits small-scale roughness (Fig. 4C). On the north-east flank of this platform, sub-bottom reflectors appear and become thicker to the north-east, but it is not clear whether any reflectors are truncated by erosion.

On the shallow shelf near the islands the sidescan sonar shows abundant iceberg furrows (Fig. 4D) and one large iceberg was actually observed grounded at the end of its furrow. On the 650 m platform a rather poor record shows a number of straight furrows up to at least 100 m wide and 2 km long.

Stratigraphy

The cores range in age from Recent/late Pleistocene (*Coscinodiscus lentiginosus* zone) to late Pliocene (*Cosmiodiscus insignis* to *Nitzschia interfrigidaria* zone). Fig. 5 summarizes the diatom stratigraphy. Net sedimentation rates are extremely low. The base of the *C. elliptopora*/*A. ingens* zone is at 1.60 Ma (Ciesielski, 1985), giving a sedimentation rate for core 019 of 0.8 m/Ma and for 022 of 1.4 m/Ma. Core 025, entirely of *C. lentiginosus* age, accumulated at at least 3.4 m/Ma.

Sedimentology

The cores consist mainly of diatomaceous muddy sands, with local gravel lags and some intervals containing abundant foraminifera. Lithology, grain size data, carbonate and silica contents and terrigenous fraction composition are shown in Fig. 6. Bedding is visible as colour changes which are either sharp or gradational over 1–2 cm. No bioturbation was observed. Ice-rafted debris (coarse sand and gravel) occurs in all cores but is sparse in 022. Coarse grains are scattered throughout the sediment except in core 021, where a clast-supported gravel lag occurs from 48 to 54 cm; gravel-rich layers also occur in cores 20 (1.1 m) and 25 (2 m) (Fig. 6). Sorting

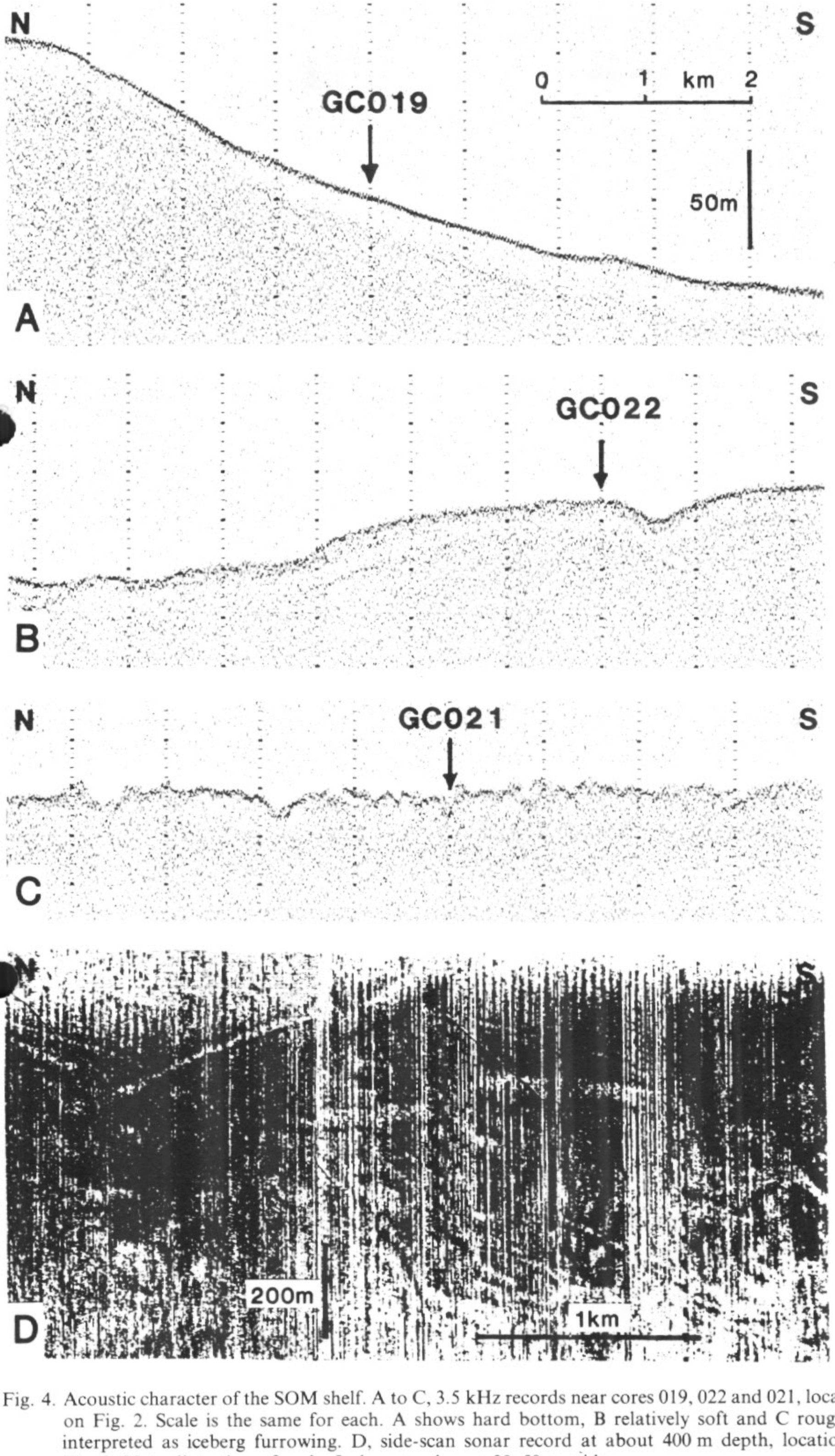


Fig. 4. Acoustic character of the SOM shelf. A to C, 3.5 kHz records near cores 019, 022 and 021, locations on Fig. 2. Scale is the same for each. A shows hard bottom, B relatively soft and C roughness interpreted as iceberg furrowing. D, side-scan sonar record at about 400 m depth, location on Fig. 2. Note distortion of scale. Iceberg tracks are 30–50 m wide.

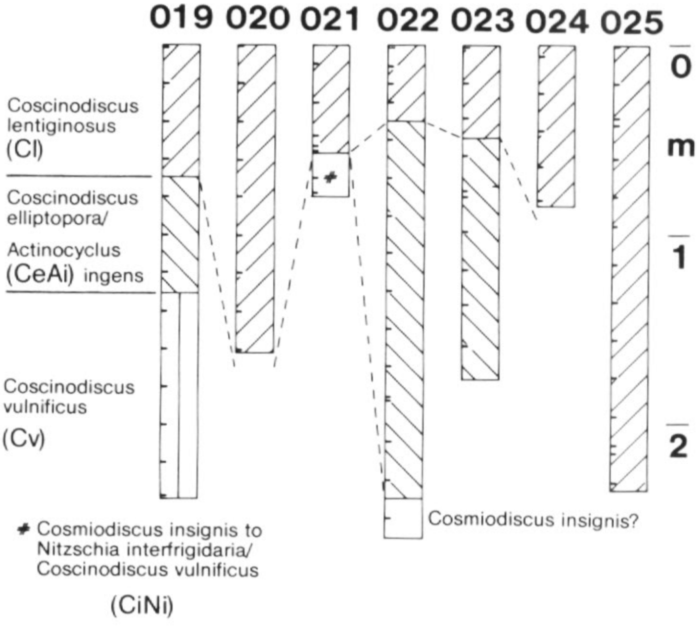


Fig. 5. Diatom stratigraphy of cores 019 to 025. The zonation of Ciesielski (1983, 1985) is used. The *Rhizosolenia barboi/Nitzschia kerguelensis* and *Coscinodiscus kolbei/R. barboi* zones are not represented. Ticks are sample positions.

is very poor, most samples having a total grain size range from -1 to $+13$ ϕ and at least two modes. Major constituents are quartz, feldspar, rock fragments, diatoms, foraminifera and clays. Heavy minerals form 2–3 wt% of the sand fraction. Also observed in smear slides are silicoflagellates (only in surface sediments), radiolaria and sponge spicules.

In general, lithological variation between cores is greater than within each core. Only 020 and 022 contain abundant carbonate as planktonic foraminifera. Biogenic silica mainly in the form of diatoms constitutes 10–15% of most samples, rising to nearly 100% in the diatom ooze at the top of core 022.

The grain size distributions are rather uniform within each core, only 022 and 025 showing much downcore variation: one or two histograms from each are therefore representative (Fig. 7A). There is a mode in the 2–4 ϕ range and a subsidiary mode around 5 ϕ (Fig. 7B). Coarser sand occurs not simply at shallower depth, but at more exposed sites: 020 and 021 are exposed because they are shallow, 024 because it is on a current-swept corner (Fig. 2). 022 appears to be the most protected site, an isolated pond/depression. The silt mode is not affected by depth or position.

The terrigenous part of these sediments is dominated by quartz (commonly 65–80%). Undulose extinction and polycrystalline grains are only rarely observed. Feldspars include both alkali feldspar and plagioclase, of diverse composition as shown by X-ray diffraction (many peaks between 13° and 30° 2θ, of variable intensity ratios). In smear slides the feldspars are fresh or slightly altered and albite and microcline twinning are widespread. Plagioclase is more abundant than alkali feldspar. Chlorite forms 2–3% of the bulk sample, being quite conspicuous as silt-size flakes; micas are absent except for one 8 cm interval at 1.6 m in core 022. Hornblende is normally a trace constituent, but in cores 022 and 025 may form 6–8%.

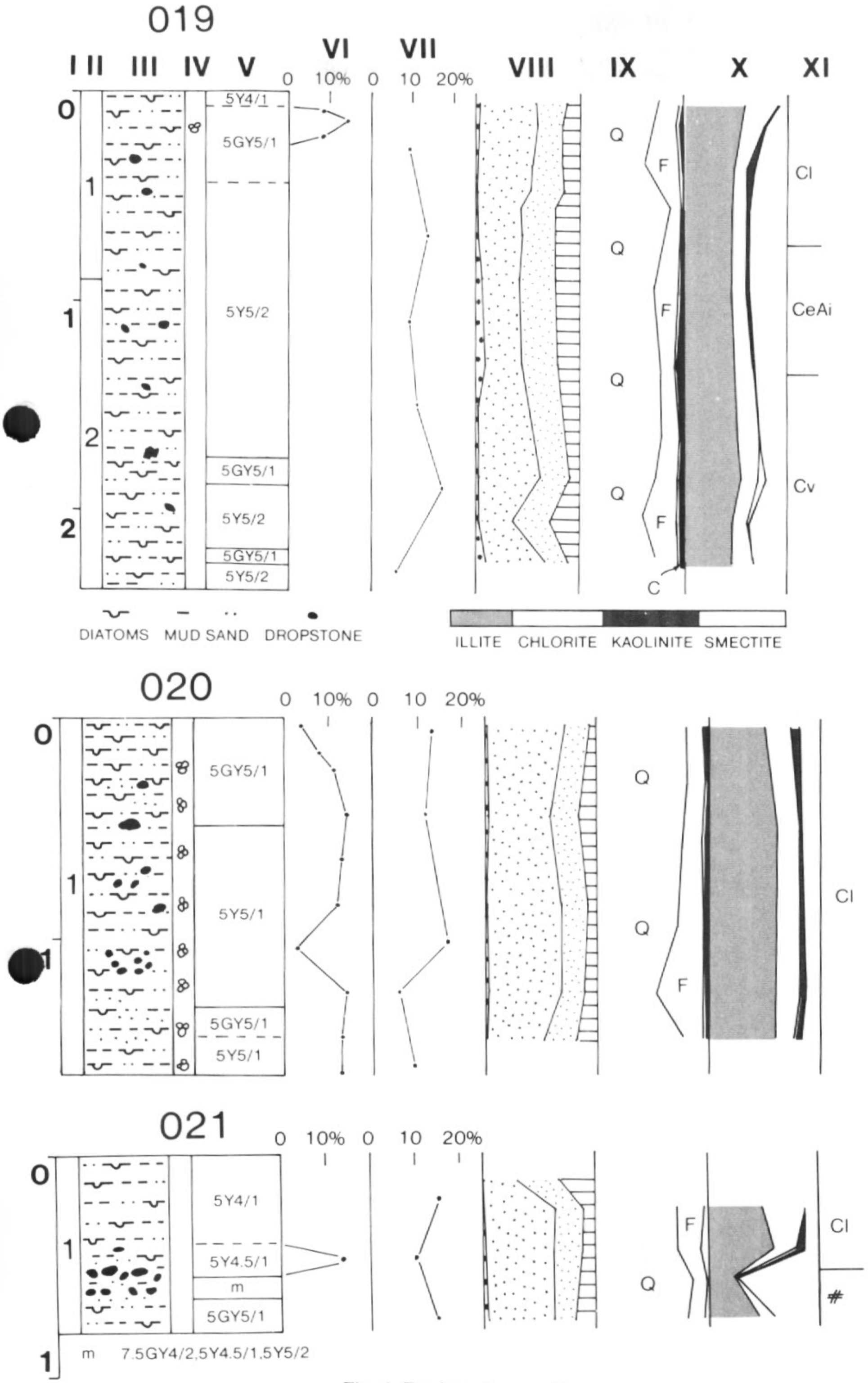
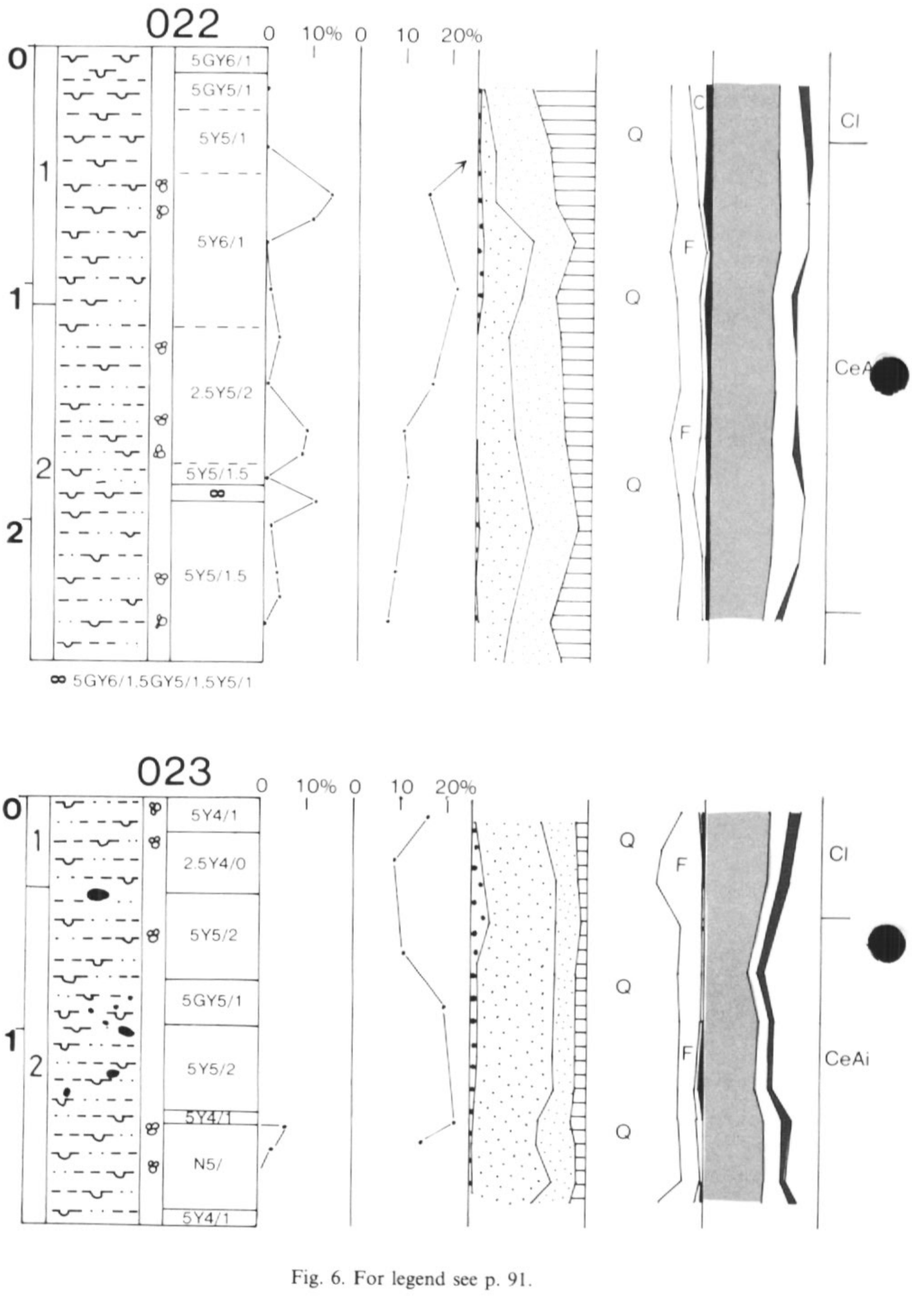


Fig. 6. For legend see p. 91.



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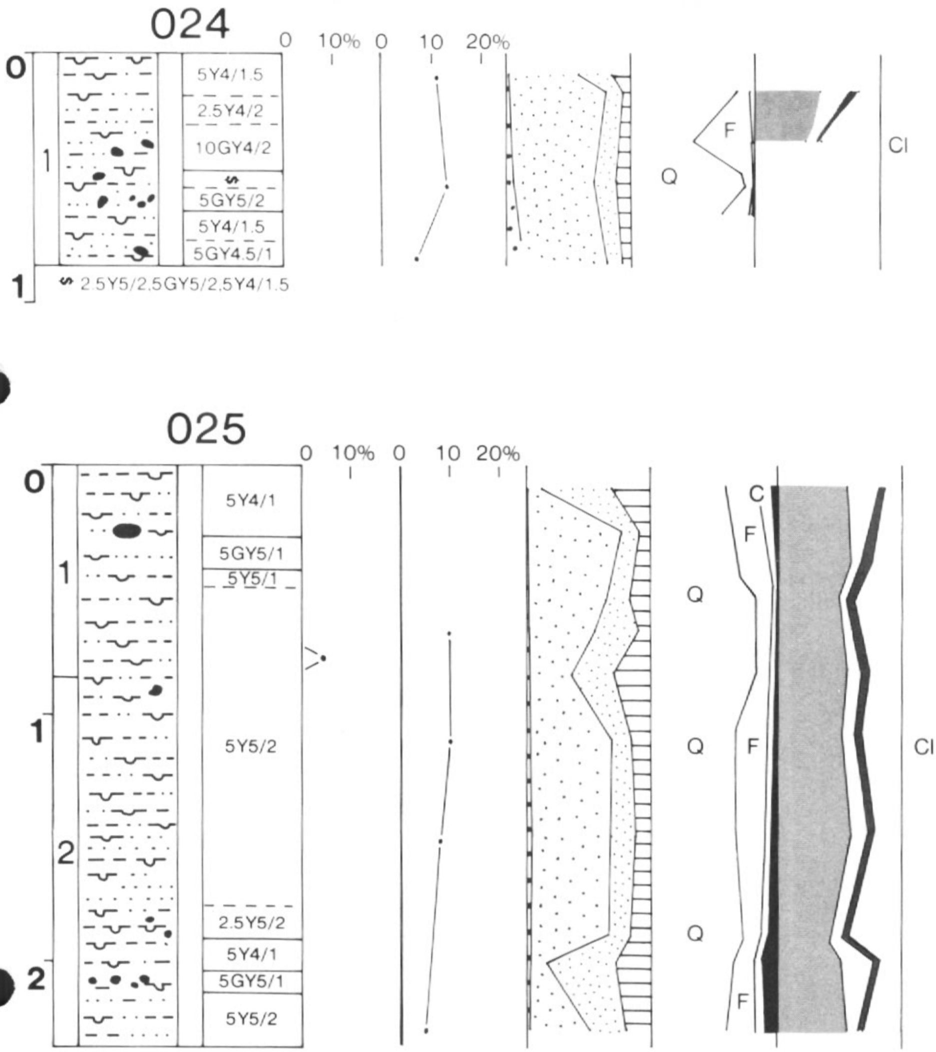

Fig. 6. Sedimentological logs for cores 019 to 025. Column I, metres below sea floor; II, section number; III, lithology, key below; IV, presence of planktonic forams; V, colour; VI, $CaCO_3$ content; VII, biogenic silica content; VIII, grain size at 4 ϕ intervals: gravel, sand, silt and clay; IX, mineralogy of bulk sample by X-ray diffraction (the non-amorphous terrigenous fraction). Q = quartz, F = feldspar, C = chlorite, black = amphibole; X, mineralogy of $< 2\ \mu m$ fraction, key below; XI, age; abbreviations Cl, etc. as in Fig. 5.

Illite consistently forms about half the clay mineral assemblage, with kaolinite only a small fraction (5 % or less). Chlorite and smectite are quite variable downcore: there tends to be more chlorite in the *C. lentiginosus* and *C. vulnificus* zones, with more smectite in the *C. elliptopora*/*A. ingens* zone. The Pliocene sediment in core 021 is very rich in smectite and poor in illite.

The relative abundances of heavy minerals in 11 samples representing Recent to Pliocene sediment are shown in Fig. 8. The assemblages are dominated by garnet and

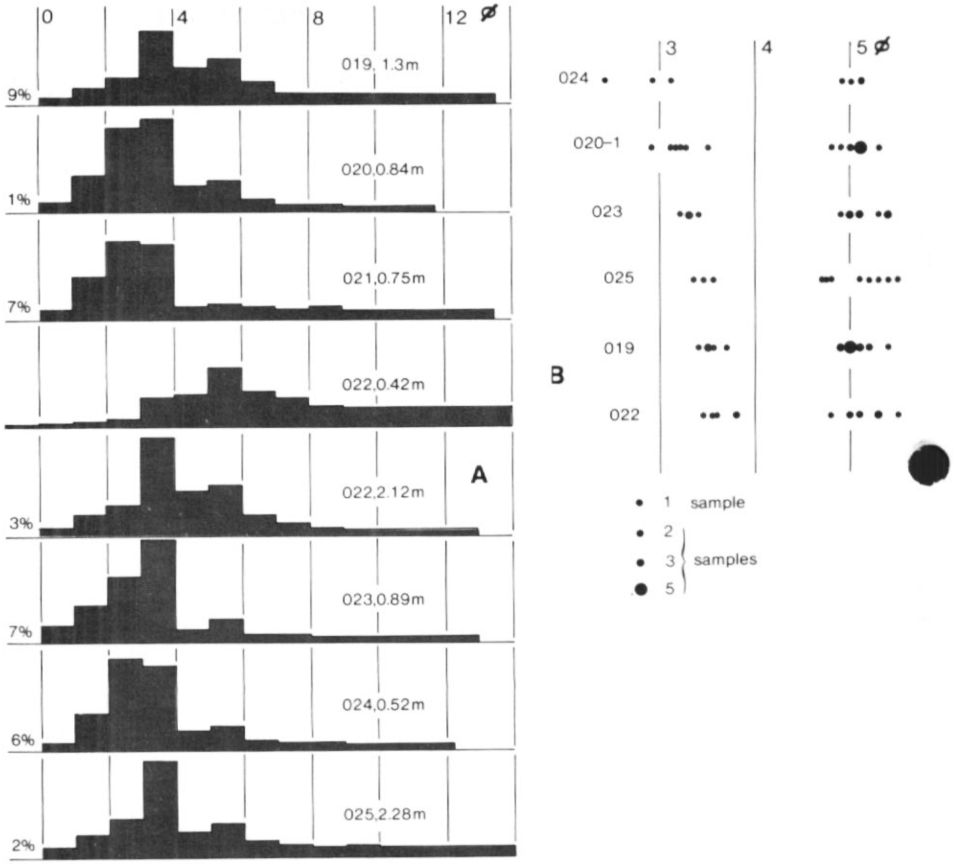

Fig. 7. (A). Representative grain-size histograms. The percentage of total gravel is given at left. (B) Modes in the very fine sand and coarse/medium silt ranges. The sites are arranged not according to depth, but with most exposed at the top and most protected at the bottom.

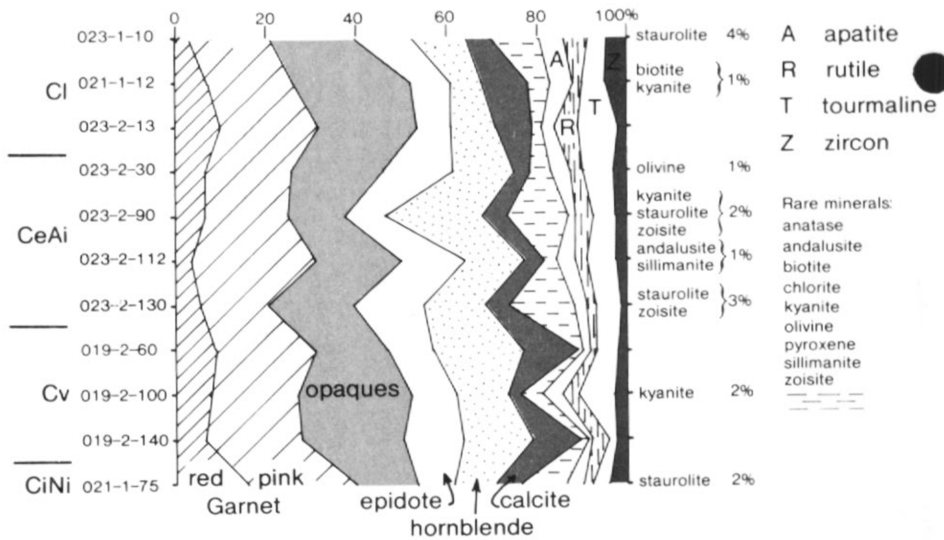

Fig. 8. Heavy minerals in the 1–4 ϕ size fraction of 11 samples from cores 019, 021 and 023. 200 grains counted per sample. Vertical scale schematic; abbreviations for diatom zones as Fig. 5.

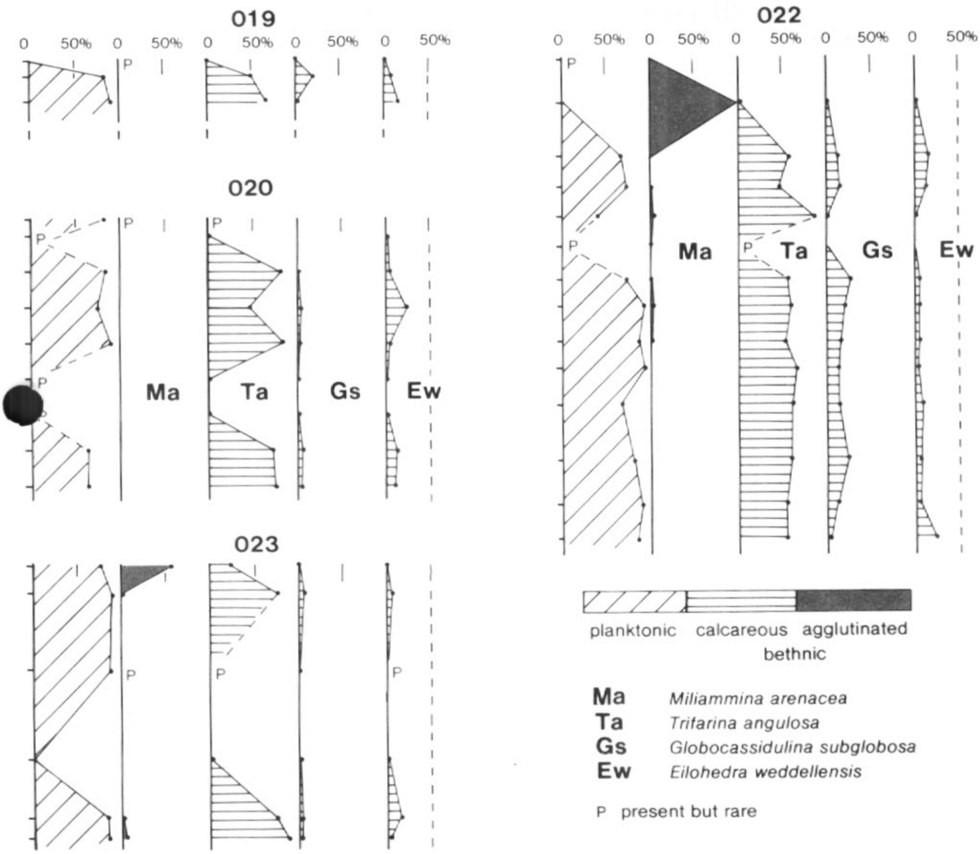

Fig. 9. Composition of the foraminiferal fauna and abundances of selected benthic species. Ticks are sample positions. P in the left-hand column signifies planktonic tests present in low abundance. The percentages in the species columns are of total benthic individuals. Core 019 is barren below 24 cm except for a few planktonics at 75 and 225 cm and a few *Miliamminas* at 175 cm. Core 020 contains 5–10% *Ehrenbergina glabra* at the same levels that *Trifarina* occurs. Core 021, not illustrated, contains a fauna of planktonics + *Trifarina* + *Eilohedra* at 47 cm, a few planktonics at 57 and 72 cm and a few *Miliamminas* at 47 cm.

opaques, with epidote and hornblende also prominent. Garnet shows a small increase downcore at the expense of (apatite + rutile + zircon); other components remain roughly constant.

Foraminifera

Most of the results are given in Fig. 9. The only planktonic species is *Neogloboquadrina pachyderma* (Ehrenberg), which is almost exclusively left-coiling. Certain levels in the cores have abundant planktonic tests and here the planktonic: benthic ratio is high ($> 80 : < 20$). Planktonic abundances of less than 80% suggest some dissolution, and the tests in these samples are corroded. Other samples have few or no planktonic tests. Cores 019, 020, 021 and 023 show alternations of high and low planktonic abundance.

The commonly occurring benthic species are:

Miliammina arenacea (Chapman) – agglutinated

Trifarina angulosa (Williamson)
Globocassidulina subglobosa (Brady)
Eilohedra weddellensis (Earland)
Ehrenbergina glabra (Heron-Allen and Earland)
} calcareous wall

Assemblages are generally dominated either by *Miliammina arenacea* with few or no calcareous species, or by *Trifarina angulosa* with subsidiary *Globocassidulina subglobosa*, *Eilohedra weddellensis* or *Ehrenbergina glabra* (Fig. 9). The core-top samples all have *Miliammina arenacea* present or dominant, except for the diatom ooze in 022, which is barren of foraminifera. The *M. arenacea* assemblage is also present in core 021 in the Pliocene. The *Trifarina angulosa* assemblage is present at all stratigraphic levels represented in these cores. Barren sections are present in cores 019, 020 and 023 in the Pleistocene.

By comparison core 028 from 3621 m to the east of the SOM contains no planktonic tests and only a sparse agglutinated benthic fauna of *Cribrostomoides* and *Cyclammina* to a depth of 3.4 m. The lowest metre of the core is barren.

Discussion

Sediment transport by ice and water

All the coarse sand and an unknown amount of finer material reaches the area by ice-rafting. Bottom currents can winnow the finest sediment and are thought to be responsible for transporting the modal fine/very fine sand across the shelf area as bed load. Estimates of current velocity may be made as follows. To transport non-cohesive particles of 80–100 μm diameter, a flow velocity of 15–20 cm/sec is suggested by Gonthier and others (1984) and McCave (1984); but for poorly sorted sediment undergoing bioturbation, 2 cm/sec may be sufficient to move very fine sand grains (Singer and Anderson, 1984). The silt mode is probably mostly diatoms. Both diatoms and planktonic foraminifera are deposited by pelagic settling but may be reworked by bottom currents.

Reworking of sediment by grounded icebergs is certainly active at less than 200 m depth today (Fig. 4d) and may have affected deeper areas in the past. Core 020 contains upper Pleistocene sediment to 1.6 m but core 021, only 2.4 km away, has only 0.5 m of upper Pleistocene overlying Pliocene. Scouring and removal of sediment are evidently very localized and therefore unlikely to result purely from strong bottom currents. The small-scale roughness at sites 020–1 is inferred to be iceberg furrows similar to those higher on the shelf. Ploughing by icebergs is an effective way of removing soft sediment from narrow strips of seabed; in addition, sediment thus churned up is more susceptible to winnowing by bottom currents. The age of the main ploughing episode may be late Pleistocene, since sediment of this age overlies the lag and disconformity in core 021.

Source areas

Potential sediment sources include the South Orkney Islands and shelf, the Antarctic Peninsula and the East Antarctic craton. The latter two contain a very wide variety of igneous and metamorphic rocks respectively, and without detailed study of the ice-rafted debris it is not possible to identify specific sources. On the South Orkney Islands, quartzo-feldspathic and micaceous schists of the Basement Complex form Signy Island and most of Coronation Island; the smaller islands to the east consist of a greywacke-shale series and the Powell Island Conglomerate of metamorphic provenance (Matthews and Maling, 1967; Thomson, 1968, 1973, 1974).

In the ice-rafted sand and gravel from the South Orkney cores, fragments of partly lithified siliceous sediment may have been eroded by icebergs from the local submarine shelf and almost immediately redeposited. Quartzite and micaceous schist may be locally derived; the absence of mica from the fine fraction can be explained by bottom-current winnowing. The abundance of epidote and hornblende in the heavy mineral assemblages, and the presence of dark fine-grained volcanics as ice-rafted grains, require a volcanic source in addition to the volumetrically minor amphibolites in the local Basement Complex. The garnet could have come partly from East Antarctica, since it is not among the prominent minerals in most of the South Orkney schists (Thomson, 1968, 1973, 1974). Although sphene is a prominent accessory mineral in almost all South Orkney rock types (Thomson, op. cit.) it has not been found in our cores, again suggesting distant sources are more important than local ones.

Foraminiferal ecology

The presence or absence of planktonic tests reveals something of both the surface and bottom water masses. In the modern surface waters, left-coiling *N. pachyderma* makes up > 90% of the assemblage as far north as the Antarctic Convergence (Be, 1969). However, abundant planktonic tests are present in the core tops only of 020 and 023. Elsewhere they are rare or absent, presumably due to postmortem dissolution in the corrosive bottom waters. At sites 020 and 023 the bottom waters may also be corrosive, as the former has no calcareous benthic fauna and the latter only 23% calcareous forms (Fig. 9). Perhaps the input of planktonic tests is faster at these two sites. In the upper Pleistocene at Kapp Norvegia, Grobe (1986) distinguished three sedimentary facies: warm, characterized by *N. pachyderma*, transitional, characterized by siliceous microfossils, and cold, characterized by the absence of biogenic material. The terms warm and cold are relative, and the present environment of the South Orkney shelf would be classed as warm.

In view of the effects of corrosive bottom waters, the warm category may be subdivided thus: (i) *N. pachyderma* plus calcareous benthic tests represents low or no dissolution, (ii) *N. pachyderma* plus agglutinated or small numbers of calcareous benthic tests represents some dissolution, (iii) agglutinated benthic tests alone represent severe dissolution. The latter category is distinct from the siliceous or barren sediments representing transitional or cold conditions. Although the cores contain levels with sparse faunas there are few truly barren intervals.

The modern benthic assemblages from the South Orkney shelf are dominated by non-calcareous individuals, but no single species is dominant. *Miliammina arenacea* ranges from 1 to 80%, *Portatrochammina wiesneri* 0–11% and the calcareous species *Fursenkoina earlandi* 0–15% (Echols, 1971). Although the modern Warm Deep Water around South Georgia supports assemblages rich in calcareous forms (*Trifarina angulosa* 9–17% with *Bulimina aculeata* 14–33% and *Cassidulinoides parkerianus* 3–38%; Echols, 1971), the modified warm deep layer at −0.2 °C on the South Orkneys is corrosive to $CaCO_3$.

The core top samples have assemblages dominated by *M. arenacea* corresponding to those recorded by Echols (1971). However, many of the subsurface samples are dominated by *Trifarina angulosa*. The nearest modern analogue is the modern-day assemblage from South Georgia, although *T. angulosa* is less abundant there than in the cores. These subsurface assemblages indicate a non-corrosive water mass *different* from that found in the South Orkney area today. There are only two samples completely barren of foraminifera, which may represent a cold period.

Conclusions

Cores 019 to 025 contain an incomplete sedimentary record from late Pliocene to Recent, although many of the breaks may be short. Only in core 021 is there a long time gap: a coarse gravel lag and four missing diatom zones signify that most of the Pleistocene is not represented. Terrigenous sediment sources do not appear to have changed very greatly during the late Neogene, in contrast to biological productivity and preservation, particularly of carbonate. The modern calcite compensation depth may be as shallow as 500 m (Echols, 1971). Abundant planktonic foraminifera in cores 020 and 022 indicate that the CCD may have been 800 m or more during the Pleistocene. The preservation of planktonic foraminifera at one level in core 019 may result from a brief increase in productivity.

The record in these cores, notably of grain size, implies that there have not been major and long-lived changes in bottom-water velocity in the southern South Orkney area within the last 2 Ma. However, conditions of sedimentation must have been very different from 2 to about 36 Ma to allow several hundred metres of sediment to accumulate (see ‘Tectonic setting’). Higher biological productivity, increased terrigenous supply, or both, are implied. Lower bottom-water velocity (i.e. less winnowing) would have permitted more fine-grained sediment to accumulate.

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