AGSO

ANTARCTIC CRC MARINE GEOSCIENCE

PRYDZ BAY, MAC.ROBERTSON SHELF AND KERGUELEN PLATEAU

POST CRUISE REPORT

BY

P.E. O'BRIEN, P.T. HARRIS, P.G. QUILTY, F. TAYLOR & P. WELLS

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AGSO CRUISE 149
ANARE VOYAGE 6, 1994/95 (BANGSS)

by

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ISSN: 1039-0073
ISBN: 0 642 22375 0

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INTRODUCTION

This record is a summary of the preliminary results of the second AGSO/Antarctic Co-operative Research Centre/ANARE marine geoscience program in Prydz Bay, the Mac.Robertson Shelf, Antarctica and the Kerguelen Plateau (Fig.1). The cruise program consisted of activities aimed at understanding modern sedimentary processes on the Antarctic margin, understanding the Plio-Pleistocene environmental history of the region and obtaining samples from the Kerguelen Plateau to illuminate the history of water mass reorganisation in the Southern Ocean during Quaternary climate change episodes. The cruise is designated AGSO survey 149 in AGSO's data bases and has the acronym BANGSS (Big ANtarctic Geology and Seismic Survey) in Antarctic Division data sets.

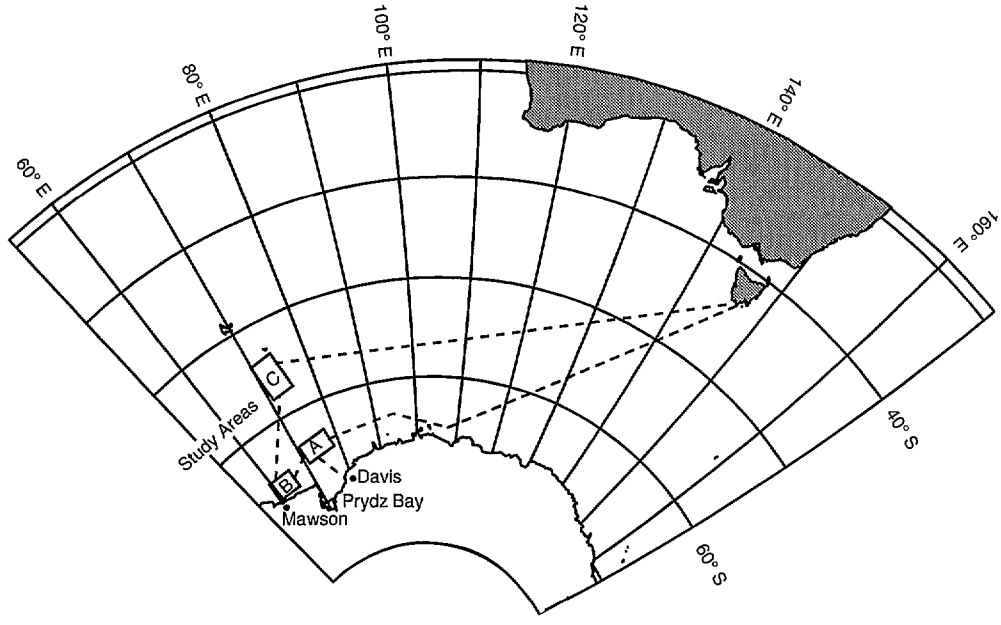


Figure 1. Cruise track and marine geoscience study areas for ANARE 1994/95 Voyage 6 (AGSO Cruise 149). Study areas are: (A) Prydz Trough Mouth Fan; (B) Mac.Robertson Shelf; (C) Kerguelen Plateau.

The cruise program set out in O'Brien et al., (1995) was to meet the common goal of the Antarctic CRC Natural Variability (sediments) sub-program and the ASAC strategic plan for Antarctic Geosciences which is to promote a better understanding of global climate change by providing statements of the Antarctic and Southern Ocean palaeoenvironments over the following time intervals:

(A) 0-10,000 years (post-glacial warming)
(B) 0-160,000 years (last glacial cycle)
(C) 0-5,000,000 years (Pliocene "warming" of Antarctica).

Studies of modern sediment transport and modern organisms that contribute to Quaternary sediments were designed to aid the understanding of the ancient sedimentary record and the modern Antarctic environment. Seismic lines and sampling on this cruise were

also expected to provide insights into the tectonic and stratigraphic development of the parts of the Antarctic margin. The three features targeted for study during the cruise were: (A) the trough-mouth fan deposits adjacent to Prydz Bay; (B) sediment traps associated with deep, shelf-basins on the Mac.Robertson Shelf; and (C) sediments on the Kerguelen Plateau.

These features were selected because in anticipation that they should provide insights into Antarctic environmental history. Sediments deposited in Prydz Bay should contain a record of ice sheet fluctuations because of their location at the downstream end of the largest outlet glacier draining from the East Antarctic Ice Sheet, the Lambert Glacier. The Mac.Robertson Shelf, in contrast, was glaciated by ice originating entirely in the adjoining coastal region. It also contains deep basins that contain thick Holocene sediments that are useful in the detailed study of post-glacial environmental change.

The Southern Ocean is a major component of the global climate system. Its water masses play a pivotal role by absorbing, transporting and releasing heat and by transferring oxygen, nutrients and CO_2 to and from the deep ocean. In this context, the Kerguelen Plateau has accumulated sedimentary sequences that will contain records of how the Polar Front and its associated water masses have varied between glacial and interglacial periods.

REGIONAL SETTING OF STUDY AREAS

Prydz Bay overlies a sedimentary basin, the Prydz Bay Basin (Fig. 2; Stagg, 1985). A fault-bounded structure, the Lambert Graben, extends about 600 km inland through Prydz Bay to the Prince Charles Mountains (Fedorov et al., 1982, Stagg, 1985). This structure is occupied by the Amery Ice Shelf - Lambert Glacier ice drainage system, which drains up to 1.09 million km or about 22% of the East Antarctic ice sheet (Allison, 1979). The ice transport efficiency of this system has produced a large depression in the ice cap and exposure of the Prince Charles Mountains.

Major fluctuations of the East Antarctic ice sheet should be reflected in glacial geological evidence on these bedrock features and sedimentary or morphological evidence at the downstream end of the ice drainage system in Prydz Bay. During Cainozoic glacial episodes, the Amery Ice Shelf advanced across Prydz Bay to the shelf edge (Cooper et al., 1991; Hambrey et al., 1991). However, lateral moraine elevations in the Prince Charles Mountains indicate ice thicknesses only about 100 m more than present during the last glacial maximum,

suggesting the Lambert Glacier did not reach the outer shelf during this time (M. Mabin, pers. comm, 1995).

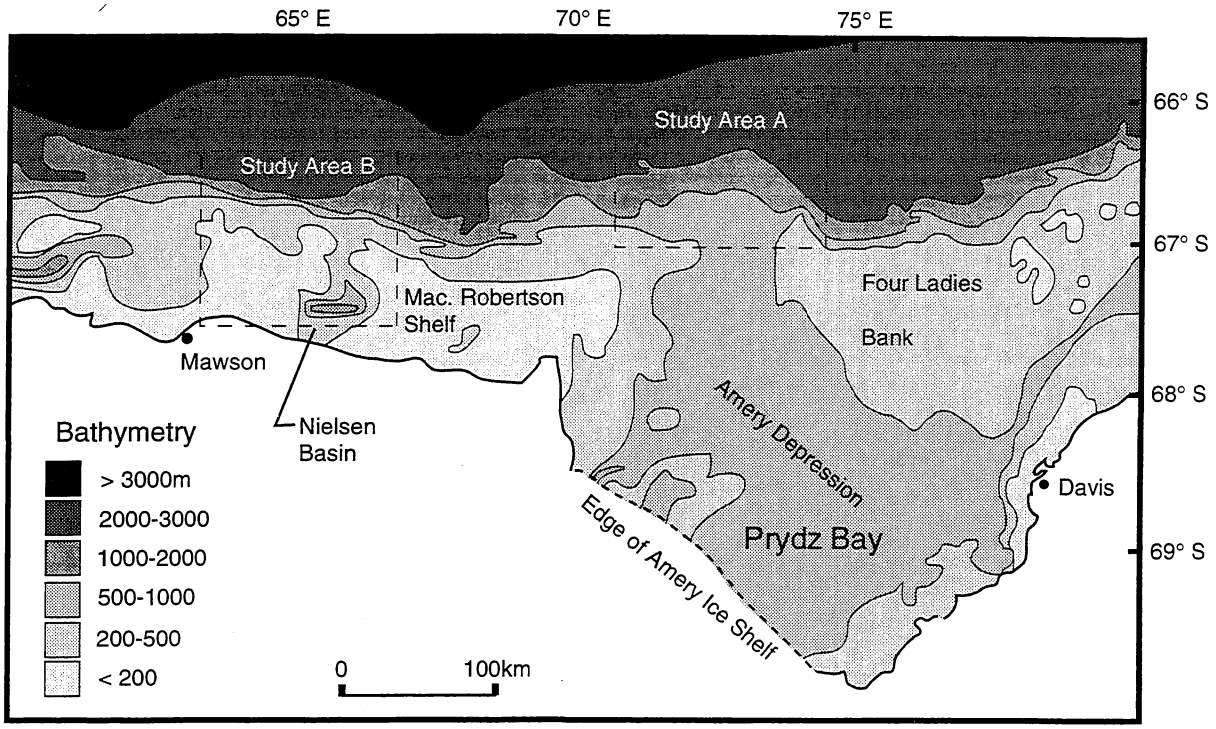


Figure 2. Regional bathymetry and location of study areas: (A) on the Prydz Channel Fan; and (B) on the Mac.Robertson shelf.

Physiography

Prydz Bay is occupied mostly by a broad topographic basin, the Amery Depression. As with much of the Antarctic continental shelf, the deepest part of the Amery Depression is near-shore (Anderson et al., 1994; Vanney & Johnson, 1985). Depressions up to 1000 m deep are found in the south-western corner of the Bay (the Lambert and Nanok Deeps) and parallel to the Ingrid Christiansen Coast (the Svenner Channel). The Prydz Channel extends from the western side of the Amery Depression to the continental shelf edge (Fig. 2). Prydz Channel resembles shelf-crossing valleys seen on other glaciated shelves.

Offshore from the Amery Depression, the shelf shallows are less than 200 m deep along the shelf edge, at the Four Ladies Bank, on the eastern side of the Prydz Channel and Framm Bank on the western side (Fig. 2). Sea floor topography is also rugged close to the present position of the Amery Ice Shelf front between the edge of the Svenner Channel and the present coast where large, U-shaped valleys extend northwest from the termini of the Sørsdal, Ranvick and Polar Record Glaciers.

The western part of the continental slope beyond Prydz Bay offshore from the Prydz Channel consists of a large, smooth-surfaced fan. The Prydz Channel Fan extends 90 km seaward and is 150 km across with a surface slopes of 1.2° to 2°. It lacks submarine canyons. The slope east of the fan is steeper (4°) with several submarine canyons that start as dendritic tributaries on the upper slope that join in the mid-slope (Vanney & Johnson, 1985). These canyons are not as steep-sided as those further west on the Mac. Robertson Land slope.

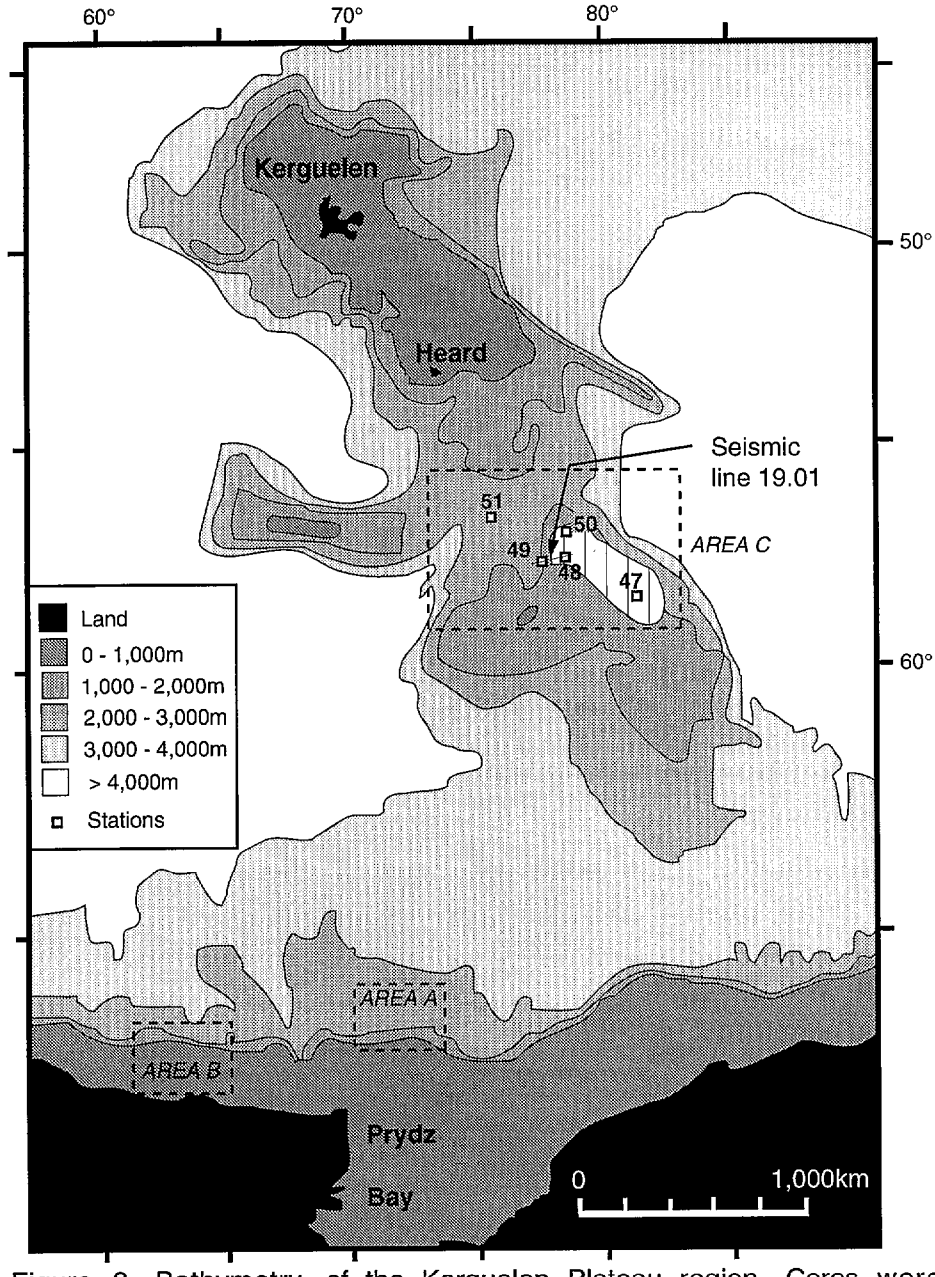


Figure 3. Bathymetry of the Kerguelen Plateau region. Cores were collected at Stations 47 to 51, CTDs at 47 and 49 and seismic acquire between stations 48 and 49.

The Mac. Robertson Shelf is narrower and more rugged than Prydz Bay and was glaciated by coastal ice during Pleistocene glacial maxima. It has flat-topped outer banks, Storegg and Framm Banks, at depths of 110

to 150 m, separated by three deep valleys that cross the shelf - Iceberg Alley, Nielsen Basin and Burton Basin (Fig. 2). Nielsen and Burton Basins are partly coast-parallel with the Nielsen reaching depths of 1400 m. Palaeogene sediments recovered by dredging on the 1993 ANARE/AGSO cruise suggest extensive older sediments crop out on the outer shelf (O'Brien et al., 1994).

The Kerguelen Plateau is a NNW-trending plateau, 2100 km long and 500 km across extending from about 61°S to 45°S. Its geology and sampling coverage are extensively reviewed by Ramsay et al.(1985) and Schlish et al.(1990). It has an axial region of relatively flat sea floor with flanks sloping rapidly down to the adjacent 4500 m deep ocean. The plateau is divided into northern and southern sectors (Fig. 3; Ramsay et al., 1986). The northern sector is 800 km long and 400 km wide and generally lies at water depths of less than 1000 m. This sector is capped by Heard, Kerguelen and Mac Donald Islands. The southern sector is mostly between 1500 m and 2500 m, although it is as shallow as 700 m in places. It is separated from the northern sector by a saddle 2500 m deep (Fig. 3).

EXISTING DATA

Antarctic Shelf

Seismic Data: Prydz Bay has received relatively more attention than other parts of the East Antarctic continental shelf and slope. A marine geoscience cruise by Australian National Antarctic Research Expeditions (ANARE) and the Bureau of Mineral Resources (BMR) on the *M.V. Nella Dan* in 1982 acquired 5000 km of multichannel seismic reflection data and 8-10 000 km of 3.5 kHz echo sounder data plus magnetic data along straight tracks (Stagg, 1985). Russian and Japanese expeditions have also obtained multichannel seismic data in the area (Kuvaas & Leitchenkov, 1992; Mizukoshi et al., 1986). An additional line was shot by the Ocean Drilling Program (ODP Leg 119) in 1988 to aid siting of ODP holes 739 to 743 that were situated on line PB-021 of the ANARE/BMR survey (Barron et al., 1989). Many of these seismic lines show prograding foreset bedded units that have been related to episodes of glacial advance to the shelf break (Fig. 4)

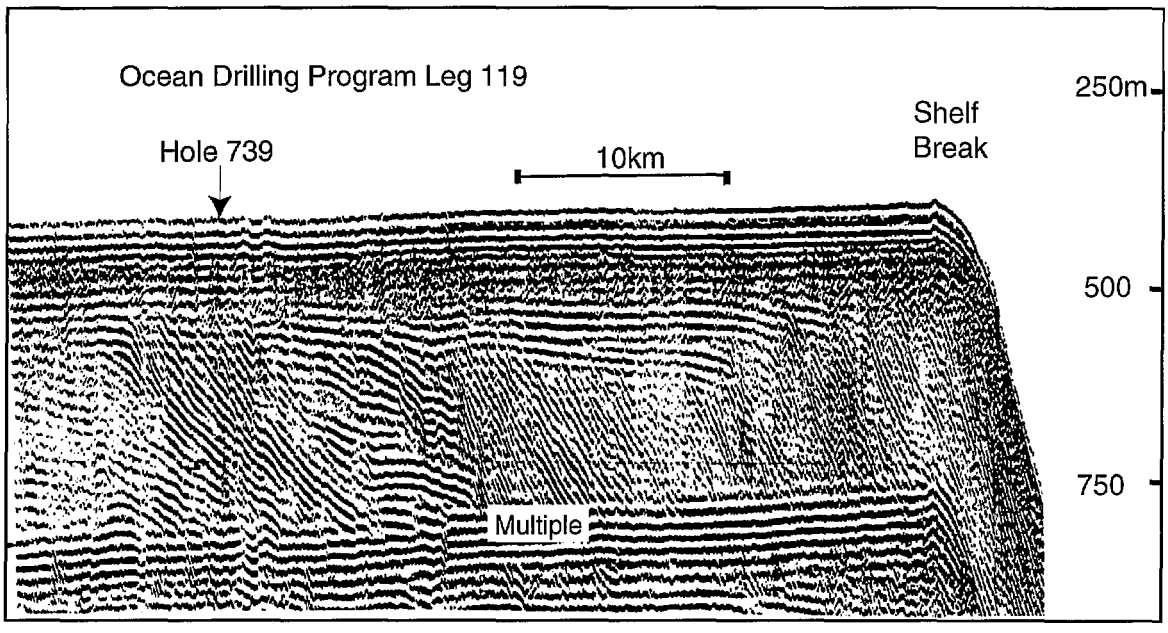


Figure 4. Seismic reflection profile (after Cooper et al., 1991) showing the location of ODP site 739 and progradational foreset beds in Prydz Bay.

Since 1990, ANARE cruises by the *R.S.V. Aurora Australis* have collected 12, 35 and 120 kHz echo-sounder records. These data were also used to select sites for grab and gravity coring during January and February 1993 (O'Brien et al., 1993).

Sediment Samples: Sediment samples were first collected from the region by H.M.S. Challenger in 1873 (Murray & Renard, 1891), then by the Soviet Marine Antarctic Expedition commencing in 1955 (Lisitzin, 1960). McLeod et al. (1966) described a few samples from the approaches to Mawson Station. The 1982 ANARE cruise obtained 37 bottom sediment samples using dredges, grabs and small gravity cores from locations scattered widely across Prydz Bay and the Mac.Robertson shelf (Quilty, 1985). Ocean Drilling Program Leg 119 drilled five holes up to 486 m deep in a transect across Prydz Bay using conventional rotary techniques because the ODP piston coring equipment could not penetrate the diamictites encountered. Consequently, the Quaternary sediments obtained were badly disturbed by drilling (Barron et al., 1991). Since then, the 1991 summer cruise by the *R.S.V. Aurora Australis* obtained 17 bottom samples by shallow gravity corer (up to 50 cm) and by accidental dredging by trawl nets (Franklin, 1991). Antarctic Division has also collected sea bottom photographs from 17 locations in Prydz Bay. The 1993 ANARE/AGSO geoscience sampling program on Voyage 7 (AGSO survey 901, ANARE acronym KROCK) of that season obtained 33 gravity cores and 35 grabs from Prydz Bay and the Mac.Robertson Shelf (O'Brien et al., 1993).

Kerguelen Plateau

The Kerguelen Plateau has been visited by numerous research cruises. Pre-1985 cruises are tabulated by Ramsay et al. (1986) in their documentation of the 1985 BMR seismic survey, and Schlish et al. (1989) reviewed the sea floor sampling prior to 1989. ODP legs 119 and 120 drilled 10 holes on and around the Kerguelen Plateau (Schlisch et al., 1989; Wise et al., 1990; Barron et al., 1989, 1990). Since then, seismic data and cores have been collected by the French ship *Marion Dufresne* (Schlish, pers. comm., 1994) by the All Russian Institute for the Geology and Mineral Resources of the World Ocean Antarctic Branch (Leitchenkov, pers. comm. 1994). The 1993 ANARE/AGSO program also collected one gravity core from the southern Kerguelen Plateau (O'Brien et al., 1993).

CRUISE PROGRAM

Planned

The original cruise plan proposed 25 days of marine geoscience program out of the of 58 day voyage. In addition, the voyage was to recover upward-looking sonar moorings for the Antarctic CRC Sea Ice Sub-program, re-supply Mawson and embark expeditioners and cargo from Davis and Mawson Stations. The marine geoscience program was subdivided into 10 days ship-time for the examination of the Prydz Channel Fan, 10 days for the Mac.Robertson Shelf and 5 days the Kerguelen Plateau (Fig. 3; O'Brien et al., 1995). The Mac.Robertson Shelf and Prydz Trough Mouth Fan research plans envisaged 5 days of seismic and sidescan sonar acquisition, then 5 days coring and CTD-bottom photography. The Kerguelen Plateau program consisted of 7 cores and CTDs and 176 km of seismic data, taking about 5 days.

Actual

The actual cruise program was extensively modified by blizzards and what were probably the worst sea ice conditions on the Mac.Robertson Shelf and in Prydz Bay since ANARE founded Mawson Station in 1954. Appendix 1 gives a calender of events on the cruise, Figure 5 shows the extent of fast ice around Mawson on the 21st February and Figure 6 summarises wind strength for the cruise. In total, 7 days were lost to storms, not including storms during transit and re-supply operations. Mawson re-supply required 11 days instead of the planned 4, because of the need to break up fast ice to reach the station and various other problems. The voyage was extended by 8 days to allow a reasonable proportion of the science program to be completed. On the Mac.Robertson Shelf, seismic and sidescan lines 0201, 0202 and 0203 were acquired before the initial attempt to reach Mawson on February

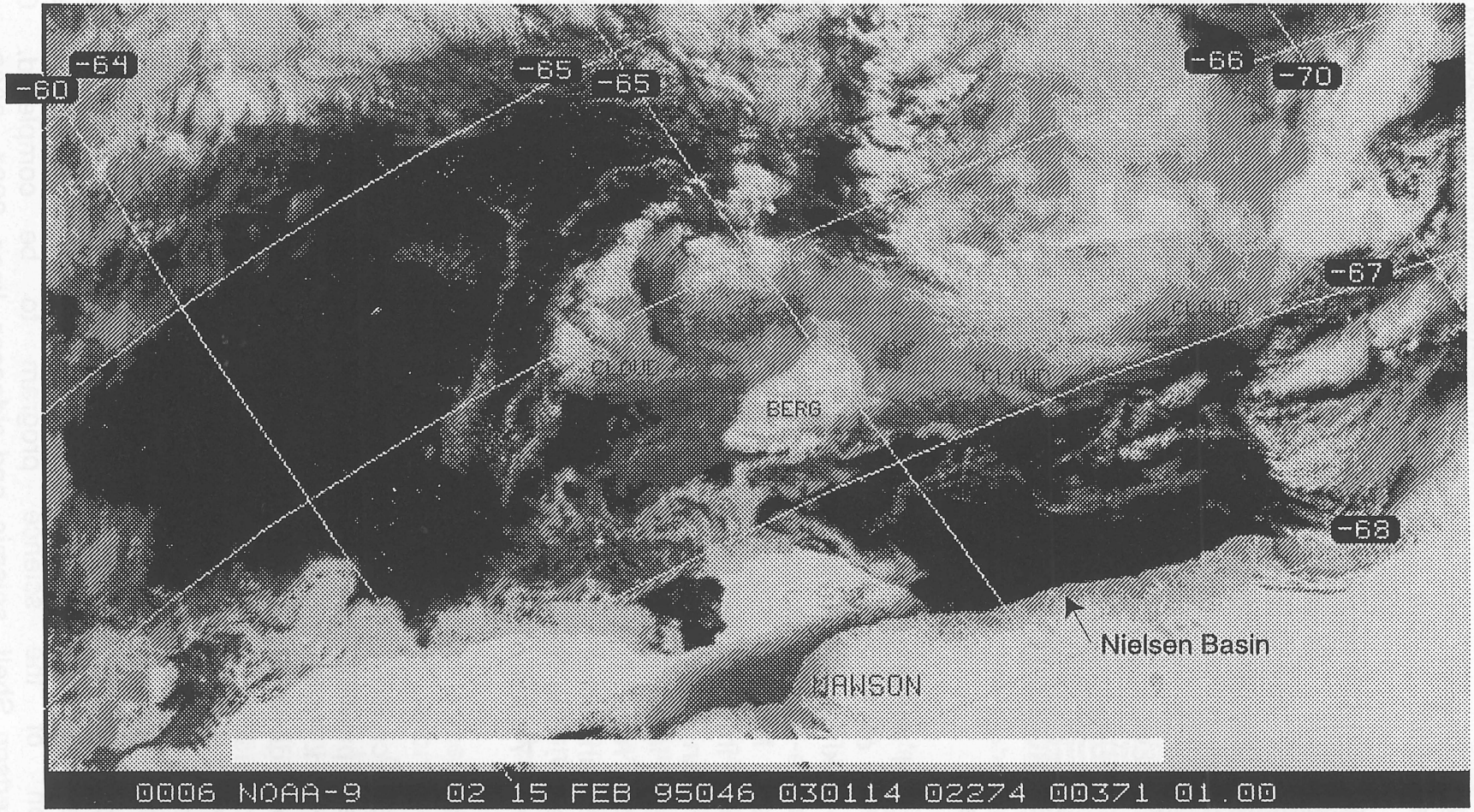


Figure 5. NOAA satellite image showing the ice conditions on the Mac. Robertson Shelf, 15th February before the start of the Marine geoscience program. Mawson was surrounded by fast ice, the dark areas close to Mawson are fast ice without snow cover. The Mac. Robertson Shelf is mostly ice-free up to Framm Bank in the east apart from some east-west belts of pack. By the 8th of March, the entire region was covered by new sea ice up to 30 cm thick.

21. Lines 0301 to 0701 were then acquired, with considerable disruption because of bad weather and areas of pack ice that required breaks in the lines (Fig. 7). The almost total coverage of the shelf by thick, newly-formed sea ice brought about by unseasonally cold weather during Mawson cargo operations thwarted our attempts to complete the seismic program on the Mac.Robertson Shelf, starting on March 8. Coring and

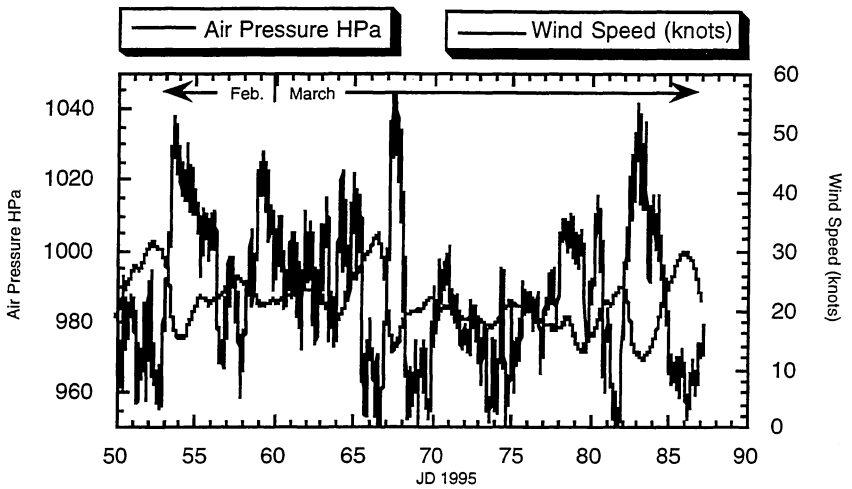


Figure 6. Air pressure and wind speeds measured on *R.S.V. Aurora Australis* for late February and March, 1995. Winds in excess of 35 knots prevented most work. Eight days were lost during this time of which 7 were during designated marine geoscience time.

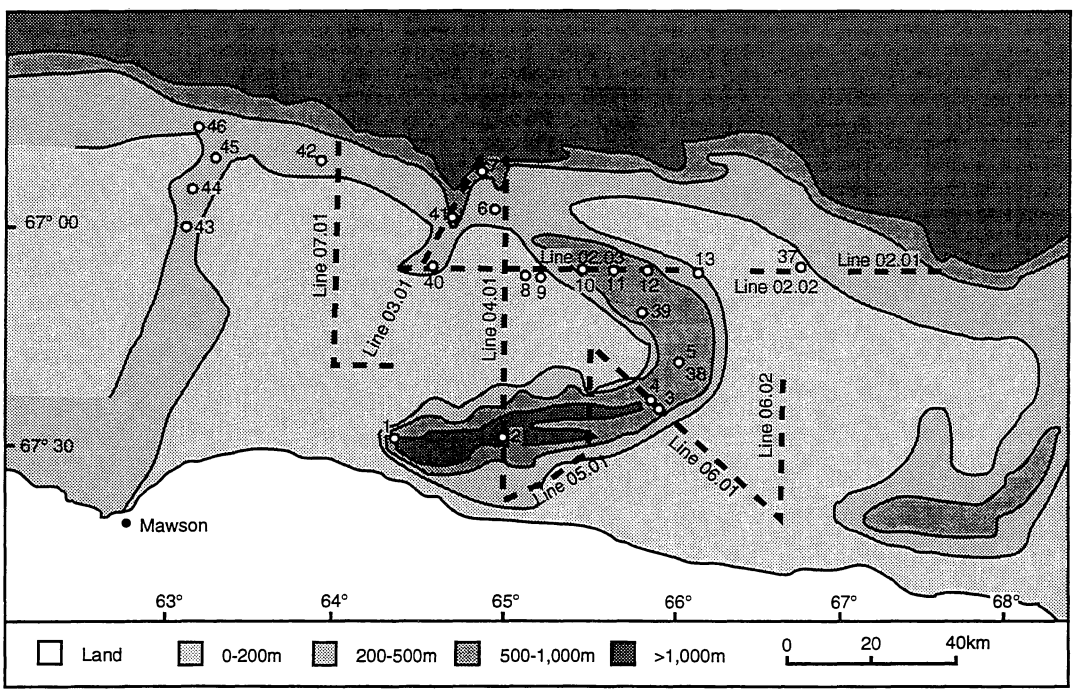


Figure 7. Seismic lines and sample stations on the Mac. Robertson Shelf. Gaps between lines 0201, 0202 and 0203 were caused by pack ice as were the northern terminations of lines 0301, 0401 and 0701. Lines 0501 and 0602 were curtailed because of bad weather.

bathymetric mapping of the Nielsen Basin were then interupted by a blizzard which had the beneficial effect of breaking up the ice sufficiently for the CTD to be used so that current meters could be deployed in the Nielsen Basin on the March 12.

Seismic surveying on the Prydz Channel Trough Mouth Fan commenced at 1200 hours local time on the March 13 in open water (Line 0801) but was soon hindered by loose pack, consisting of pancake ice and small floes up to 3 m across and 20 cm thick blocked the ship's path. It was decided to continue shooting as experience with such ice suggested that the wake would remain clear at low speed. This assesment proved correct and the Prydz Channel Fan program was shot through similar ice conditions. Notes on the methods developed to protect the equipment and the limits of ice conditions in which seismic can continue are included in Appendix 2. Lines 0801 to 1101 were shot on the fan and then line 1201 shot across the outer shelf to ODP 739. Line 1301 was shot to tie ODP 739 to ODP 742 before going to Davis to load passengers and cargo. This early visit to Davis was decided upon in case conditions for seismic worsened dictating the to curtailment of the Antarctic shelf programs and re-direction of seismic activities to the Kerguelen Plateau. As it was, the ice over the Prydz Fan remained relatively thin and unpressured so the seismic program was completed more or less as planned (Fig. 8). Twenty cores were obtained from the fan and adjacent shelf but only 6 CTDs were possible because of the ice.

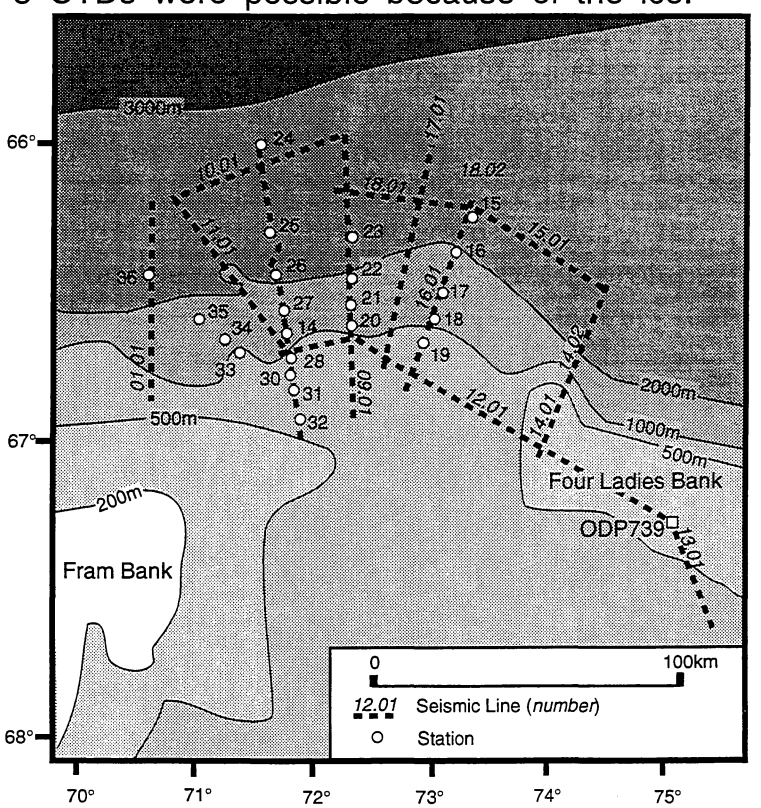


Figure 8. Seismic lines and sample stations on the Prydz Fan and Prydz Bay shelf.

Following completion of the Prydz Channel Fan coring, the ship returned to the Mac.Robertson Shelf on March 23and resumed coring. This was stopped by a blizzard at 0800 on the March 24 which produced pressure ice that rendered the remaining core sites inaccessible; attempts to return to areas that might have had lighter pack ice were also prevented by pressurised ice. Even moderation of the winds did not improve access to the remaining Mac.Robertson Shelf coring sites so the ship headed for Mawson, arriving at 1000 on March 28 for the fly-off of personnel. The final core sites in Iceberg Alley were accessed by steaming through relatively ice-free water on the western, leeward side of the grounded icebergs flanking the valley then turning east through the pack trapped up-wind of the bergs. Antarctic shelf operations concluded at 0300 on March 29.

Arrival at the Kerguelen Plateau was delayed somewhat by thick pack ice extending about 110 nautical miles from the Mac.Robertson Land coast. Five cores, 2 CTDs and one of the two planned seismic lines were completed between April 1 and 2000 on April 3at which time the ship set course for Hobart where it arrived on April 12.

In total, 17 days of marine geoscience operations were possible on the voyage in which 52 cores, 22 CTD station, with water samples and bottom photos, 14 grabs and 1523 km of seismic were collected. Table 1 lists stations and the data and samples collected at each one and Table 2 lists the start and end points of all seismic and sidescan lines.

Equipment Performance

The cruise employed a single 150 cu in GI airgun driven by a containerised Price W-200 compressor. The streamer had a 25 m active section with 40 hydrophones in 4 channels. A 25 m stretch section was used to reduce noise. Data were recorded on AGSO's high resolution digital acquisition system. Shot rate was 7.5 seconds and recording was for 6 seconds at a 0.5 msec sampling rate. Notes on the streamer and gun deployment are contained in Appendix 2. Seismic data quality was very good with monitor records of sufficient quality to allow preliminary interpretation. Data quality was degraded during gales because of cable noise.

The sidescan sonar was an EG & G Model 990 SMS tow fish deployed on the *Aurora Australis* net sonde cable. This cable is relatively thick so that sidescan towing depths of more than 500 m were impractical. Sidescan output was via a Model 996 SMS modem recorded on an analog EPC 9800 recorder. Records were good but few lines were recorded because of the depth limit and because the sidescan could not be deployed in pack ice. Lines 0501 and 0601 have no sidescan record

Table 1. Location, water depth and activities carried out at each station on AGSO cruise 149 to Prydz Bay and Mac.Robertson Shelf and Kerguelen Plateau.

Station Number	Latitiude	Longitude	Water Depth (metres)	Activity
1	-67° 28.7	064° 21.0	1100	GB1,GC1,GC2, CTD1
2	-67° 29.87	064° 59.8	1200	GC3
3	-67° 23.6	065° 18.6	855	GC4
4	-67° 24.2	065° 15.8	870	GC5
5	-67° 17.0	066° 01.4	805	GB2,GC6,CTD2
6	-66° 55.9	064° 56.3	376	GB3,GC7,CTD3 CM1
7	-66° 50.7	064° 55.2	643	GB4,CTD4,CM2
8	-67° 05.1	065° 13.6	130	GB5,GC8,CTD5
9	-67° 05.2	065° 19.3	388	GC9,CTD6
10	-67° 05.1	065° 27.9	627	GB6,GC10,CTD7
11	-67° 05.2	065° 38.9	587	GC11,CTD8
12	-67° 06.7	065° 46.7	626	GB7,GC12,CTD9
13	-67° 05.3	065° 59.0	413	GB8,GC13,CTD10
14	-66° 38.4	071° 44.0	849	GC14
15	-66° 15.2	073° 20.4	2250	GC15
16	-66° 23.1	073° 11.1	1960	GB9,GC16,CTD11
17	-66° 30.2	073° 05.5	1540	GC17
18	-66° 36.0	073° 00.5	1174	GB10,GC18,CTD12
19	-66° 41.2	072° 55.5	765	GC19,CTD13
20	-66° 37.1	072° 18.3	697	GC20
21	-66° 37.1	072° 17.6	1060	GC21
22	-66° 27.4	072° 17.8	1450	GC22
23	-66° 19.2	072° 17.6	1884	GC23
24	-66° 00.7	071° 32.1	2535	GC24
25	-66° 18.0	071° 36.1	2010	GB11,CTD14,GC25
26	-66° 26.9	071° 38.8	1623	GC26
27	-66° 34.1	071° 42.8	1200	GB12,GC27,CTD15
28	-66° 43.8	071° 46.7	527	
29	-66° 43.7	071° 46.5	527	GC28
30	-66° 47.0	071° 47.5	515	GC29,GC30
31	-66° 50.3	071° 49.0	512	GC31
32	-66° 55.6	071° 50.8	502	GC32
33	-66° 42.9	071° 21.9	834	GC33
34	-66° 39.9	071° 12.4	1215	GC34
35	-66° 35.2	071° 00.6	1566	GC35
36	-66° 27.0	071° 34.5	2105	GC36
37	-67° 04.8	066° 42.1	168	GB13,GC37,CTD16
38	-67° 16.7	066° 01.9	815	CTD17
39	-67° 09.4	065° 45.1	722, 620	GC38,GC39,GC40 CTD18,CTD19
40	-67° 04.8	064° 35.7	345	GC41,GC42
41	-66° 55.6	064° 43.3	824	GC43
42	-66° 49.4	063° 56.8	364	GC44
43	-67° 00.0	063° 05.0	462	GC45
44	-66° 54.3	063° 06.0	440	GC46
45	-66° 49.0	063° 14.0	354	GC47
46	-66° 45.6	063° 09.0	248	GB14,CTD20
47	-58° 31.0	081° 73.0	1500	GC48,CTD21
48	-57°36.2	078° 18.1	1720	GC49
49	-57° 45.1	077° 32.1	2050	GC50,CTD22
50	-57° 07.2	078° 27.2	1710	GC51
51	-55° 45.2	076° 30.2	2210	GC52

Table 2. List of start and stop points for seismic lines

Line No.	FGSP	Start time	Start position	LGSP	End time	End position	Length (nm)
0101	188	050.1803	S66 11.021, E70 36.116	4010	051.0219	S66 53.095, E70 35.982	42.224
0201	158	051.1202	S67 4.969, E67 44.051	1744	051.1528	S67 5.091, E67 0.610	19.994
0202	3082	051.1612	S67 5.473, E66 49.502	3777	051.1745	S67 5.319, E66 29.779	7.715
0203	5378	051.1901	S67 4.786, E66 3.046	8663	052.0207	S67 4.999, E64 29.166	36.730
0301	198	052.1643	S67 4.563, E64 29.782	1914	052.2026	S66 50.192, E64 52.490	16.964
0401	4681	052.2206	S66 51.519, E64 59.915	9657	053.0852	S67 32.342, E65 21.412	52.553
0501	132	053.0940	S67 31.111, E65 26.110	1601	053.1251	S67 16.723, E65 29.864	14.513
0601	225	055.1028	S67 15.540, E65,31.355	5618	055.2208	S67 29.319, E66 40.078	45.212
0701	142	056.1141	S67 18.102, E64 16.950	3738	056.1928	S66 46.89, E65 57.50	50.336
0801	322	072.0553	S65 58.744, E71 28.403	6555	072.2026	S67 0.123, E71 52.534	62.351
0901	205	072.2215	S67 0.298, E72 20.126	6614	073.1206	S65 57.295, E72 15.281	63.256
1001	120	073.1226	S65 57.637, E72 16.337	3619	073.2000	S66 11.222, E70 45.736	39.350
1101	125	073.2042	S66 10.927, E70 46.060	4250	074.0537	S66 43.339, E71 46.635	40.608
1201	320	074.1022	S66 42.718, E71 41.461	10144	075.0736	S67 16.873, E75 6.404	87.455
1301	160	075.1025	S67 14.423, E75 2.943	2911	075.1621	S67 36.692, E75 25.282	23.954
1401	195	077.0716	S67 4.326, E73 54.798	1512	077.1007	S66 53.874, E74 5.767	11.34
1402	2598	077.1118	S66 55.321, E74 4.003	5505	077.1735	S66 29.600, E74 30.427	27.866
1501	145	077.1828	S66 30.376, E74 32.319	4089	078.0259	S66 12.815, E73 19.203	34.324
1601	137	078.1431	S66 12.168, E73 20.986	4811	078.1437	S66 50.315, E72 46.926	40.637
1701	145	078.1603	S66 46.225, E72 34.441	5418	079.0327	S65 59.922, E73 0.185	47.608
1801	149	079.0838	S66 9.624, E72 9.088	2940	079.1440	S66 12.490, E73 8.227	24.162
1802	4052	079.1617	S66 12.30, E73 4.73	4835	179.1759	S66 13.119, E73 20.725	6.533
1901	331	092.0924	S57 35.978, E78 20.513	3246	092.1542	S57 45.145, E77 31.580	27.835

because the sidescan fish had been damaged in a collision with a shallow basement pinnacle crossed on Line 0401. Bathymetry was recorded by the *Aurora Australis'* 12 kHz echo sounder and recorded by the ship's Data Logging System (DLS).

Sediment samples were obtained using a Shipeck grab and a 1 tonne, 90 mm diameter gravity corer, using 3 or 6 m barrels. Both tools performed well but the corer was used more often because it can be deployed from the ship's stern in quite heavy ice whereas the grab is deployed via the CTD room which opens through the port side and therefore requires open water. The CTD was a Neil Brown Mark IIIB upon which were mounted 3, 10-litre Niskin bottles for sampling bottom and surface water, a Benthos bottom camera and strobe light and a Seatech transmissometer for measuring suspended sediment concentrations. Only twenty-two CTD stations were possible because CTD operations require open water and lighter winds than coring. CTD equipment performed well. Problems with firing the Niskin bottles were mainly with surface samples which did not take long to repeat. The bottom camera exposed all the film but the results will not be known until after processing in Hobart.

RESULTS

MAC. ROBERTSON SHELF

Objectives

1. Mapping of seismic sequences in the shelf's banks and troughs to understand sedimenmt distribution and origin.
2. Obtain cores that will give records of Holocene and Pleistocene environmental changes and the sedimentary evolution of the Nielsen Basin and Iceberg Alley.
3. Ascertain the geological history of the Mac. Robertson Shelf edge by sampling any outcropping seismic sequences.
4. Investigate the modern sedimentary environment of the Mac.Robertson Shelf to enhance understanding of sedimentation during interglacial periods and the present oceanographic conditions.

Bathymetry

Bathymetric profiling continued even during bad weather and through thick pack ice (Fig. 9). The result is a much better picture of shelf geomorphology and of the Nielsen Basin in particular (Fig. 10). The Nielsen Basin extends much further west towards the shore than was previously thought and features several closed depressions on its floor separated by shallower sills. These are elongate parallel to the basin axis, morphology that strongly resembles fjords from many glaciated coasts (Embleton & King, 1975). East and

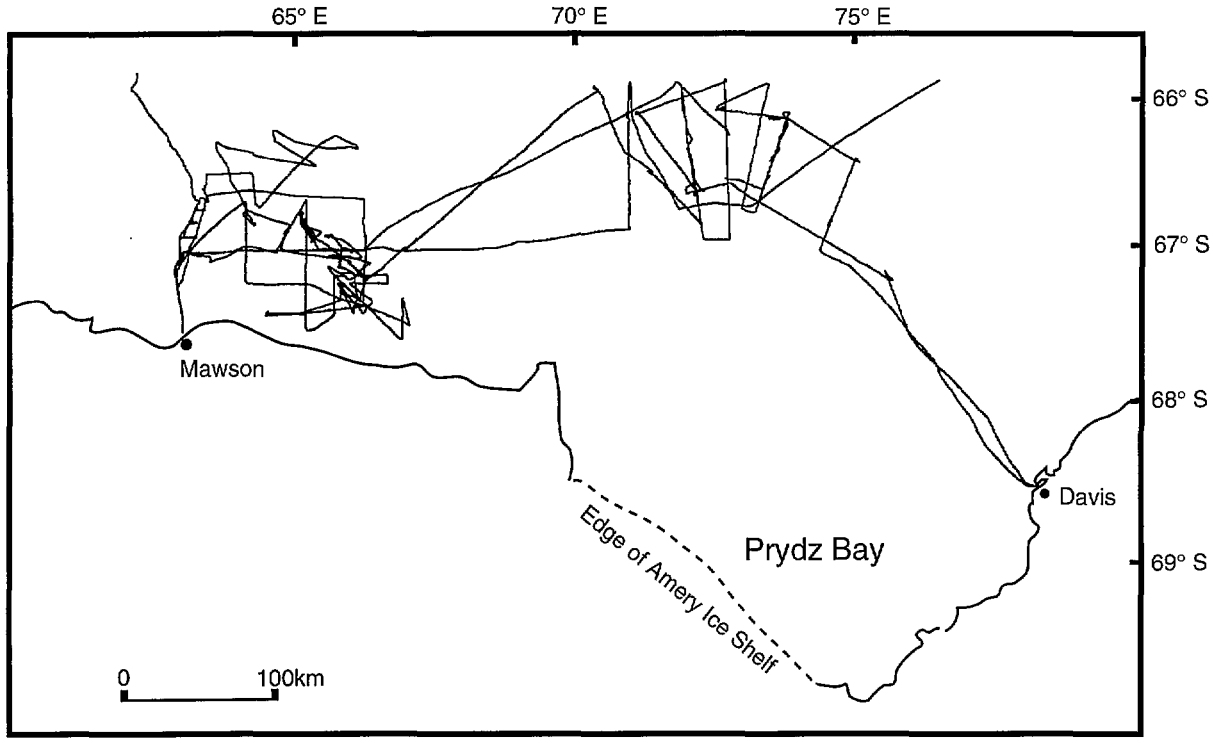


Figure 9. Ship's track for cruise. Bathymetry was collected by the 12 kHz echo sounder for the entire voyage.

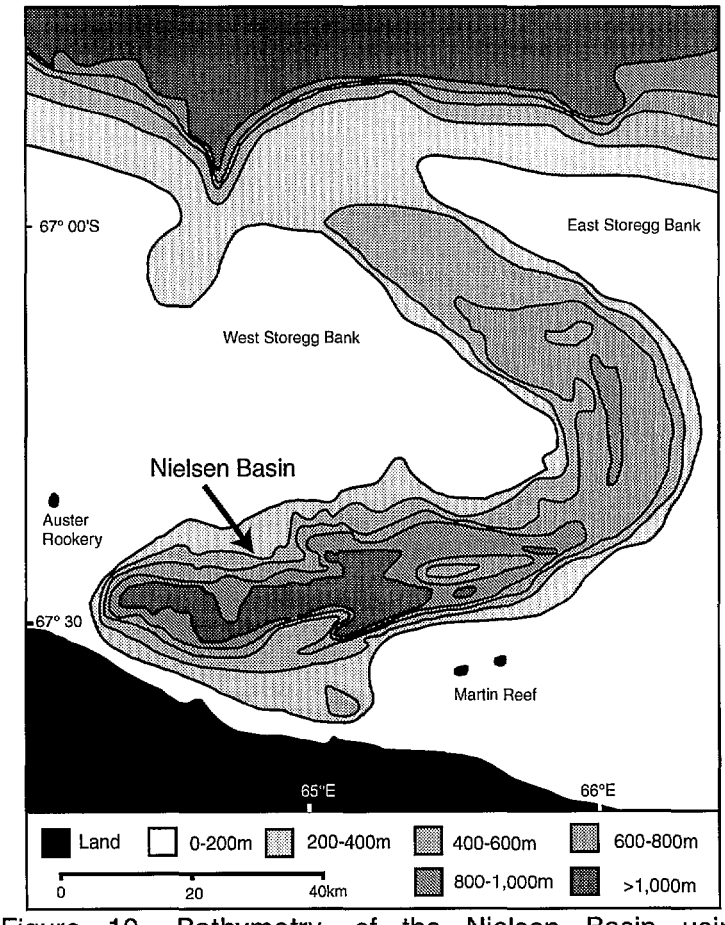


Figure 10. Bathymetry of the Nielsen Basin using bathymetry collected on Voyage 6 (1995) and Voyage 7, 1993 (KROCK).

West Storegg Bank have planated upper surfaces at between 110 to 150 m deep covered with ice berg plough marks and with areas of shallow gullies up to 1 km wide and 10 to 20 m deep.

SEISMIC

A total of 675 km of seismic reflection data were shot on the Mac. Robertson Shelf, all prior to February 26 (Fig. 7). Few of the lines tie satisfactorily because of patches of heavy pack ice or because it was necessary for part of the time to shoot directly into strong winds in order to prevent the airgun and streamer entanglement (Line 0601).

Seismic data from the inner Mac. Robertson Shelf show abundant diffractions from pinnacles on the sides of the Nielsen Basin (Fig. 11) and powerful reverberations beneath planar bank tops underlain by acoustically featureless basement. The only sediments beneath the inner shelf are the remnants of a half-graben beneath the Nielsen Basin (Fig. 11). The GI gun data shows landward-dipping sediments truncated by a seaward-dipping normal fault beneath the deepest parts of the basin. This suggests that the shore-parallel part of the Nielsen basin formed by preferential erosion of soft graben fill by ice advancing across theshelf. The seaward dip on the boundary fault suggests that the half graben formed during pre-rift extension along what is now the continental margin. If this is the case, the sediments may be Neocomian or older (Stagg, 1985).

On the outer shelf, a step in the bank surface marks the point where sedimentary sequences lap onto basement (Fig. 12). The sedimentary sequences are of three types; the lowest rest on a seaward-dipping basement surface and dip at the same angle as the unconformity (Fig. 12). The internal reflectors are of consistently high amplitude and are truncated at the sea floor at a steep angle. The second set of sequences overlie the first and have a similar seaward dip but lower reflector amplitudes. The reflector dips decreases seawards and folds with wavelength of about 1 km have developed beneath the outer shelf (Fig. 12). The uppermost sequence group consists of stronger amplitude reflectors with dips only slightly steeper than the sea floor and which onlap the underlying sequence.

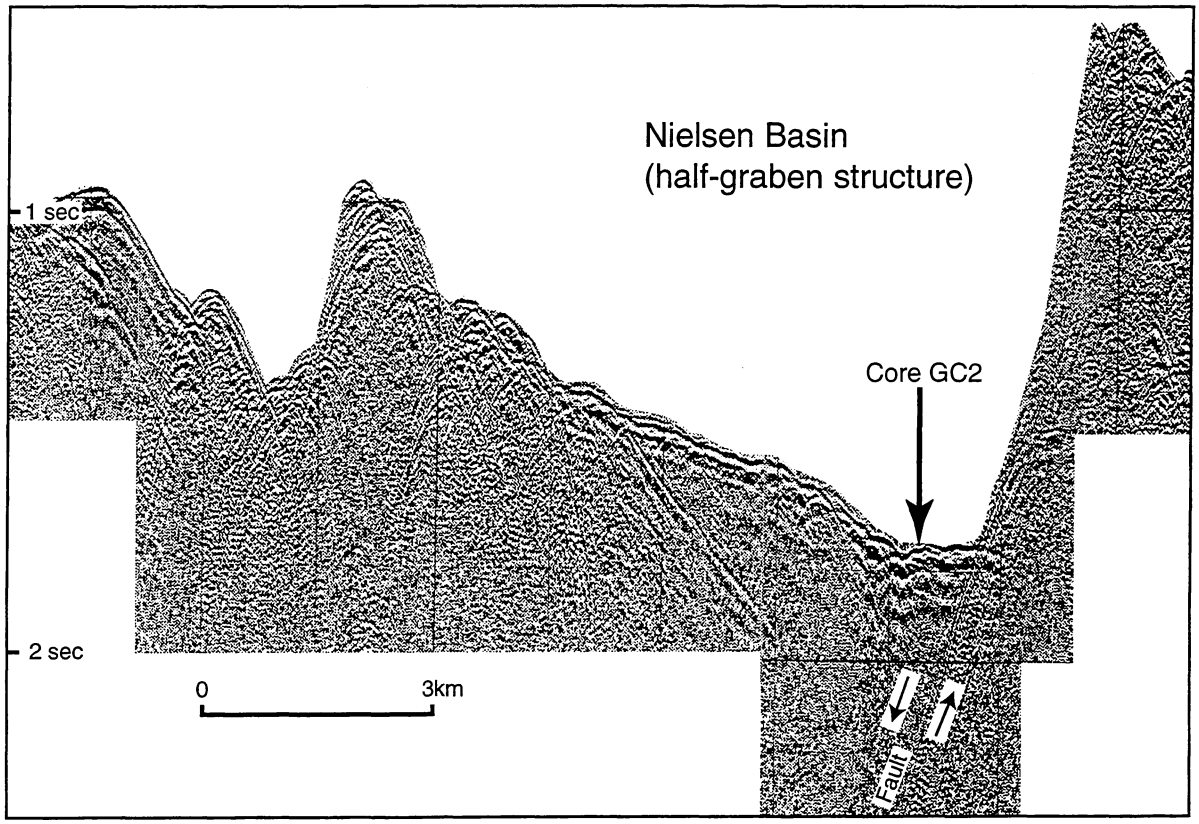


Figure 11. Seismic line across the Nielsen basin (Line 0401) showing the erosional remnant of a half-graben beneath the deepest part of the basin. The offshore dipping fault suggests it formed during pre-breakup rifting on the continental margin.

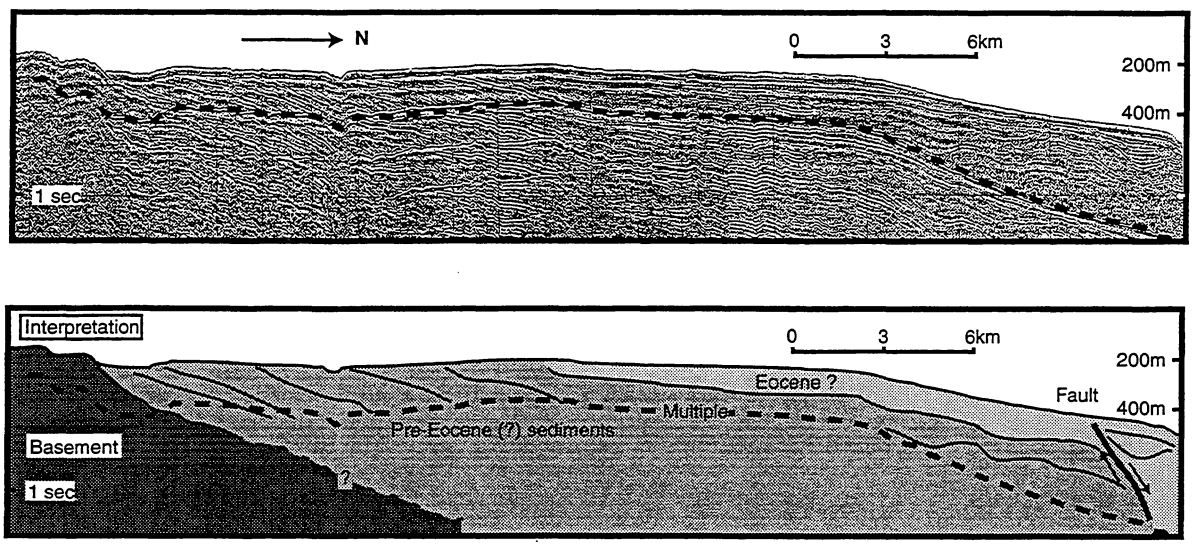


Figure 12. Outer part of Line 0701, Mac. Robertson Shelf showing seaward-dipping Palaeogene sediments unconformably overlying basement.

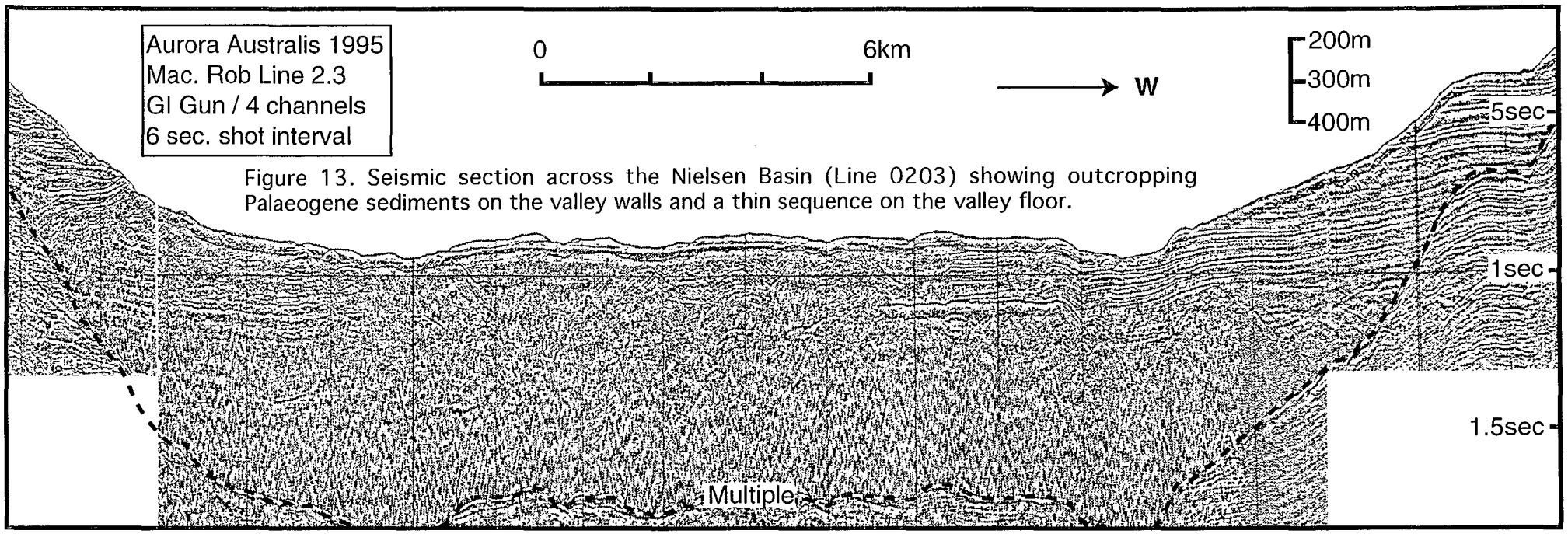
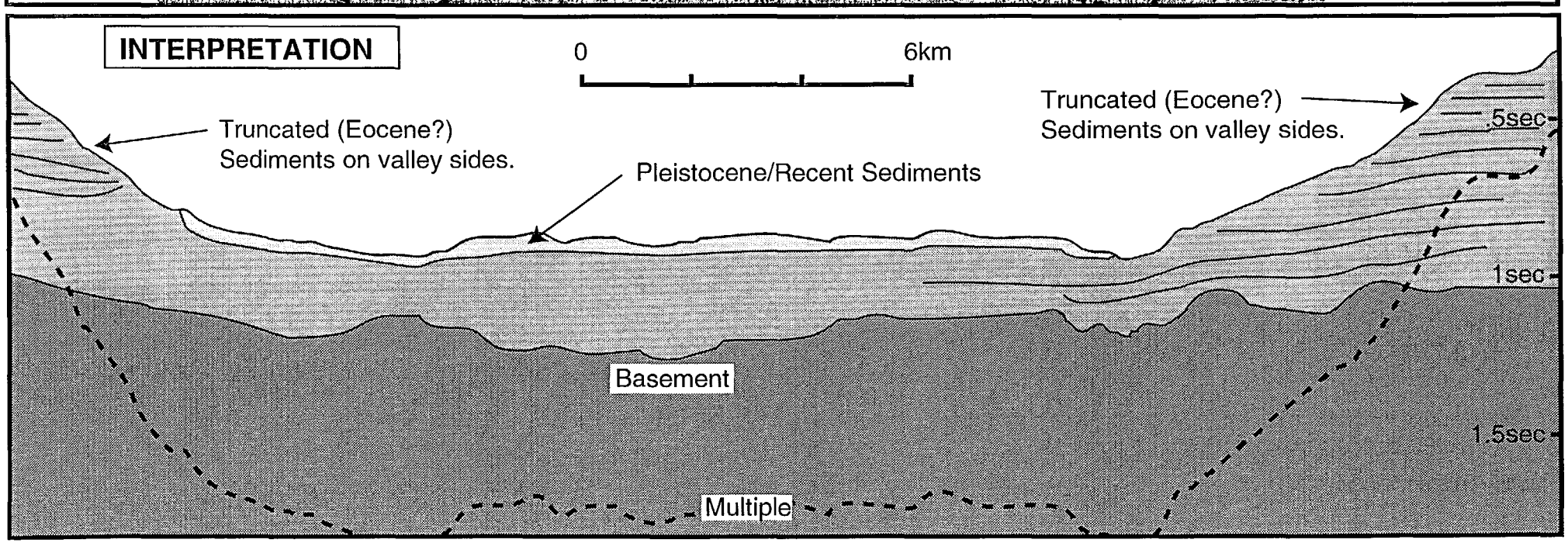


Figure 13. Seismic section across the Nielsen Basin (Line 0203) showing outcropping Palaeogene sediments on the valley walls and a thin sequence on the valley floor.



Palaeontological evidence from dredge samples from Iceberg Alley and cores collected on this cruise suggest that the oldest sequences beneath the outer shelf are Palaeocene and the uppermost may be as old as Eocene (Fig. 12). Probable Pleistocene sediments appear on the seismic section that crosses the Nielsen Basin in mid-shelf (Line 0203) as a thin sequence unconformably overlying Palaeogene sediments on the valley floor (Fig. 13).

Sidescan Sonar

Although the sidescan sonar was used for only a small proportion of the survey, it provided valuable insights into the nature of sediment transport and distribution on Storegg Bank, vital for interpretation of sediment samples from the bank. Four types of bank surface were identified:

1. *Iceberg gouged surface* - East Storegg Bank (Line 0202) has a surface covered with intersecting sets of gouge marks. Gouges generally trend east-west with significant variation imposed by local slopes, as in Figure 14 and significant scatter about the mean. The abundance of superimposed gouge marks makes identifying individual scours difficult but where they are recognisable, they are in the order of 200 m wide. Some sub-circular marks reminiscent of the closed depressions found by Barnes (1987) on banks of the Wilkes Land margin are probably produced by icebergs that ground and wallow in the one place for a relatively long time (Fig. 14). Arcuate light and shade lines crossing the gouges roughly at right angles are possible sediment bedforms moving along the iceberg scour axes, in the same direction as the icebergs that formed the scours.

2. *Dune and Sand ribbon surface* - Parts of West Storegg Bank display a surface with barchanoid and linguoid bedforms passing into linear sand ribbons (Line 0401; Fig. 15). Their orientation indicates easterly-flowing currents. The bed profile show shallow iceberg gouges but on the sidescan image of the surface, these gouges are not obvious, presumably because of the extensive current reworking of the surface.

3. *Erosional Gullies and sand ribbons* - West Storegg Bank also has areas that are mostly planar bedrock with erosional gullies up to 1 km across and 10 to 20 m deep and surface sand ribbons (Fig. 16). Gullies and sand ribbons are oriented east-west.

4. *Bare Basement outcrop* - Areas of East and West Storegg Bank that lack sediment cover display rounded knolls on the sidescan record, closely resembling the outcrop surface of the Mawson Charnockite at Mawson Station and on the islands in the area.

Aurora Australis 1995 Sidescan sonograph showing iceberg gouges on East Storegg Bank

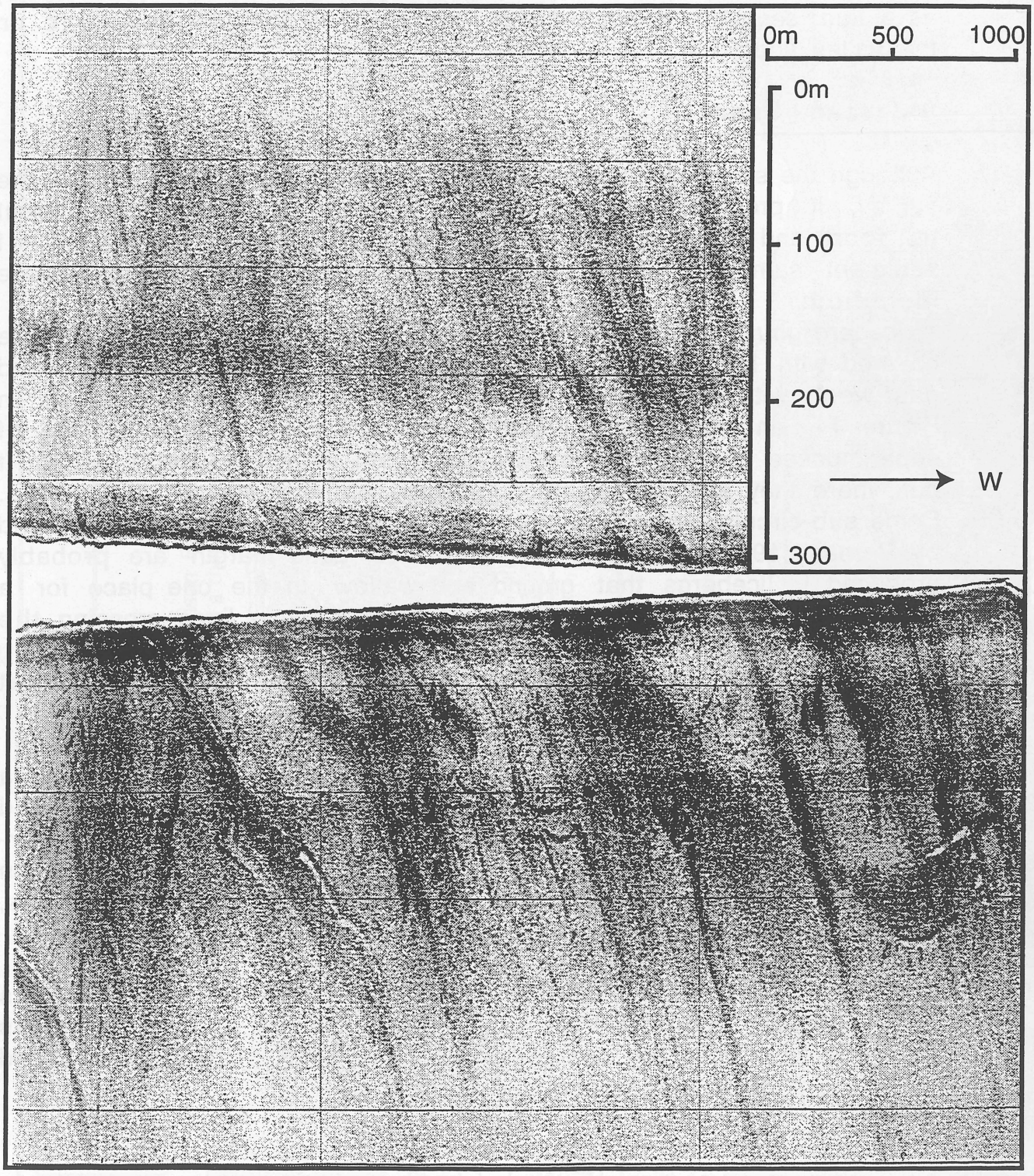


Figure 14. Sidescan sonograph showing iceberg gouges on East Storegg Bank.

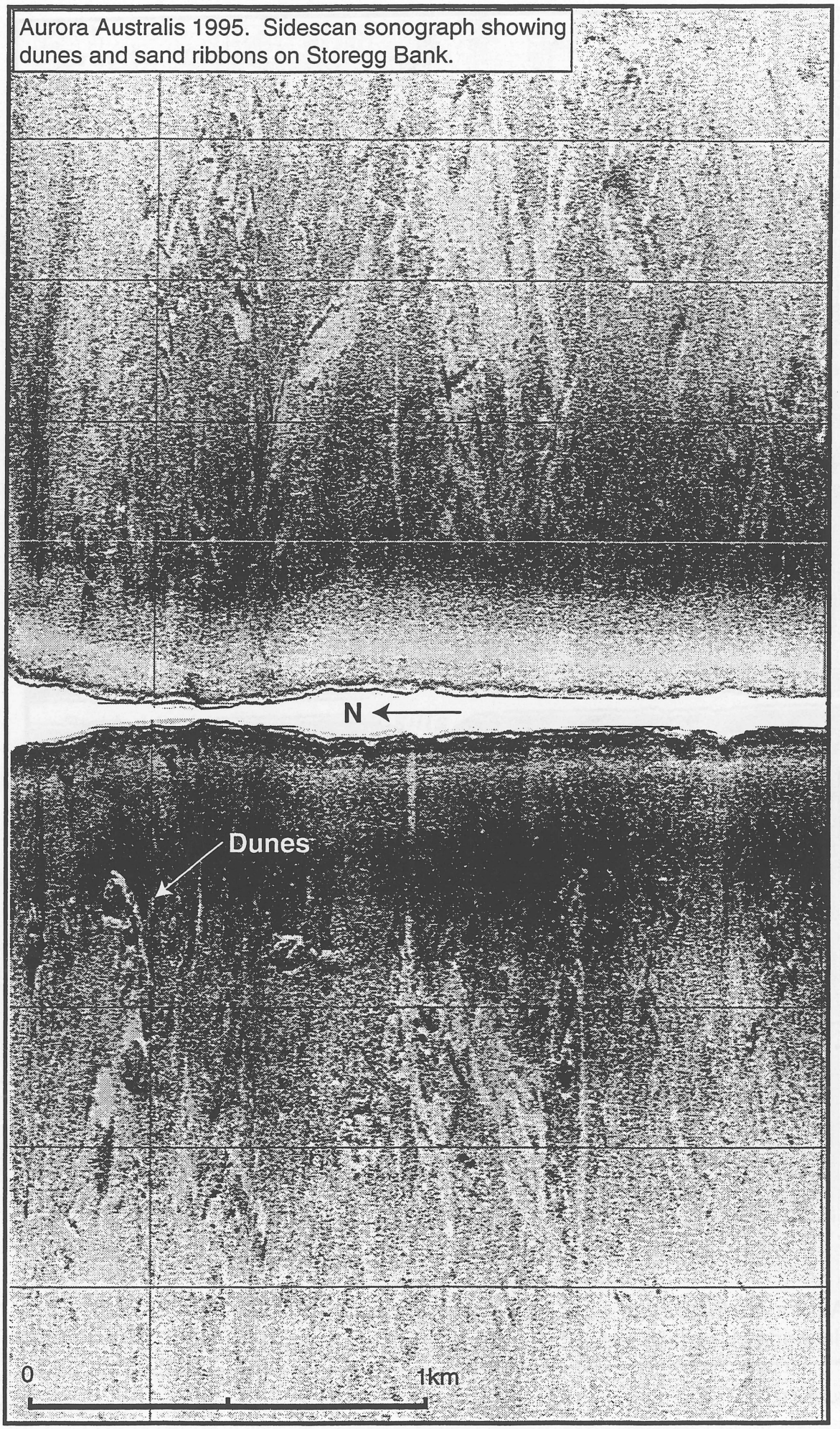
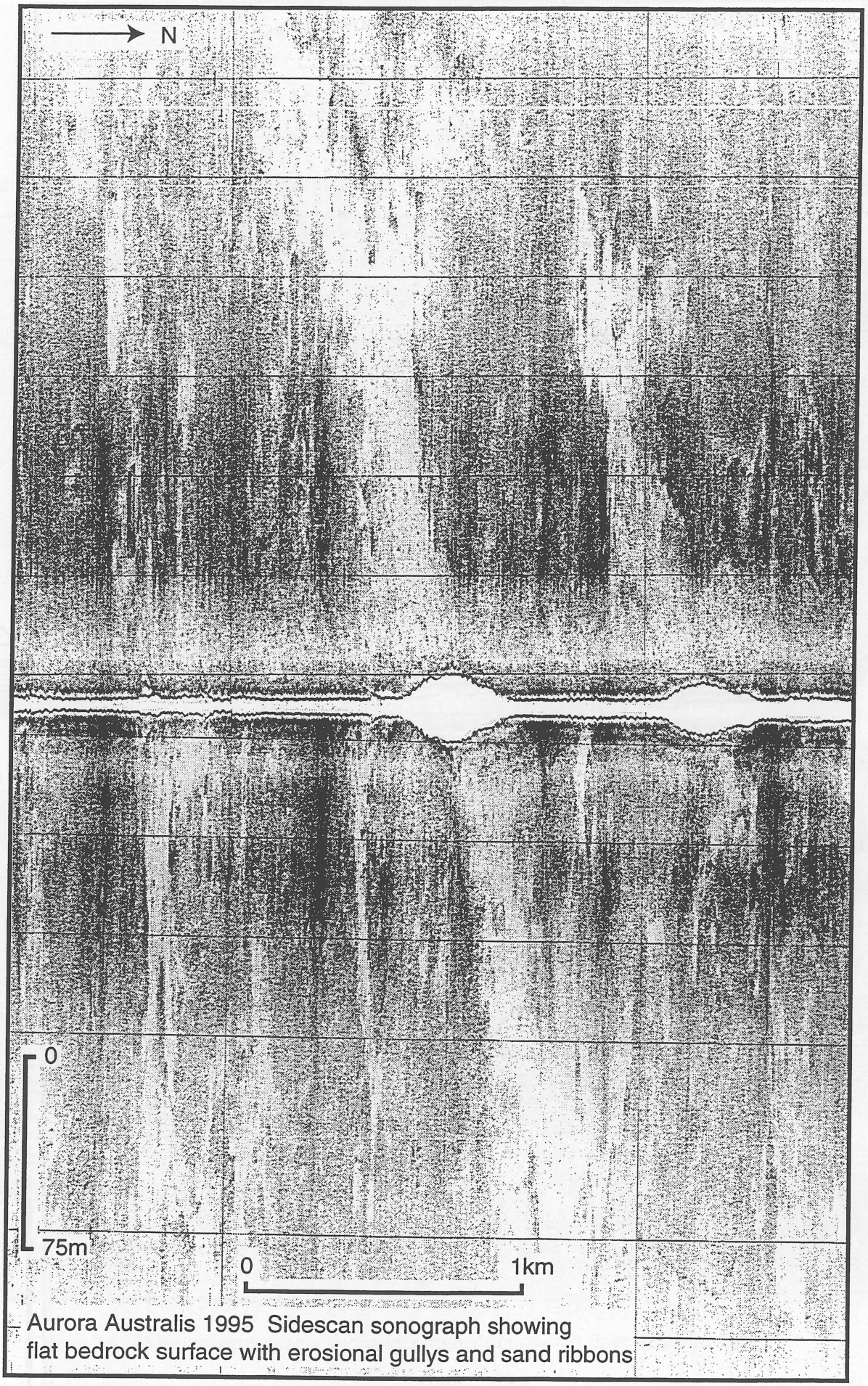


Figure 15.



Aurora Australis 1995 Sidescan sonograph showing flat bedrock surface with erosional gullys and sand ribbons

Figure 16.

Gravity Cores

Twenty gravity cores were collected from the Mac.Robertson Shelf. Initial descriptive core logs are presented in Appendix 2. Preliminary palaeontological examination of core samples carried out on the ship are included as Appendices 3-5. Three broad facies can be recognised in the cores after the first inspection and their distribution on the Mac.Robertson Shelf is shown in Figure 17; this subdivision will be refined with further analysis. The facies are:

Very fine sandy, diatom ooze - This facies is present in the top part of most cores and appears to be the main sediment type accumulating today and through the Holocene. The clastic component is made up mostly of very fine quartzose sand with 5 to 10% grains of heavy minerals such as hornblende and pink garnet. The biogenic component is mostly diatoms and sponge spicules but foraminifera and bryozoa are present in some cores.

Poorly sorted gravelly muds to muddy sands - Dark grey to black very poorly sorted pebbly muds and sands underlie the diatom ooze facies in four cores in the Nielsen Basin and two in Iceberg Alley. One core from the outer shelf (Core GC44) has a thin bed of this material.

Bedded to laminated sandy silts - Dark grey to olive grey bedded silts are present in a few cores in the Nielsen Basin and Iceberg Alley (Fig. 17) underlying the diatomaceous ooze and sand facies.

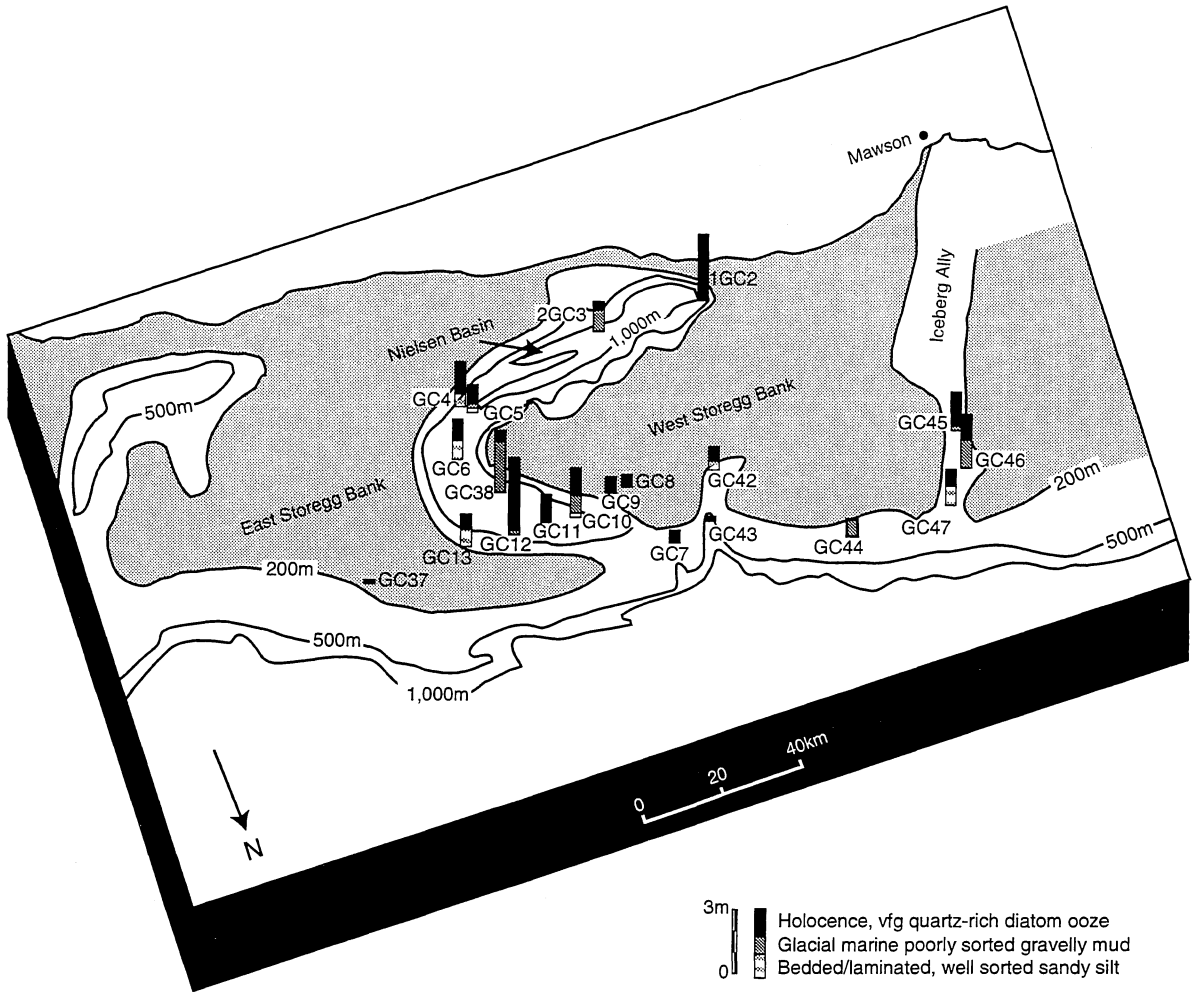


Figure 17. Distribution of major facies groups in cores from the Mac. Robertson Shelf.

Palaeontology - The second two facies in many of the Nielsen Basin and Iceberg Alley contain microfossils as old as Palaeocene and woody fragments, frequently mixed with Pleistocene diatoms (see Appendices 5 & 6). Also, the lower unit in GC3 has a red colouration different to all others on the shelf. This suggests that significant reworking of older sediments has taken place into these units or that some may be Palaeogene sediments.

Interpretation - The sediment presently accumulating on the Mac.Robertson Shelf consists of ice-rafted fine sand and diatoms redistributed by currents and ice gouging. This material becomes coarser towards the outer shelf where the boundary current is strongest. The sedimentary succession in Nielsen Basin and Iceberg Alley are similar to the ice retreat facies of fjord glaciers (Barrett & Hambret, 1992) with the massive poorly sorted sandy muds forming close to the ice front or beneath a floating ice tongue. Bedded, sandy silts represent sorting by currents. Meltwater streams are unlikely to be important in Antarctic glaciers so the currents could have been generated by gravity flows from the banks or by enhancement of

geostrophic current velocities by constriction between the ice front and banks as the shelf gradually flooded during transgression.

CTD Data

CTD data was visually inspected during the cruise so only a few comments can be made. The Mac.Robertson Shelf profiles shows a cold, fresh surface layer of variable thickness overlying water with gradually increasing salinity but with a two-fold temperature structure (Fig. 18). The transmissometer shows low readings in the surface layer, probably because of abundant plankton. Readings rise abruptly beneath the surface layer and remain high down to the bottom in most profiles but in CTDs 2 and 9, low transmissometer readings near the bottom indicate sediment plumes (Fig. 18).

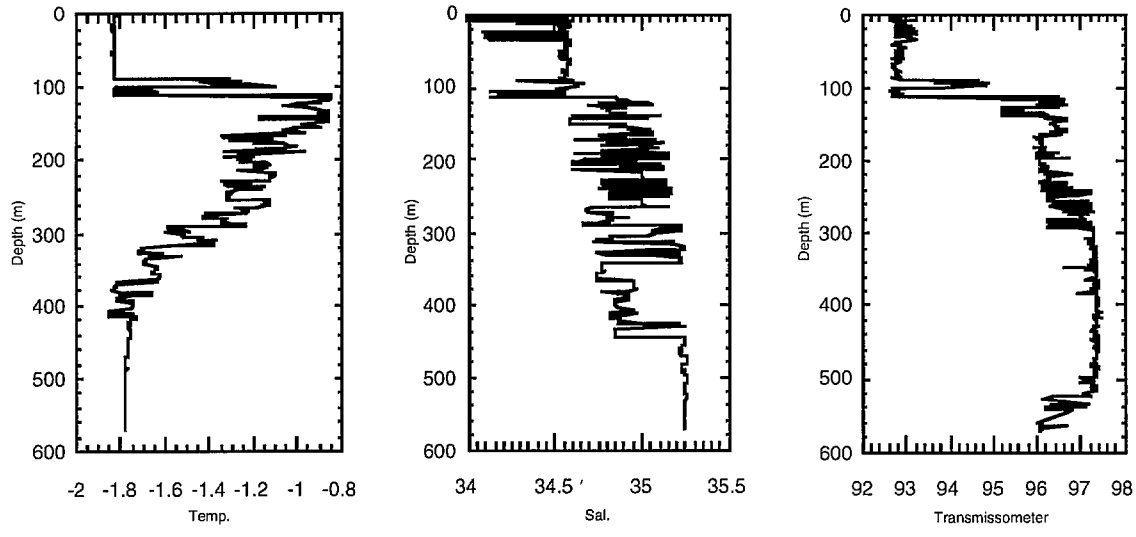


Figure 18. 11CTD8 from the Mac.Robertson Shelf. Shallow, cold, fresh water has low transmissometer readings because of plankton in the surface mixed layer, whereas the low readings near the bed represent a suspended sediment plume.

PRYDZ CHANNEL FAN

Objectives

1. To map seismic sequences in the trough mouth fan built by advances of the Lambert Glacier-Amery Ice Shelf from the Pliocene to the present.
2. Obtain cores that will give records of Holocene and Pleistocene environmental changes on the continental slope on the western side of Prydz Bay and a sample of the sedimentary facies of the fan.

3. Interpret the history of ice advances to the shelf edge by sampling any seismic sequences that crop out on the sea floor and by tying to ODP Site 739.
4. Investigate the modern sedimentary environment of the Prydz Channel Fan to understand fan modification during interglacials and the present oceanographic conditions in the region.

Seismic

Nine hundred and fifty-three kilometres of seismic were shot in the trough mouth fan study area (Fig. 8). The survey differs somewhat from that planned because of the need to orient Line 1101 directly into the wind to avoid ice crossing the wake and damaging the equipment. Line 0101 was shot very early in the program but could not be tied into the grid because of the development of thick pack ice. Line 1401, which is east of the trough mouth fan was added to the survey to improve the mapping of older seismic horizons on the slope and Line 1301 was added to tie ODP 739 to ODP 742. Line 0801 is curved between the sites of Stations 25 and 26 because we were attempting to find the narrowest parts of ice packs to negotiate at this stage (Appendix 1).

The success of this GI gun survey is most clearly demonstrated by the preliminary well tie to ODP Site 739. Cooper & others (1991) identified 2 sequences on multichannel lines intersecting the hole; PS.1, a horizontally bedded, Late Miocene to Pleistocene sequence overlying PS.2A, a Late Eocene to early Oligocene sequence of offlapping clinoforms. Stratigraphic studies of ODP 739 subdivided PS.1 into three, recognising late Miocene, early Pliocene and younger sequences within it, with the acoustic impedance log reflecting this subdivision. However, the multichannel seismic could not resolve these intervals (Cooper & others, 1991). Line 1201 monitor records clearly show reflections that can be correlated with Impedance log changes in ODP 739 (Fig. 19). Both processing of the line and synthetic seismogram generation are required to confirm the well tie but the higher frequency content of the GI gun data has clearly been more successful in subdividing the glacial sediments of Prydz Bay than systems designed to image the deep structure.

Preliminary tracing of Neogene horizons on Line 1201 indicates that Plio-Pleistocene sequences in the trough mouth fan are 0.8 to 1.2 sec TWT thick, consisting of offlapping clinoforms of sediment (Fig. 20). Within the prograding sediments are strong reflectors which stand out, sometimes through the first multiple. Kuvaas & Leitchenkov (1992) interpreted some of these reflectors as marking major sedimentation changes on the slope. The GI gun data images several of these within the Plio-Pleistocene package and reflectors that downlap onto them (Fig.

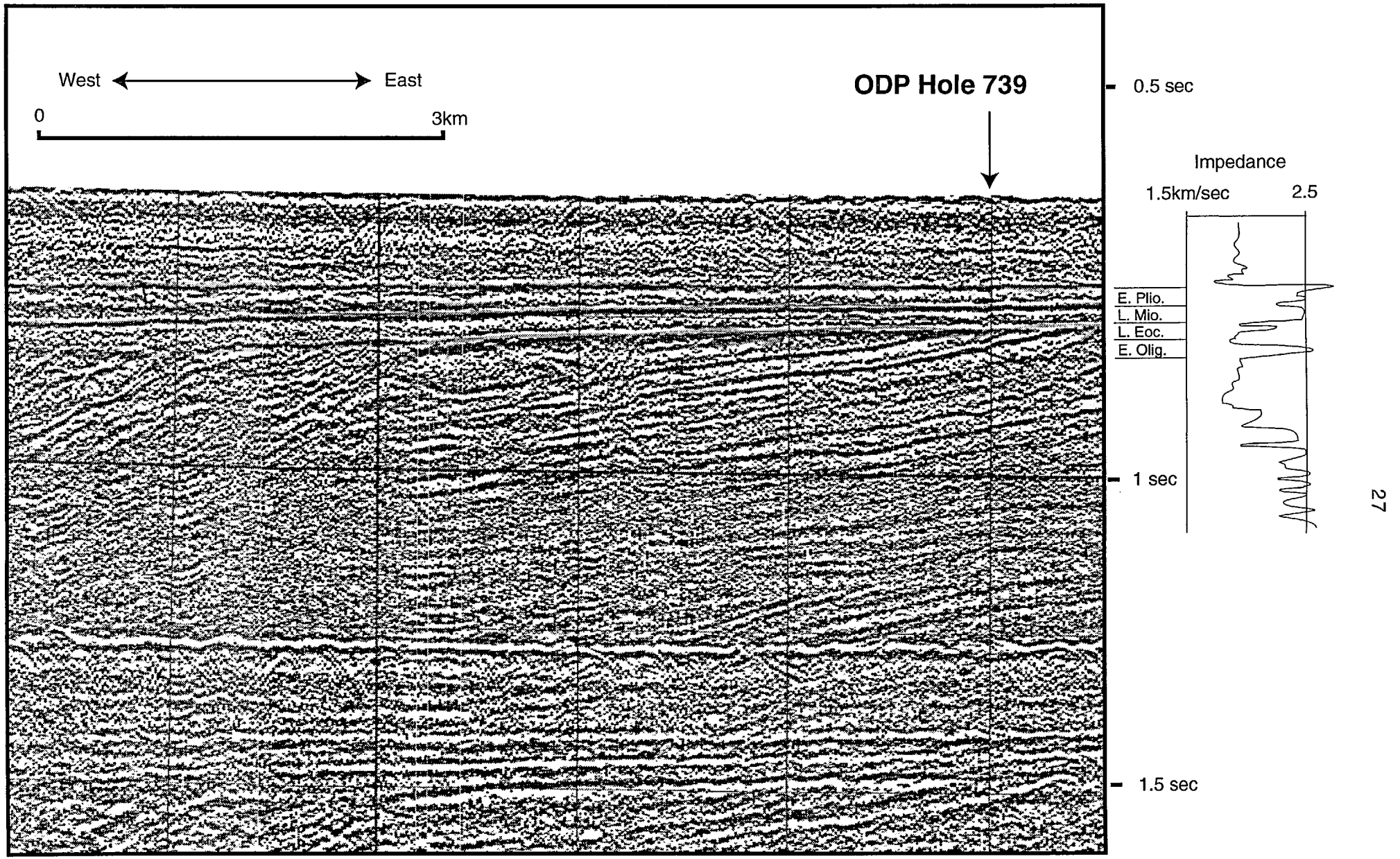


Figure 19. Preliminary tie between ODP 739 and monitor record of Line 1201.
Impedence log rescaled from Cooper & others (1991).

20). We interpret these reflectors as marking periods of ice withdrawal from the shelf break and sediment starvation of the slope (Boulton, 1990). Also, there are reflectors which have high amplitudes on the uppermost foreset to topset transition (Fig. 20). These may also represent periods of non-deposition followed by over-compaction by the next glacial advance.

The lower fan reflectors downlap onto a major sequence boundary, which is probably one of the reflectors mentioned by Kuvaas & Leitchenkov (1992). Processing of the data and tying to multichannel data will be necessary before these events can be assigned to existing horizon identification schemes. Reflectors seem to be mostly parallel without major high-angle truncation, suggesting that the fan has accumulated without major channels or slumps developing (cf. Hiscott & Aksu, 1994; Bart & others, 1994). The fan surface is similar with a few lines showing shallow channels suggesting that the fan is not deeply eroded by channelled turbidity currents. The only area where slump scars are common in just below the shelf break (Fig. 20). They are not deep features and no deep failure planes are apparent on the monitor records.

The relatively undisturbed appearance of the Prydz Channel Fan contrasts with the line shot west of the fan on the slope offshore from Framm Bank (Fig. 21, 22), where of the continental slope is extensively.

Cores

Cores from the shelf above the fan penetrated stiff, dark grey to black, poorly sorted sandy clay with scattered pebbles, overlain by diatomaceous sand containing deformed fragments of the underlying clay (Fig. 23). The clay is identical to glaciomarine clays deposited near the Amery Ice Shelf grounding line in the Amery Depression. The sand overlying it is an ice keel turbate. The grey to black glaciomarine muds continue beneath the upper slope overlain by proximal sandy sediment gravity flow deposits. Glaciomarine facies on the slope feature bedded intervals and contain foraminifera. Sediment gravity flows also contain foraminifera. More distal cores from the fan comprise finer turbidites and hemipelagic muds.

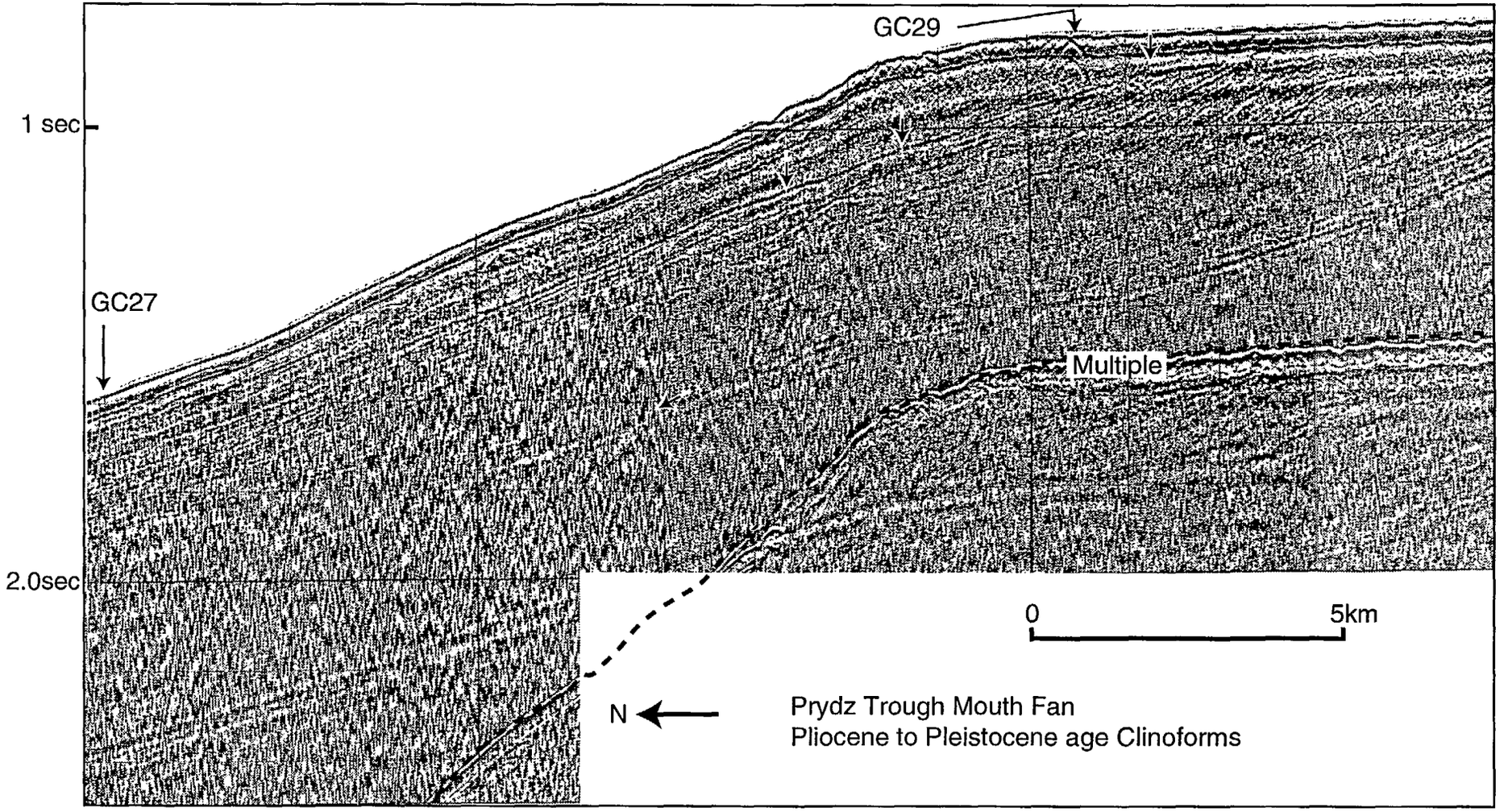


Figure 20. Monitor record of Line 0801 across the shelf edge of the Prydz Fan. Vertical arrows indicate high amplitude foreset to topset transition. Lower arrow indicates downlap onto major sequence boundary.

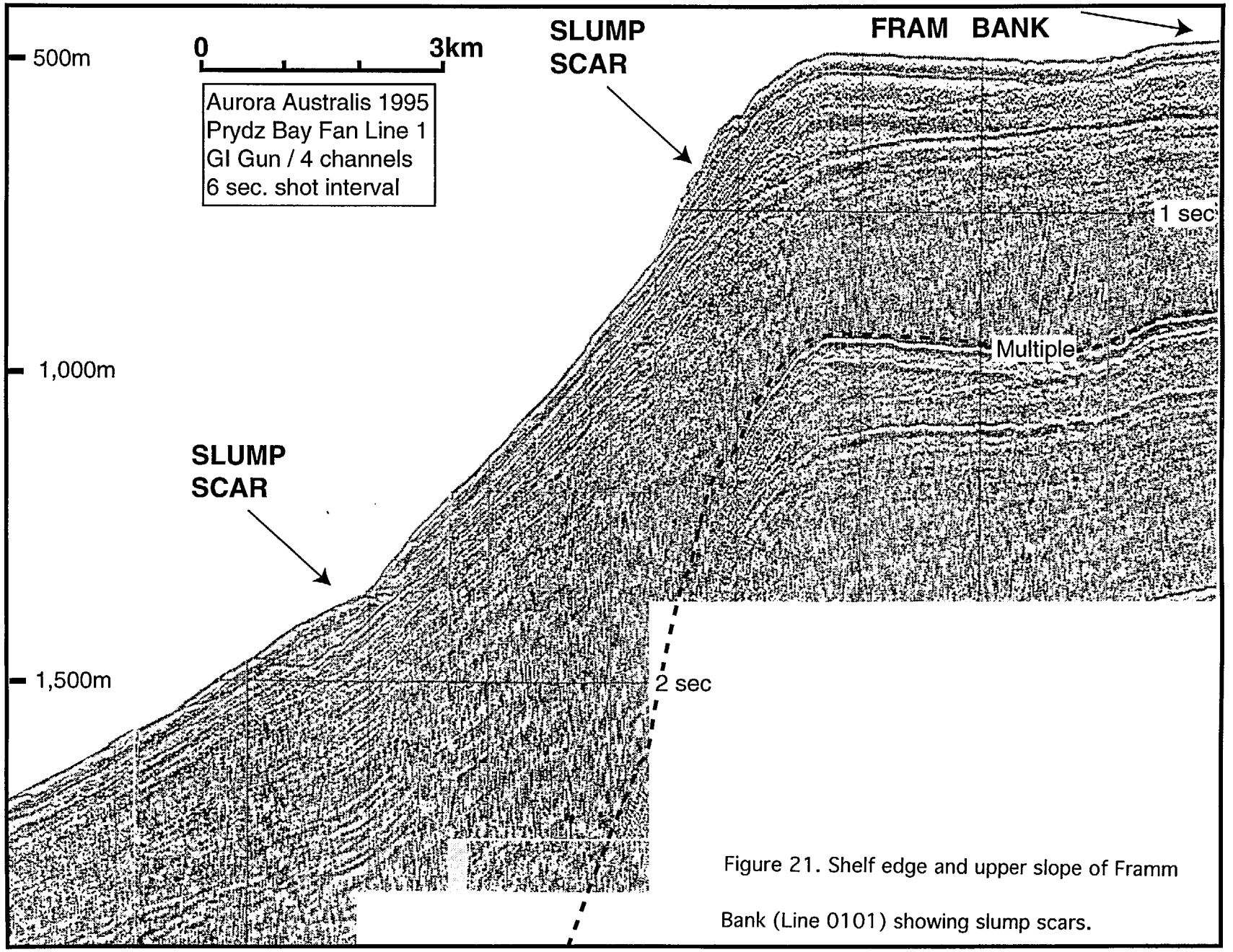


Figure 21. Shelf edge and upper slope of Framm Bank (Line 0101) showing slump scars.

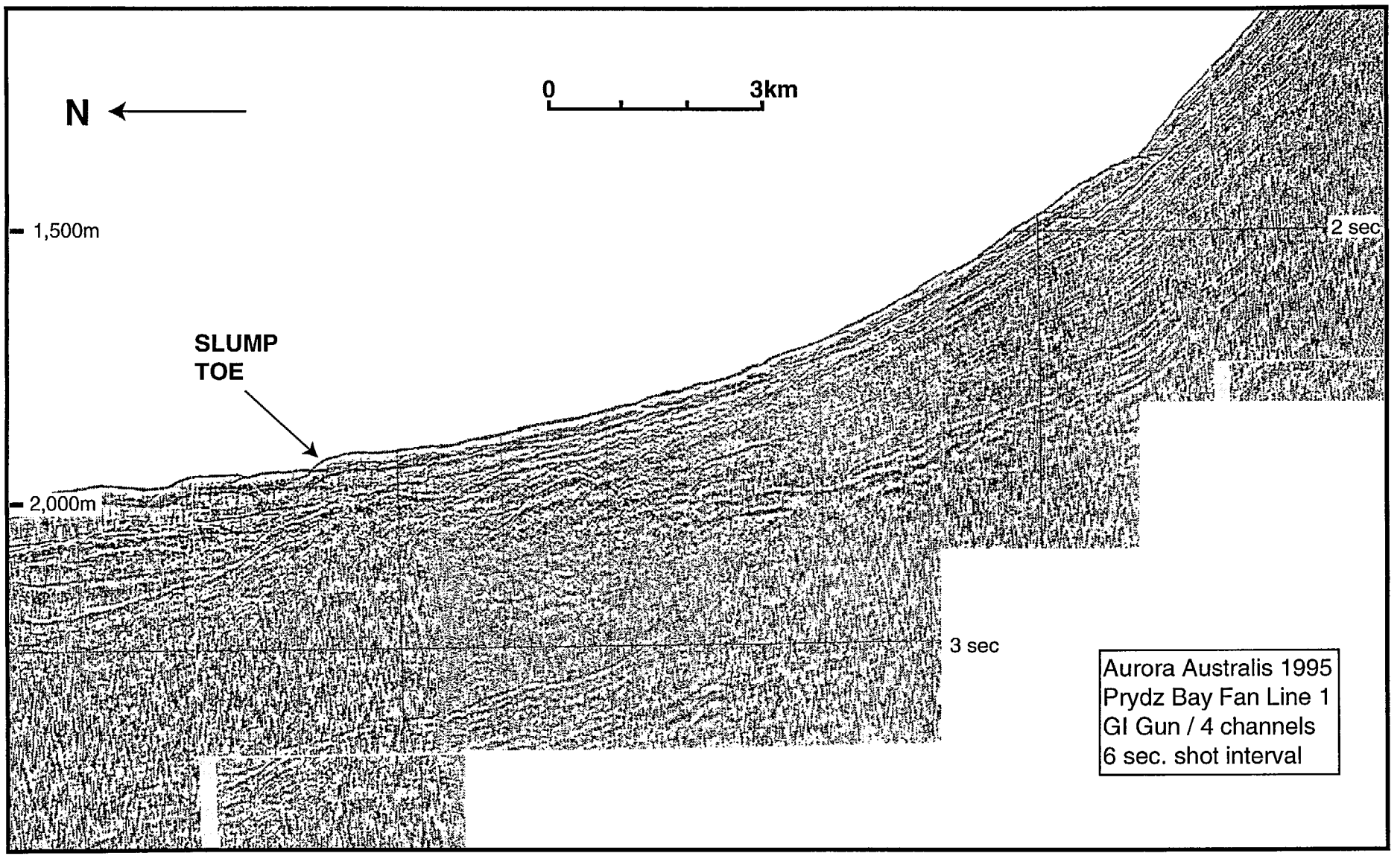


Figure 22. Lower slope of Framm Bank (Line 0101) showing lower end of slump mass.

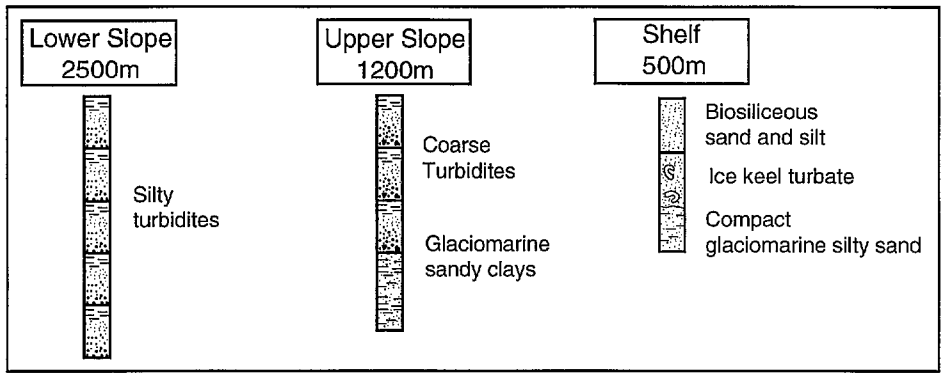


Figure 23. Idealised logs representing down-slope succession of facies on the Prydz Fan.

The glaciomarine sediments of the fan were deposited either by rain-out beneath a floating ice shelf or from meltwater plumes coming from the grounded ice front. Dating of foraminifera from the glaciomarine muds and the overlying sediment gravity flows will give maximum and minimum ages for the last time the Lambert Glacier reached the shelf edge.

CTD Data

CTDs were possible at only 6 of the 17 stations cored on the Prydz Trough Mouth Fan and adjacent shelf. The water structure in this areas did not show recognisable trends and no suspended sediment plumes were detected by the transmissometer. These data will need to be compared with the large body of CTD data that already exists for this area.

KERGUELEN PLATEAU

Objectives

1. Obtain cores of calcareous pelagic sediments from a range of depths and latitudes on the Kerguelen Plateau that will provide evidence of water mass changes in the region during periods of climate change, in particular the Holocene and Late Pleistocene.

2. Collect high resolution seismic data in areas of existing seismic coverage and in association with coring to see if high-resolution seismic data can better identify areas of relatively continuous Pleistocene sedimentation.

Seismic

One 46 km long seismic line was shot between Stations 48 and 49 (Fig. 3). The line follows part of the 1985 *Rig Seismic* Line 047/22 which

employed 2 x 8 litre airguns and a 1200 m, 48-channel streamer. The GI gun data were recorded in moderate to rough seas and 30 knot winds, so the monitor records are noisy. The data will be compared to the *Rig Seismic* line after processing.

Cores

Cores from the Kerguelen Plateau are characterised by numerous hiatuses and the presence of pre-Quaternary sediment at the sea floor (Schlish & others, 1990). In order to increase the chances of coring Pleistocene sediments, ODP holes on the plateau *Rig Seismic* and *Eltanin* lines were examined to identify Late Pleistocene seismic sequences. ODP 751 was found to have the thickest Late Pleistocene section and the line that intersects it has a distinct package of closely-spaced reflectors just below the sea floor. This package of reflectors extends over an elliptical area on the crest of the southern Kerguelen Plateau at 1500-2000 m water depth. Most sections crossing the flanks of the plateau and shallower areas show outcropping reflectors that underlie this package of reflectors. Therefore, 3 core sites were chosen within the area to give a spread of latitudes and 2 sites chosen, one on what appeared to be sediment ponded against the side of the plateau at 2050 m water depth (Station 49) and another (Station 51) based on the presence of Holocene sediments in a *Marion Dufresne* core.

The cores from Kerguelen Plateau are composed of diatomaceous foraminifera ooze with abundant calcareous nannoplankton, radiolarian and scattered horizons of ice-rafted pebbles and coarse sand grains(Appendix 2). Sediment colours range from white to grey, with some sharp colour changes and burrowing suggesting hiatuses. This is supported by diatom biostratigraphy (Appendices 2 & 4). Diatom assemblages indicate that all cores except GC52 have less than 1 m of sediment younger than 620,000 years old. Late Pliocene diatoms are present in the base of each core, except GC52 in which the zone diatom *Achnocyclus ingens* appears 40 cm above the base of the core, indicating an age between 620,000 and 1.25 Ma years for the lowers part.

CONCLUSIONS

The 1995 AGSO/ANARE Marine geoscience program on *Aurora Australis* was able to meet most of its objectives under difficult conditions. Seismic and coring on the Prydz Channel Fan have provided a basis for understanding the behaviour of the Lambert-Amery system for the Plio-Pleistocene. Coring on the Mac.Robertson Shelf has provided material for the study of Holocene environmental change and for developing a facies model that will be necessary for understanding the significance of sediments in East Antarctic shelf deeps. Seismic data and coring has revealed previously unknown Palaeogene sediments on the shelf and the origins of the major intra-shelf basins. Sidescan sonar has provided

insights into sediment transport on the banks. Cores from the Kerguelen Plateau are of suitable composition for palaeoceanographic studies and one holds some hope of containing an unbroken record of Late Pleistocene environmental change. The other cores have demonstrated the need to understand the relationship between erosion and oceanographic conditions on the plateau in order to understand changes in the Southern Ocean.

ACKNOWLEDGMENTS

We would like to thank the Master and crew of the R.S.V. Aurora Australis for their support throughout the cruise and the many people in AGSO Engineering Services and Marine Operations Group who built and installed the equipment. Antarctic Division staff, particularly Dave O'Neill and Dave Moser helped greatly with logistics and Andrew Tabor with preparing the coring equipment.

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Appendix 1. Calendar of Main Events, AGSO Cruise No. 149 (Aurora Australis Voyage 6), 1995. Times given are local time.

6 Feb.	Depart Hobart 1900hrs local time.
7 Feb.	Transit to Casey ULS mooring
8 Feb.	Transit
9 Feb.	Transit
10 Feb.	Transit
11 Feb.	Transit
12 Feb.	Transit
13 Feb.	Transit
14 Feb.	Transit
15 Feb.	Arrive at station. Unable to locate mooring due to100% ice cover. Proceed to Mawson.
16 Feb.	Transit
17 Feb.	Transit
18 Feb.	Transit
19 Feb.	Arrive Prydz Bay. Begin seismic survey Line 0101.
20 Feb.	End Line 0101. Transit to Mac. Robertson shelf. Begin seismic Line 0201.
21 Feb.	End Line 0203. Attempt to enter Mawson but too much ice cover. Decide to wait for storm to clear ice, doing seismics in mean time. Begin seismic Line 0301.
22 Feb.	Seismic Line 0401, Line 0501. End Line 0501 due to blizzard.
23 Feb.	Blizzard, hove to.
24 Feb.	Storm moderates. Shot seismic Line 0601. Head for Mawson.
25 Feb.	Transit to Mawson, Seismic Line 0701.
26 Feb.	Transit to Mawson, break ice.
27 Feb.	Breaking ice in Mawson harbour.
28 Feb.	Breaking ice in Mawson harbour.
1 March	Launch *Aurora Australis-2* clear ice from approach to jetty. Begin cargo unloading 1200 hrs.
2 March	Blizzard. No work today.
3 March	Water in *Aurora Australis-2* fuel delays unloading until 1200 hrs.
4 March	Unloading cargo.
5 March	Unloading cargo.
6 March	Unloading cargo.
7 March	Unloading cargo.
8 March	Unloading cargo. Depart Mawson 1530 hrs local time. Arrive at first station 1800hrs but unable to work due to sea ice cover.
9 March	Proceed to Nielsen Basin area but discover sea ice cover is too extensive for seismic survey. Decide to conduct Core/CTD operations.
10 March	Coring stopped at about 0600 due to blizzard.
11 March	Begin coring 0800. Current meter deployments
12 March	Finish coring 2200 and head for Prydz Bay.
13 March	Transit. Begin seismic survey 1200 hrs, Line 0801.
14 March	Seismic survey, Prydz Channel trough mouth fan, lines 0901-1201
15 March	Seismic survey, Prydz Channel Fan.
16 March	Seismic Line 1301 finished 2330hrs.
17 March	Davis resupply & collect passengers.

18 March	Transit. Begin seismic Line 1401 at 1200hrs
19 March	Seismic survey Prydz Channel fan, Lines 1401-1802
20 March	Seismic survey
21 March	Finish seismic Line 1802 at 1200hrs. Start coring stations.
22 March	Coring stations, Prydz Channel fan and adjacent shelf.
23 March	Coring stations, finished at 2000hrs. Transit to Mac.Robertson shelf.
24 March	Coring stations, Mac.Robertson shelf.
24 March	Coring stopped 0600 due to blizzard.
25 March	Blizzard, hove to.
26 March	Blizzard, hove to.
27 March	Blizzard, hove to. Head for Mawson.
28 March	Transit. Arrive Mawson 1000 and collect passengers. Start coring stations in Iceberg Ally 1800 hrs.
29 March	Finish last station 0300hrs. Head for Kerguelen Plateau.
30 March	Transit
31 March	Transit
1 April	Transit, arrive coring station 2000hrs
2 April	Coring, seismic line 1901.
3 April	Coring finished 2400hrs
4 April	Transit
5 April	Transit
6 April	Transit
7 April	Transit
8 April	Transit
9 April	Transit
10 April	Transit
11 April	Transit
12 April	Arrive Hobart 0700. End cruise.

Time Budget:	
In transit or breaking ice	30 days
Unloading/loading cargo & passengers	9.5 days
Time lost to storms	7 days
Marine Science 17 days	
TOTAL cruise duration	63.5 days

Appendix 2.

Mechanical Report

Compressor

The air supply for this survey was supplied by a Price W-200 compressor driven by a 671 GM diesel. The air pressure was a constant 2100 psi. The whole compressor unit was custom-built by AGSO Engineering Services Unit in Canberra, fitted into a 20' x 8' container and mounted on the rear trawl deck of the *R.S.V. Aurora Australis*. The compressor performed well during the survey with only minor breakdowns and oil leaks occurring. During 24 hour operation the unit was refueled twice a day, at 1000hrs and 2200hrs. It was found that two belts were necessary to drive the compressor. Extra heaters were necessary during down time to prevent freezing and some flow through the salt water cooling system (or drain exchanges) was necessary at all times to prevent freezing.

G.I. Gun

The G.I. gun was operated in true G.I (Generator-Injector) mode. The gun has two chambers. In G.I. mode, the generator chamber produces the initial sound pulse, the injector chamber then releases air into the bubble to prevent its collapse and secondary bubble pulse generation. The gun can also be run in airgun mode where both chambers fire as one, producing a more-powerful pulse, but with a secondary bubble pulse. The gun performed extremely well in the harsh conditions. The De-iceant proved an essential part of the operation, not only stopping the gun from freezing but also acting as a lubricant. Prior to deployment, hot water was needed to de-ice the gun. It was lowered down and dragged up the angled trawl deck on the port gilson wire.

Shooting in Ice

Shooting in ice was possible provided it wasn't too thick or under pressure. The best test for conditions was to pull in the gear and watch the wake to see if it stayed open. At 4 knots the ship pushed the ice aside, any faster and it overoad the ice and pieces came up in the wake, any slower and the wake closed. Towing the gun near the prop wash kept it away from the ice. The gun bundle was found to be the most vulnerable equipment with ice being caught in the loop formed by the gun and the bundle. This was helped by tying the bundle off with bunji cord, with 2 m of slack on deck and tied off again. The advantage of this was that, if the bundle was hooked by ice, the bunji broke giving the bundle a chance to come free. However, a spare gun bundle was essential.

Geological equipment

The gravity coring equipment again proved reliable, with some good samples achieved. Operations were carried out following procedures in the appendix in O'Brien et al. (1993). Grab samples were obtained using Shipeck grabs rather than the Van Veen grabs used in 1993. The Shipeck grabs were deployed on the CTD room hydrographic wire and was found to be easier and safer to deploy than the Van Veens. Although the Shipeck grabs produce smaller samples than the Van Veen grabs, water washing is less in the Shipeck, giving a more realistic sediment sample.

LIST OF GEOPHYSICAL EQUIPMENT

Seismic System

Streamer : - 25 m FJORD Instruments analogue streamer with 4 x 6.25m groups of 10 TI-1 hydrophones per group, and 2 depth transducers.

Energy Source: - single element GI (generator/injector) airgun using 45 cu.in generator and 105 cu in injector chambers.
- Teledyne gun signature phone
- 1 x Price W-200 compressor rated at 200 scfm @ 2000 psi, driven by a 671 GM.

Recording : - AGSO designed and built seismic acquisition system based on Microvax II computer
  - 12 channel digitally controlled preamp/filters
  - Andatco DAT tape drives
  - 0.5 msec sampling, 16-720 Hz passband
  - streamer noise, amplifier tests and individual /group QC
  - recording oscillator and seismic monitor QC

Appendix 3.

Core Logs

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CORE NO: 01GC01 LOCATION: Nielsen BSW LENGTH: 2m + bag.
LAT: 67° 28.7' LONG: 64°21.0' WATER DEPTH: 1100m
DATE: 9-3-95. SHEET NO: 1/1.

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	0-1		↑ dom.: 5Y4/4 mod olive brown	laminated to cm-bedded			extant diatoms species *Nitzschia curta dominates*	40% very fine quartz silt 60% decomposed organics. Strong H_2S odour
	29-30							
PART B	64-65	massive						
	94-95							
	104-105	mottled	alt'g with 5Y3/2 olive grey			N/A		
	115							(large (10cm), thick (1cm diam) worm – found on corer weights) → cause of mottling?
PART A	134-135			laminated to cm-bedded				
	164-165							
200cm	190-191		↓				extant diatom species → *Nitzschia curta* dom.	Bottom of core

NB • Core top extruded during collection → material is stored in a 1g plastic bag.

• cc sample taken

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CORE NO: 01gC02 LOCATION: Nielsen Basin LENGTH: 3m

LAT: 67°28.7' LONG: 64°21.0' WATER DEPTH: 1100m

DATE: 9-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
Pit A 30	0-1		5Y4/4 ← Dark	≈			Diatom sponge spicules	Modern te olive brown to dark greenish grey bioturbated ooze. Mottles ~2-3 mm dia
	29-30		5Y4/1					Silt, traces of clay 80% organic matter
Pit C	59-63			=				As above but bedded Dark layers have more clay content
	74-77							
100	82-83			≈				Mottled
113	119-120			=		Quartz grains too small		Bedded
Pit B	149-150							
	179-180							
196	200-201		Moderate Brown 5Y4/4					Massive with single dark bed & f mottle as shown
200 211								
	239-240			≈				Laminated to bedded with mottled sections
	259-260							
	284							
	290							
300 C14	301-302							
308	302-303							
								Bottom of Core No Core catcher sample

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CORE NO: 149 026C03	LOCATION: Nielsen Basin	LENGTH: 140 cm	
LAT: 67° 29.4 S	LONG: 64° 59.8' E	WATER DEPTH: 1200	
DATE: 9-3-95	SHEET NO: 1 of 1		

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
PART B	0-1 9-10 29-30		5Y4/4 olive greenish grey 5G6/1	≠		Angular	~10um diatoms + sponge spice	~50% pale yellow brown organic matter ~45% angular quartz 5% clay biotite Traces of glauconite No reaction to HCl
40								Part B / Part A
PART A C-14	55-56 75-76 87-86 85 89-90 119-120 140-141	8	Medium grey N5 ← N3 N4	≠ ? Possible beds weakly bedded			diatom + sponge spicules	~70% angular quartz ~30% organic matter Traces of clay mineral Lithic pebbles ~1cm diameter 70-80% quartz, angular medium size 10-20% silty matrix No reaction to dlCl
140								Bottom of Core

(Cc sample collected)

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CORE NO: 149/03 GC 04	LOCATION: Nelson Basin	LENGTH: ~2 m
LAT: 67 23 80	LONG: 65 53 57	WATER DEPTH: ~ 855 m
DATE: 10/3/95	SHEET NO:	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
34	0-1 29-30		Moderate olive brown				Nitzschia curta ooze	Uniform moderate olive brown biosiliceous ooze. 50% v.f. sand & silt quartz 50% organic Traces of clay & lithics. Massively bedded [Part C]
100 124	59-60 89-90 114-115 119-120		5Y4/4					[Part B]
C14 153 165-166 166	159-160 163-164 167		5GY4/1	gravel bed			nil	Dark greenish grey gSM 80% quartz 20% grey clay. Traces of lithics, clay minerals & forams. Large pebble ~3 cm diameter. No HCl reaction
A	172-173 175-176 189-190 219-220		[illegible]			Angular to rounded	Diatoms absent	Greyish brown gSM 80% medium-fine quartz sand. 20% brown clay No HCl reaction [Part A] Bottom of Core 214 cm

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CORE NO: G149/04/GC5	LOCATION: Neelsen Basin	LENGTH:
LAT: −67 24.21	LONG: 65 55.82	WATER DEPTH: 870m
DATE: 10/3/95	SHEET NO: 1	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
[illegible] B	0-1		Moderate olive brown 5Y 4/4	Massive			Diatoms Sponge spic.	Uniform moderate olive brown biosiliceous ooze 50% [illegible] Sand [illegible] Diatoms dominated by Nitzschia curta
34	29-30							
55cm	59-60		Moderate [illegible] brown [illegible]	Massive Patches [illegible] Burrows			Diatoms Sponge Spic.	Massive moderate olive brown biosiliceous ooze ~50% of sand passing down into biosiliceous [illegible] Sand. Rounded pebble [illegible] sand [illegible] sand [illegible]
[illegible]	89-90		Olive Grey 5Y 3/2	Contact Sharp			Diatoms	Massive diatom [illegible] 10% [illegible]
108-109	RS		Olive [illegible] 5Y 4/1				Rare Diatoms	Massive [illegible] silty [illegible] 20% [illegible]
	119-120							

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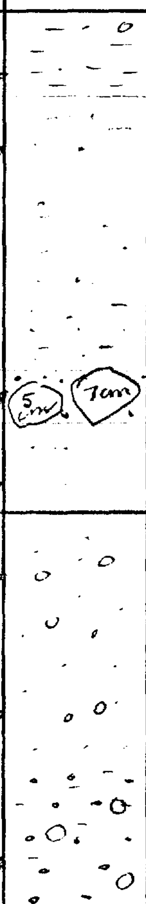
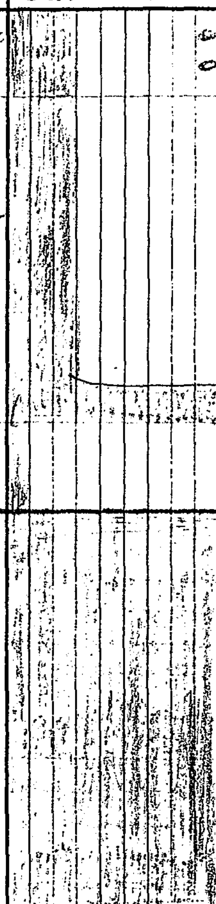
ANTARCTIC C R C

CORE NO: 149/5/GC06	LOCATION: Nielsen Basin	LENGTH: 189cm	
LAT: 67° 16'96"	LONG: 66° 01'30"	WATER DEPTH: 800-805	
DATE: 14/3/95	SHEET NO: 1/1		





DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
A 18	15 16		5Y 4/4 mod olive brn	massive		ang	diatoms forams Spi-16	Massive unsorted v. fine sand & ooze with rare pebbles. 50% ooze 50% quartz grains 95% quartz 2% lithics <1% forams
B 16	30 31		"	massive			N. curta	Nitzschia curta dominated [illegible] Corethron criophilum abundant at 20 cm "
86 C-14 85-86	80 81	5cm 7cm	grades to	"		sub Rnd		" Grading down to unsorted sands & subrounded cobbles 5-7 cm diam.
100 108	100 101		5Y 3/2	"				[illegible] mottled olive grey silt Sand « 125µm quartz
C	118 119		5Y 4/1	"			Grains angular N. curta	Massive olive gray unsorted silt to coarse quartz sand with small to medium pebbles (up to 1cm long) - volume: grains ≥60% ; silt ≤40% - grains: 70% quartz ; lithics <1% ; biotite <%
150 156	149 150							
189	179 180		5Y 4/1	"			Grains angular Pebble: subang.	Massive olive grey unsorted silty [illegible] to coarse sand with small to medium pebbles (up to 2cm length)
200		base of core @ 189cm						

Foram Samples taken (PW) at 0-1, 5-6, 9-10 cm

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149/06/9C07

CORE NO: 9C06/9C07 LOCATION: Mielsen Bay LENGTH: 63cm

LAT: 66° 55.87' LONG: 64° 56.25' WATER DEPTH: 376cm

DATE: 15-3-95 SHEET NO: 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
4cm	F2		5Y 4/4	massive		—	Nitzschia cuspidata dominate throughout core	unsorted massive med. to fine sands, bio-ooze Vol.: >50% quartz. Grains quartz 90%
IR	9-10		"	"		ang		Massive unsorted pebbly med-coarse quartz sand & ooze. Gradation contact over 3cm
			5Y 3/2			ang		Massive pebbly olive grey medium to coarse unsorted sand & ooze. Volume: 40% quartz ; 60% bio ooze Grains: 90% quartz ; <5% biotite ; <5% lithics
50	40-41							
	60-							
63 cm	61	base of core						

Forams samples to PW
@ 0-1cm, 5-6cm, 9-10cm

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CORE NO: 149/08/GC8	LOCATION:	LENGTH: 61 cm
LAT: 67° 05 10'	LONG: 65° 13 60'	WATER DEPTH: 130 m
DATE: 15-3-95	SHEET NO:	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	4-5		5Y 4/4	massive		–	Holothurians, forams	massive olive brn fine qtz sand with ooze Vol:50% minerals 90% qtz.
8							Bryz. for	2 cm bioclastic horizon → bryozoans, forams etc
A			5Y 4/4			gR ang	forams	massive med-fine qtz sand c biosiliceous ooze. Volume
34 37	30 31			massive				3 cm bioclastic horizon: bryozoans
			5Y 4/4	massive			forams	massive med-fine qtz sand, ooze
55	55 56		5Y 4/4	"			sponge forams	6 cm biosiliceous-rich bed.
61		base of core @ 61 cm						61 cm base of core

Nitzschia curta dominated ooze 0-61 cm

Samples
2 lge seaslugs/[illegible] [illegible] occupied the top 3 cm of core → preserved in formalin
Foram samples taken by PLV at 0-1 cm; 20-21 cm; 33-34

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CORE NO: 149/09/GC9 LOCATION: Nielsen Basin LENGTH: 75

LAT: 67°05.1 LONG: 65° 19.30' WATER DEPTH: 388m

DATE: 14/3/95 SHEET NO: 1/1

DEPTH | SAMPLE | VISUAL LOG | COLOUR | SEDIMENTARY STRUCTURES | Clay, Silt, Very fine sand, Fine sand, Medium sand, Coarse sand, Very coarse sand, Pebbles | ROUNDING | FOSSILS

8 — A — 40 — 48 — 50 — 52 — 64 — 75/76 cm

	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS
1	5Y 4/4	m	ang	diatoms, rads, forams
2	10Y 4/1/2	m	ang	forams
3	5Y 4/1		ang	forams
4	5Y 4/1		"	forams
5	5Y 4/1		"	forams, brrozoa
6	5Y 4/1	massive	ang	forams, brrozoa
7	5Y 3/2	massive	"	forams

base core at 75 cm

DESCRIPTION/REMARKS

unsorted, fine to med qt sand ± biocl

1) 8cm massive mod olive brn biosiliceous ooze 50% bio ooze 50% vol mineral
qtz >125μm: 85% qtz, <5% biotite + black
5% sparse radiolarians & foram fragments
+ diatoms & sponge spicules

2) Grades down into (at 20 cm)
massive, unsorted, med qtz sand + bio ooze.
by vol: 60% qtz : 40% ooze / 7115 - 80% qtz +5%

3) weakly laminate, fine to med qtz sand.
Some mottling.
coarse fraction → 80% qtz.

4) massive silty to fine qtz sand and bio ooze
vol = 50% qtz, sand 50% qtz

5) weakly laminate, v. fine sand? bmyzoa
vol: 38% qtz sand → 80+% qtz, some biotite.
mottled, ? burrows ± reworked bmyzoa

6) massive, mottled (? bmyzoa)
fine qtz sand ± some med-coarse + pebbles
Scivel predom. qtz; lithic pebbles.

7) massive olive grey fine to med qtz sand + org.
grains: 50% of which ooze 50%
minerals: 80% qtz, 10% biotite 5% lithics
other black mins
Rare forams.

Nitzschia cf. interrupted ooze

* Tertiary forams present at 39 cm

FORAMS

1) Reworked Tertiary forams
evidence PQ sampled.
34-35 cm - 30 cc taken
61-62 cm - 30 cc taken

2) PW sampled
0-1 cm (10cc),
21-22, 33-34, 43-44.

Note Archive half is inverted to the 'working' half → Both core photographed. → Image on top

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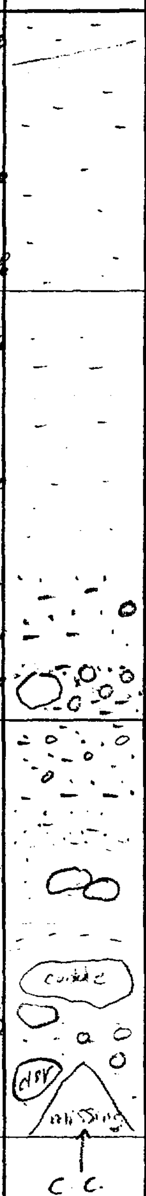
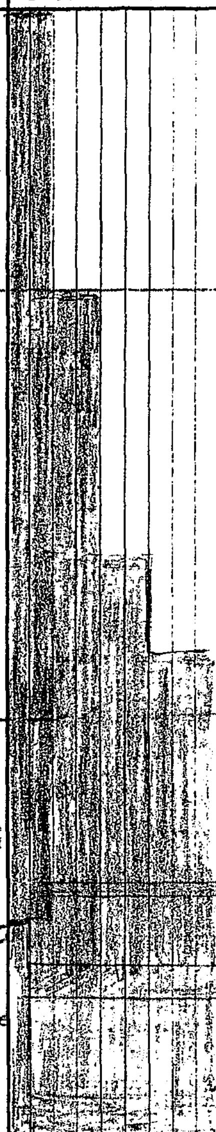
CORE NO: 149-10-GC10	LOCATION:	LENGTH: 235cm
LAT: 67°05.01'	LONG: 65°27.87'	WATER DEPTH: 627m.
DATE: 13/3/95	SHEET NO: 1/1	





DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
C	5-6; 35-6; 55-6	5Y 4/4 mod olive bn	massive	—	Nitzschia curta ooze	massive md. olive brown biosiliceous silty ooze. ?burrow (5Y 3/2) at 10 cm/diag.
59					← Diatoms	
B (100)	67-?; 99/100	5Y 4/1 olive brn	massive			massive olive brn v-fine sandy Silt (at 112 gradational change to
	120/121	112 5Y 3/2				"massive" olive grey pebbly crs. sand to sandy silt c mottling
C14/135	130/131; 140/141	136 5Y 4/1	massive		← Diatoms ?	massive grey silty pebbly crs sandy crs fraction → 98% angular qtz. <1% biotite
148						
A	155-156	5Y 4/1	massive	ang.	Diatoms rare. N. curta dominant 148-235cm	18cm massive olive gy pebbly silty crs angular pebbles up to 1cm. >125 → 90% angular qtz ~10% lithics.
	177-178	5Y 3/1	laminated		← F, D	finely laminate siltstone with occasional cobble/pebbles & sand. 42cm.
(200)			laminated mottled			laminated with slight mottling.
	208-209	5Y 3/1	massive		← F; ← D.	massive silty clay c pebbles >125μ fraction = 85% angular qtz 10% lithics. 5% {glauconitic + biotite. {?malachite? angular. triangular [illegible]
235	230-231					— Bottom of core @ 235cm —

x Diatom samples @ 220, 185cm (?)
(Foram samples at 185-6cm, 218-9 (?) (20cc), (?)

[illegible] f rea [illegible] 155-235 [illegible] [illegible] diatom [illegible] (Late Quaternary) in association with Paralia sulcata var. crenulata, Hemiaulus sp. & Stephanopyxis (Eocene +).

* comment: predom litho. is silty mud, but unit 6 contains sands, pebbles & clasts

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CORE NO: 149/111 GC11 LOCATION: Nielsen Basin LENGTH: 129 cm
LAT: 67° 05.17 S LONG: 65° 38.87 E WATER DEPTH: 587
DATE: 12-3-95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
P1+B	0-1		Moderate olive Brown	~			Sponge spicules N. curta	Moderate olive brown biosiliceous ooze ~50% angular clear quartz ~50% amorphous organic matter Traces of sponge spicule Diatom ooze dominated by Nitzschia curta
	29-30							
H2			5Y4/4					
P1+A	59-60					Angular		
	89-90			~				
115							Nr. surface Sponge Spicules	olive grey fine to medium quartz sand ~90% clear angular quart ~10% organic matter with
129	120-124		Olive Grey 5Y3/2	~				
	125-138							Bottom of Core traces of mica, clay minerals & some lithics. Sponge spicules

100

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CORE NO: 149-12-GC12	LOCATION: Mac Rob Shelf	LENGTH: 350 cm	
LAT: 67° 06.7'	LONG: 65° 46.72'	WATER DEPTH: 626 m	
DATE: 12-3-95	SHEET NO: 1/1		

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
10 – 85.2	2-3; 30-31; D; 55-56; 75-76		5GY 3/2; 5Y 4/4 mod olive br'n	massive		M	diatoms LQ; LQ diatoms	olive green colour band at 3-4 cm. "massive greyish olive green gelatinous ZS ooze" ≤5; biosiliceous ooze ~15% v-fine qtz sands. subangular. @ 66 cm, & 63 cm - indistinct cm-bands.
100 – 174.2	100-101; C; 130-131; 160-161		5Y 4/4 ↓ grading to 10Y 4/2	massive; some mottling		N/A		massive olive brn 'gelatinous' silty ooze (biosiliceous ooze) with sl mottling in lower 25 cm.
200 – 262.5	184-5; S; 214-215; B; 244-245	ooze; ooze	10Y 4/2; 10Y 5/4; sl darker 10Y 5/4; grading to 10Y 4/2	cm-bd.; massive; 10Y 5/4; massive			–	2 cm: 10Y 4/2 glac. siliceous ooze. massive mod olive brn biosiliceous ↑ lighter colour (ooze). Sl "darker" 10Y 5/4 glac. siliceous ooze ↓ darker colour. grading down into darker coloured slight mottling.
267.5 – 350	267.5; 282.5; 289.5; 297-298; A; 323.5		5Y 4/2 grading to 5Y 3/2; 10GY 3/2; 5G 4/1	[illegible]; massive mottled base; massive		ang; ang	diatoms	Grayish olive massive biosiliceous fine sandy silt. Massive. Olive grey faint laminated biosiliceous fine sandy silt. Black lam. Dusky yellowish green: massive v-fine sandy silt 3 cm subangular pebble at top; 1 cm black band near upper boundary. Mottled near base. Massive Dk greenish grey silty med. sand. Polymodal, pebbles at 5 cm & scattered [illegible]. Sand fraction: 90% qtz 10% lithics angular to subangular qtz grains.

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CORE NO: 149 13 GC12 LOCATION: E. Wilkes Land LENGTH: 145 cm

LAT: 67° 05.3 LONG: 65° 58.9 WATER DEPTH: 400

DATE: 12-3-95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
0	0-1		Grayish olive 10Y4/2				Nitzschia curta	95% coarse-medium angular quartz sand 5% organic matter. Traces of glauconite Dropstone ~ 1cm
40	29-30							↓ Gap in core — part extruded — ↓
50								~20cm gap
60	59-60		5GY4/1				Sponge spicules	v.f.s. to silty clay lithics, clay minerals and organic matter
71	64-65						Diatoms absent 60cm	
	89-90							v.f.s. to silty quartz with lithics, clay minerals, black organic matter, glauconite
			5YR 2/1					
	119-120							95% angular quartz, fine to coarse sand 5% organic matter, wood + lithic fragments (glauconite)
	145-146						Diatoms absent	
~148								Bottom of Core

P. Quilty has taken samples from 64-65 cm & 145-146 cm, & core catcher

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CORE NO: 149/14/GC14	LOCATION: P2 Bay Trough Fan		LENGTH: 180 cm
LAT: 66° 38.45'	LONG: 71° 44.00'		WATER DEPTH: 849 m
DATE: 15/3/95	SHEET NO:		

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
								80% quartz <5% biotite <2% forams <5% orange + black mica
C (7 cm)	2-3		10Y 4/2	≠		Ang	forams	Unsorted olive grey medium-coarse sand + ooze with subangular pebbles <1cm
								AS ABOVE
B	10-11, 40-41, 56-57		5YR 6/3, 5Y 5/2 olive, 5YR 3/4	mottling, =		ang	forams	Unsorted olive grey diam[illegible] - medium to coarse sand with angular + [illegible] pebbles in silty matrix (<5%) [illegible], 90% quartz <20% biotite 5% [illegible]; at 33-37cm coarser sands; 42-48cm [illegible] to sands; 55-60cm [illegible] coarse sands [illegible]; Planktic forams abundant
64	65-66							SHARP GRAINSIZE CONTACT
			5Y 4/1 dark gray	≠		ang to sang	forams	Massive unsorted dark grey pebbly silt. Grains: 70% quartz, forams.
97	95-96							
C (100)	100-101, 140-141		5Y 4/1 dark gray	mottling ≠		ang, subang pebbles	forams	↑ Same as above. Pebbly to sandy silt. Some mottling
163	165-166					round	diat fora	SHARP 'COLOUR CONTACT' Unsorted pebbly (cobbles) to sandy clay. Clay (clay >50%) grains
								Base of Core at 180 cm

N.B.

1. Diatoms at 9cm <0.7 Ma
2. Forams collected at 5cm intervals throughout core (0-1[illegible]) P. Wells
3. Diatoms: [illegible] Thalassiosira [illegible] / Nitzschia [illegible] laminated [illegible]

   [illegible] - unidentified fragments [illegible]

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149/

CORE NO: 15GC15 LOCATION: Pr. 1, Fan LENGTH: 2.3 m

LAT: 66° 15.16 LONG: 73° 20.42 WATER DEPTH: 2250 m

DATE: 20-3-95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
0			5Y 5/3 Lt olive gy 5YR 3/2					Olive grey diatom ooze with signs of bioturbation (mottled) N [illegible] different shade
50			5Y 5/2					As above, but slightly different colour
								Part B
140			5GY 4/1					Diatom Ooze with minor sand sized lithics
			5Y 5/2					Diatom ooze with sand + pebble sized (<1cm stones) lithics.
153								Part A
158			5Y 3/2			tangle		Diatom ooze with sand sized quartz + black [illegible]
			5Y 5/2					
230			5Y 5/2					Diatom ooze with minor clay minerals, sand [illegible] lithics + quartz [illegible] < 1cm pebble.
								Bottom of core.

Reaction to HCl

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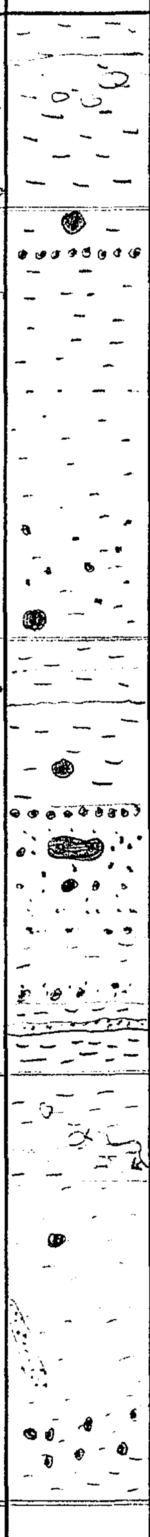
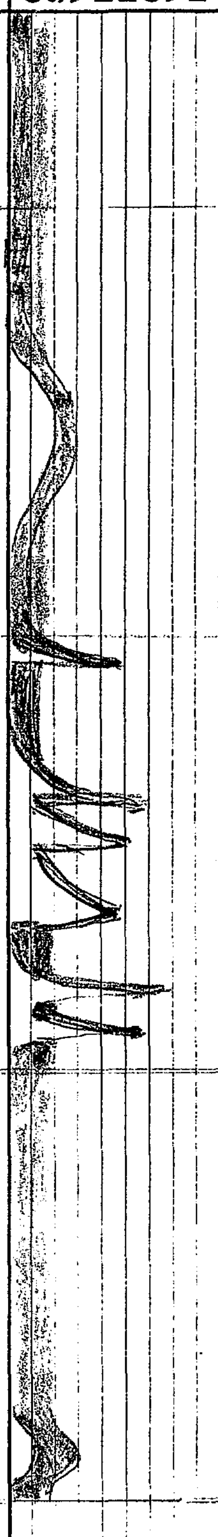
log c 16

CORE NO: 149/16GC16	LOCATION: Prydz Fan	LENGTH: 310cm
LAT: 66° 22.9'	LONG: 73° 11.0	WATER DEPTH: 1960
DATE: 27-3-95	SHEET NO: 1 of 1	

Columns: DEPTH | SAMPLE | VISUAL LOG | COLOUR | SEDIMENTARY STRUCTURES | Clay, Silt, Very fine sand, Fine sand, Medium sand, Coarse sand, Very coarse sand, Pebbles | ROUNDING | HCl React? | FOSSILS | DESCRIPTION/REMARKS

Key (DESCRIPTION/REMARKS):
- ● = clast pebble
- [symbol] = mottle colour (not texture) change
- – – = silt/clay
- ∴ = sand
- ∘•∘ = gravel





Depth (cm)	Sample	Colour	Sed. structures	HCl React?	Fossils	Description/Remarks
0–40 (Part D)	0-1	5Y5/2	≠	N		Olive grey [illegible] ooze
		2.5Y4/4	J			Olive [illegible] [illegible] with mottles [illegible]
	19-20	5Y5/2		N	Nitzschia / kerguelensis	
	39-40		≠	N		Diatoms rare/fragments
40–130 (Part C) 50						Pebbles (not graded) in silt material
	59-60	5Y5/2	=	Y	Forams	Olive grey silty clay with rare angular quartz sand grains - calcareous (forams?) fossils
	79-80			N	Sponge spicules	
100			≠	N		
	109-110	✓				
130				N		Abundant diatoms
130–220 (Part B)	139-140	5Y 5/2				
150		5Y6/4		N		Pale olive
	169-170		=	N		[illegible] layer / TURBIDITE
	176-177	5Y5/2				
		5Y4/2		N		Olive grey clay to very fine silt grading into [illegible] sand (quartz)
200		5Y5/2				
	202-203	5Y4/2		Y		Coarse layer does react to HCl
		5Y5/2, 5Y4/2, 5Y6/3				Pale olive; Abundant diatoms
220–310 (Part A)	221-222	5Y6/3	J	Y	Forams	Pale olive silty clay with olive [illegible]
		2.5Y4/3				Mottles [illegible] mottle patch
				N		
250	262-263	5Y5/2	≠	N		
			J			[illegible] filled [illegible]
	282-283			Y	Foram	
300	302-303	5Y5/3		Y, Y	Foram	Diatoms rare
310						Bottom of Core (310cm)

Rounding (150–210 cm): angular quartz sand / pebbles

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CORE NO: 149/17/gc17 LOCATION: Prydz Bay Fan LENGTH:
LAT: 66° 30.42 LONG: 73° 05.5' E WATER DEPTH: 1540m
DATE: 25-3-95 SHEET NO: 1/2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	6-14 1-20		5Y5/4 ← mottled w/ 2.5Y 4/3	≠	-	N	massive olive biosilic. Silt " mottlings of brn. Silt.
19cm							
E	30 31		5Y 4/2	≠	-		" Sharp colour change to dk gra
	50		5Y 4/1	≠	-		"
51cm	51		↓	≠ mottled		Y?	planctic forams. grad colour change over 5cm ↑
	88		5Y 5/2	≠			pebbles < 1cm. massive olive gray Silt.
1m	100 101			≠		N	massive silt ε interdispersed grits
D							massive silt ε 25% v.f.s
	130 131			≠			
147						Y	← wears (no planic forams) grad. colour change.
160	160 161		✓	≠	ang	Hce	pebbles < 1cm, cvs sand intermixed with (clam) Silt at 170cm: pebbly, cvs sand in Silt 164-168cm: pebbly cvs. sand in Silt
170			5Y6/1	≈			
185C	185 186			≠	ang	N	pebbles 2-3 cm Silt
2m	207			≈	ang		cvs. sand + pebbles in Silt
	210 211			≠			Silt
				≠	ang		cvs. sand + pebbles in Silt
							massive silt with occ. grits
237						(Y)	← no forams evident
	250 251		~		cvs		massive olive gy silt ε occ. layers of gritty to pebbly silt. (diamicton)
			=				↓ dom. Silt with occ. gritty bands
			≠				
B	277 278		≈		ang	N	
			≠				
3m			≠		ang		
	320 321		≠				massive olive gy Silt
						(Y)	← Planctic forams present.
327cm							base Bar 327cm

→ see next Sheet

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CORE NO: 149/17/9C17 LOCATION: LENGTH:

LAT: LONG: WATER DEPTH:

DATE: SHEET NO: 2/2 starts at 327cm

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
327	↑B		5Y5/1	Burrows			N	
330			5Y5/1				N	Grey [illegible] 45% fine [illegible]
			5Y4/1				N	clayey silt light olive grey. Burrowed upper surface. Pebbles to 1cm
350			5Y4/1				N	Very fine sandy silt [illegible] Massive
			5Y5/1 ↓ 2.5Y5/2				N	Grey to grey clayey silt [illegible] Greyish brown. Massive
			5Y5/1			Ang		Very clayey medium sand with 10% coarse sand grains & pebbles abundant [illegible] & labiles (garnet, hornblende) Angular
			5Y5/1					Very clayey medium sand (mostly fine sand). Pebbles to 2cm less than 5% ~5-10% (clayey diamicton) Massive clay grey, [illegible] sand grains
400			5Y5/1					
			5Y5/1					Abundant pebbles to 2cm

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149/18/9C18

CORE NO: GC18	LOCATION: Prydz Bay	LENGTH: 4.1m	
LAT: 66° 35.95'	LONG: 73° 00.34	WATER DEPTH: 1170	
DATE: 21-3-95	SHEET NO: 1 of 2		

DESCRIPTION/REMARKS: X-ray this core

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	GRAIN SIZE (Clay, Silt, Very fine sand, Fine sand, Medium sand, Coarse sand, Very coarse sand, Pebbles)	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
1m			5Y 4/4	Mass				Silty m sand biosiliceous.
5	4-5		5Y 4/2	≠				
23.5 / 23.5			close to 5Y 5/2	≡		angular		bulk: qtz 65% silt, 30% forams 3% biotite 5%; >125u: ang qtz 65%, plk forams 25%, biotite 10%
↓	40-41		5Y 4/2	≠				abundant forams plk + benth.
4m / 30cm			5Y 4/2	Mass				Mass silty fine sand Olive
	69-70		5Y 5/3					Coarse sand patch with ... Biosiliceous
50	84-85		5Y 6/3; 5Y 6/3; 5Y 3/2	mass; mass				Silty Coarse Sand Pebbles; Fine sand, silt; Mass Vcsand
100 / 15	95-96		5Y 5/3					Fine sand ... Biosiliceous
								Mass silty fine sand
25	119-120		5Y 5/3	mass				
136	134-135		5Y 7/2					Yellow v coarse sand, pebbly black grains
			5Y 5/2 Light olive grey	=			Forams + Diatoms Nitzschia kerguelensis	Light olive grey gravelly sandy mud with beds of pebble-sized clasts interbedded with graded sandy mud beds. Sediment is 50% mud and 50% angular quartz fine to medium sand with ... and ... mineral grains. Sponge ... and minor carbonate grains (...)
Part C	164-165							
200	194-195			≠				
	217-218							
	224-225							
226	230-231							
	238-239			=				As above but ... Turbidite (?) beds grading upward into finer sediment beds.
	241-242							
	252-253			Grain alignment				
	260-261							
	264-265			=				
Part B	272-273							
	281-282							
	288-289							
	292-293							
300	304-305							
316								Continued ....

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CORE NO: 149/18GC18 LOCATION: Prydz Fan LENGTH: 4.1

LAT: 66° 35.95 LONG: 73° 00.24 WATER DEPTH: 1170

DATE: 21-3-95 SHEET NO: 2 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
316			5Y5/2	7				
	345-346		Olive grey 5Y4/1	7			Diatoms	Olive grey gravelly sand mud with some weak bedding (?) grain alignment otherwise massive sediment. 70% mud 30% sand/gravel and minor black mineral grains giving the darker colour from above. No rxn to HCl (Forams absent?)
	378-379			7		angular		
400								
406	400-401							Bottom of Core

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23/3/95.

CORE NO: 149 / 19GC19 LOCATION: Prydz Fan LENGTH: 2.75m

LAT: 66° 41.15 LONG: 72° 55.49 WATER DEPTH: 765m

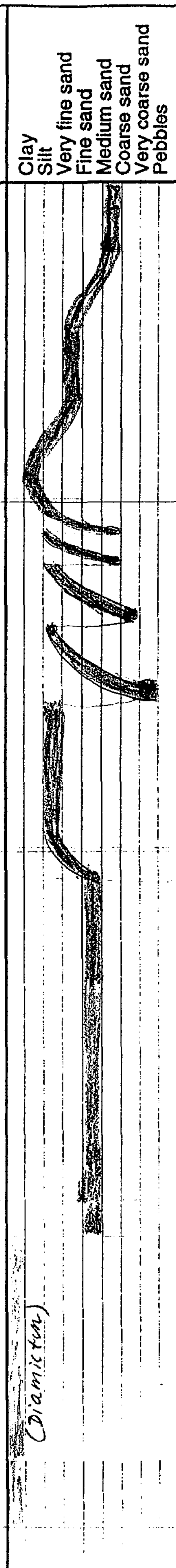
DATE: 23-3-95 SHEET NO: 1 of 1

Part D

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
10cm		Disturbed	5Y5/2		VA	Forams	Half of core lost due to mixing consider top 12cm as one homogenous sample.
		Disturbed	5Y5/2		VA		Muddy foram sand w. quartz + heavy mineral sand grains.
					SA		Muddy Quartzose fine sand with heavy minerals
					A		Upper part of core disturbed during splitting process. Stratigraphy of upper part is doubtful.
					A		Large pebble ~7cm
95			5Y5/2		VA		coarse, angular quartzose sand with heavy minerals and pebbles + forams, in a muddy matrix
100		Disturbed			VA		
					A	Sponge spicules	coarse, angular quartzose sand with fine gravel heavy minerals and lithic fragments in a muddy matrix.
			5Y3/2	bed			
			5Y3/2		A		
185					A		
200			5Y5/2	gravel bed	A		coarse, angular quartzose sand with heavy minerals in a muddy matrix
					A		Weak bedding
			5Y2/1		A	Sponge Forams	dewatered fine sandy bed quartz sand w. minors.
275							Bottom of Core

CORE NO: 149/20GC20	LOCATION: Prydz TMF	LENGTH:
LAT: 66° 37.08'	LONG: 72° 18.27'	WATER DEPTH: 697m
DATE: 26-3-95	SHEET NO: 1 of 2	

DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	CARBONATE	FOSSILS	DESCRIPTION/REMARKS
	0-1, 2-3, 4-5, 9-10, 20-21	5Y5/3		y	Nitzschia kerguelensis	Olive gray fine to med sand c pebbles & silty matrix; abundant plank forams.
		5Y5/2		y		
	29-30					
D		2.5YR 5/4		y		Reddish brown stain vfs
50		5Y5/2				
		2.5Y 5/3		y		Light olive brown med vf to fine sand; with pebbles
		5Y5/2				
82	81-82	5Y 5/1		y	Diatoms rare	← no calc. forams.
		5Y5/2				
100				y		speckled sand layer
	115-116	2.5YR 4/4				Reddish brown gravel layer
C		5Y5/2		y		Turbidite? graded bed
	128-129	2.5Y 4/4				Speckled sand layer [illegible] brown [illegible] pebble [illegible]
		10YR 5/3		y		brown gravelly [illegible] bed
150	144-145, 147	2.5YR 4/-		y		Reddish-brown
172		2.5YR 4/3			Diatoms Absent	← abundant plank forams
		5Y 4/2		ang, y		massive greenish olive gray silty to med sand c pebbles
						massive olive gray, med to crs silty sand
200	199-200	5Y 5/2				
B		5Y 4/2	mottles			
		5Y 4/4		y		2cm 'olive' band, med sand, foram rich.
				y		~~pebbly~~ med calc sand, foram rich. grayish
250		5Y 5/1	5Y 5/1	y		
261	63-?			y	Diatoms absent	massive olive gr, fine to med, calc sand c silt [illegible]
274		"	"	y		"burrowed" contact (over 3cm)
		5Y 5/1				[illegible]
	284-85	5Y 3/6				[illegible]
A		↓ Grad				[illegible]
300		↓ 3/1				
308						[illegible] 1-3cm [illegible] burrows
323		5Y 7/1, 5Y 4/1				
		5Y 4/1	[illegible]			Sandy [illegible] faintly banded
343	340-341	5Y 5/1	[illegible]	y	Diatoms Absent	← no calc forams.
						Bottom of Core



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CORE NO: 149/21/gc21 LOCATION: PRydz TMF LENGTH:

LAT: 66° 33.09 LONG: 72° 17.60' E WATER DEPTH: 1060m

DATE: 25-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
18			5Y 6/2				Forams	Poorly sorted ... light olive ...
35						subang		Light Olive ...
40								Red mottled ...
52								Poorly sorted ...
84								Colour ...
110								
164			2.5Y N3					Faint ...
174	PR 244-245		2.5Y N3					

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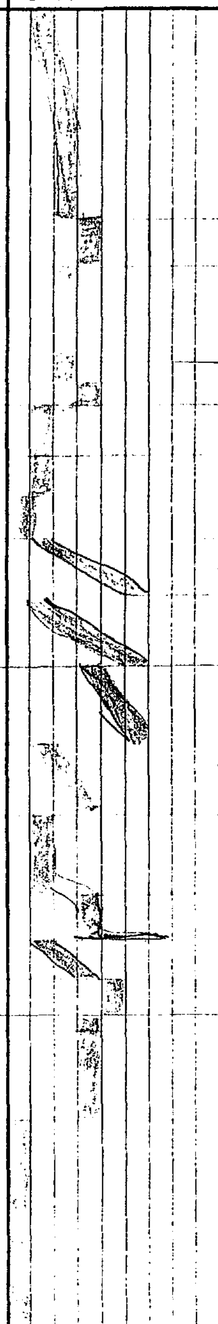
CORE NO: 149/22/GC22	LOCATION: Prydz TMF	LENGTH: ~2.75
LAT: -66°27'.37	LONG: 072 17.84	WATER DEPTH: 1459m
DATE: 27/3/95	SHEET NO: 1	



DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	DESCRIPTION/REMARKS
	0-2		≠	Fine sandy silt grading down into very silty fine sand, sandy silt (~50% very fine sand)
		5Y5/2 olive grey	≠	
	29-30		≠	
44		5Y5/2	≠	Poorly sorted fine [illegible] silt with 10% [illegible] sand. Massive quartz - some [illegible] grains
54	59-60	5Y5/2		Silty very fine sand with [illegible] coarse [illegible] grains
				As above, but with [illegible]
76		2.5YR5/4		
82				Silty fine sand [illegible] to 2 [illegible] Olive grey
	89-90	5Y5/2		Fine [illegible] silt olive grey, [illegible] fragments
100		2.5YR5/4		Clayey silt [illegible]
110	114-115	5Y5/2 5YR5/4		Fine sandy silt
				Coarse sand ▲ Reddish at base ▲ [illegible]
121		5Y5/2		Fine sandy silt. Poorly laminated
	135-137			Coarse sand
138		5Y5/2 + 2.5YR5/4 mottle		Coarse sand grading up into silty fine sand
152	149-150 / 151-152	5Y5/2		V silty fine sand grading into [illegible] silt
167		2.5YR5/4		Fine [illegible] clayey silt Pebbles [illegible]
	180-181	5Y6/1		fines up
194		5Y6/1		Silty fine [illegible] with coarse pebbly [illegible] at base. Sharp [illegible]
				Silty fine [illegible]
204	200-201	5Y6/2		Silty medium sand
209 / 213	206-207	5Y6/2		Silty fine sand
				Silty fine [illegible] ~5% medium [illegible] grains
	236-237	5Y6/2 ↓ 2.5YR4/4		Silty fine to medium [illegible] Mottling [illegible]
	268-269	↓ 10R4/2 ↓ 10R4/1		[illegible] D[illegible] M[illegible]

Diatoms [illegible])
Rouxia [illegible] >1.8 < 3.[illegible] Ma
Thalassio[illegible] torokina
Undetermined [illegible]

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CORE NO: 149/23/GC23 LOCATION: Prydz Bay LENGTH:

LAT: 66° 19.22' LONG: 72° 17.61' WATER DEPTH: 1884m

DATE: 21-3-95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	HCl reaction	FOSSILS	DESCRIPTION/REMARKS
			5Y5/3				N		Light olive clayey silt, mostly quartz with some clay, minerals + angular sand. Diatoms abundant
C				≠				sponge spicules diatoms	
			5Y5/2				Y	Forams	As above but with calcareous (foram ?) diatom material rare
28							Y		Diatoms rare
									Light olive clayey silt mostly quartz with minor angular quartz sand grains. Mottled, signal clay minerals.
B			5Y5/6	≠			N		
				≠			Y		Diatoms rare
100			2.5YR 5/4				Y		Reddish-brown staining associated with deeper stones. Diatoms rare
121							N		
			5Y5/2						Abundant diatom
A			2.5YR 5/4				N		Reddish brown staining associated with deeper stones. Sediment contains large (c. sand) clasts of (mica ?) clay, granite and angular quartz.
			5Y5/2	≠			N		
			2.5YR 5/4						
200			5Y5/2				Y		Diatom rare
211									Bottom of Core
									Inverse correlation between diatom abundance and carbonate (HCl reaction)

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CORE NO: 149/24 GC24 LOCATION: Prydz Fan LENGTH: 2.5 m

LAT: 66° 00.66' LONG: 71° 32.06' WATER DEPTH: 2,535

DATE: 22-3-95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles (Maximum)	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
Part C	0-1						*Nitzschia kerguelensis*	Light olive grey biosiliceous ooze with granule to pebble-sized clasts (sponge spicules) increasing w/ depth
	27-30		5Y5/2 Light olive grey	≠				N. kerguelensis dominated ooze at 0 - 18cm. Diatoms are sparse / absent below this depth
	59-60							cluster of granule / pebbles
70								
	89-90			≠				
100				⊔				
	109-110		10R4/6					Moderate reddish brown staining around angular black rock (~2cm)
	119-120							Mottled appearance increases from 115 to 153
								silt mottles, probably burrowed
	149-150		5Y5/2	⊔ ≠				
160								
				≠				Pocket of granule ~164 cm
	179-180		10Y4/2					silt
								Grey/ol olive bed
200			5Y5/2	J				Mottled up to 208
	207-210		5YR5/2	= =		wel sorted		Quartz sand-rich beds (Turbidites?) fining upwards hint of ripple-marks on the crooked surface Traces of shell frag, coal + other minerals Interbedded to bedded pale brown sandy clay, silt + pebbles
			5Y5/2	J				
250								Bottom of Core

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CORE NO: 149/25/GC25	LOCATION: Prydz Fan	LENGTH: 246 cm
LAT: -66° 18'	LONG: 71° 36.12 E	WATER DEPTH: 2010 m
DATE: 22-3-95	SHEET NO: 1.	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
0 (A?)	10-11		olive 5Y 5/3	≠				ooze massive; massive, olive, biosiliceous clay
	40-41			≠		Sub	Forams? Diatoms. A. [illegible]	Biosiliceous finesandy silt Massive. Pebbles to 1cm scattered massive. Pebble of red quartz fine sandstone, well rounded grains.
50								
66cm								
15cm	66-67		5Y 6/3 (2.5YR [illegible])	≠				mottled medium sandy silt Olive to red [illegible]. Massive Poorly sorted
(B)	100-101		Mottled 5Y/6/3, 5Y/5/1	≠				Mottled fine sandy silt. Mottled fine sandy silt
100								
116	118-119		2.5YR 5, 5YR/3	–				Patch of granules to [illegible] pebbles. One pebble of red quartzose ss. friable [illegible] material & hard [illegible]? Red mudstone
140	144-145		5Y 5/2	Massive				Massive sandy silt, Pebble to 5.5cm (Vein Qtz?)
156cm								
(C) 162			5Y 5/2	≠				massive silt (as above)
			5Y 5/2	≠				olive gy massive silt, traces v f. snd.
177			5Y 6/2					~~as above, sl. paler~~
178	186-187		5Y 6/2, 5YR 3/4	Intermixed colours / mottled				med sandy silt. mottled → red/green brn. scattered pebbles <1cm
200	200-201			≠				
217			5Y 6/2					v fine sand & clayey silt with sed. clast of red-brn clayey sand
223	235-236		10R 4/6, (5Y 6/2) (5YR 3/4)	≠			A. ingens	← patch of red clayey sand. red, olive, intermixed colours silt & traces vfs.
246								Base of core [illegible] at 246 cm

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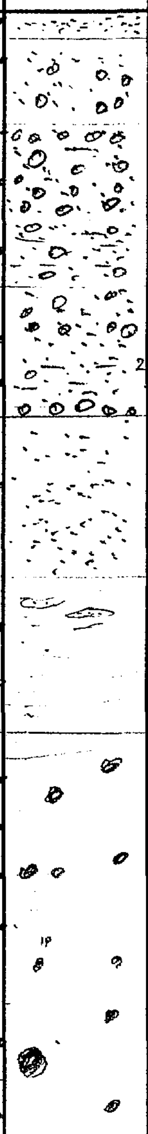
149/27

CORE NO: GC27	LOCATION: Prydz Fan	LENGTH: 236 cm
LAT:	LONG:	WATER DEPTH: 1200 m
DATE: 22/3/95	SHEET NO: 1	

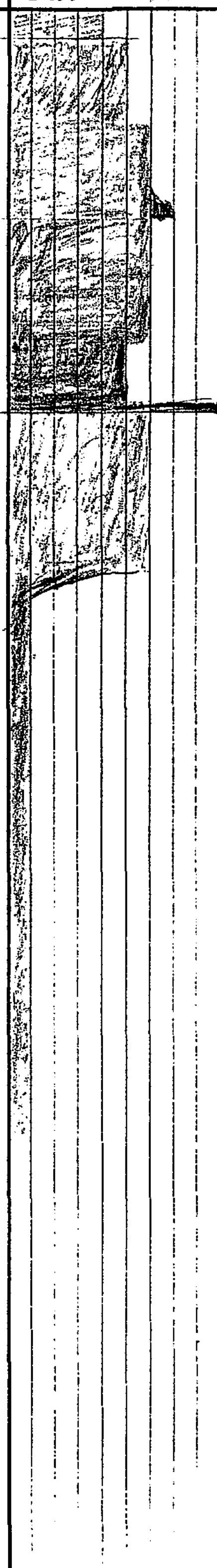
DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	DESCRIPTION/REMARKS
0 – 15cm	1-2	5Y6/2	Mott ≠	Mass[illegible] [illegible] to fine sand Diatomaceous
	11-12	Red patch 2.5Y4/4 Red 5Y6/2		Crudely bedded poorly sorted pebbly medium sand. Silty. Red patches on olive Red. Abundant black grains.
22	23/24, 35/36	5Y6/2, 2.5YR4/4		Crudely bedded silty coarse sand with pebbles to 2.5cm. Olive + reddish bed.
43				Lower part fines up from vc sand.
50	50/51	5Y6/2, 7.5YR4/4		Poorly sorted silty medium sand + 20% coarse sand & granules. Red[illegible]. Horizontal colour striping olive ⟷ Red.
58cm	69/70	5Y6/2	≠	Poorly sorted coarse sand [illegible] pebbles to 2cm.
70	79/80	2.5YR5/3, 5Y6/2	≠	Clayey medium sand. Red. Gravel to 4mm.
81 – 100	100/101	5Y6/2	Massive	Massive coarse sandy medium sand 10% black very coarse sand grains.
118	130/131	5Y5/2 ↓		Gradational ↓ Grey sandy clay with clayey sand patches. Gradational mottled ↓
	140/141	5Y3/2		Massive ≥ 10% sand (medium
150	160/161, 170/171, 180/181			Dark olive grey sandy clay with rare pebbles 5% fine sand. Pebbles to 2cm.
188	190/191	[illegible]		Sharp. Black massive fine sand [illegible]. Pebbles to 9cm [illegible].
200	215/216, 230/231			Green coloured sediment surrounding large pebble.
236				

Section labels in margin: C (upper), B (~100), A (~188).

VISUAL LOG



Mean Grain size: Clay, Silt, Very fine sand, Fine sand, Medium sand, Coarse sand, Very coarse sand, Pebbles



ROUNDING

FOSSILS

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CORE NO: 149/[illegible]/[illegible]28 LOCATION: Prydz Channel LENGTH: 1.52

LAT: -66° 43.69 LONG: 071° 46.47 WATER DEPTH: 527m.

DATE: 24/3/95 SHEET NO:

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
			5Y5/3	Disturbed		Ang	Forams	Biosiliceous, poorly sorted mud sand. Argose. some pebbles some pebbles
				?			Forams	Dark grey silty mud to sand passing down into
B			5Y4/1				Wood	fine sandy silt. Glass sponges scattered
							sponges	pebbles to
61								
			5Y4/1	?			Forams.	Dark grey silt, fine sand, rare sorted mud = 10% mud. Quartzose
	21-5 22-5 PQ							
A	1.11a 1.12a PQ		5Y2.5/1 Black	?			Forams	Clayey, pebbly medium (1/2 very compact) sand (diamict) with scattered pebbles
								could be a clast in adjoining sediments
				?			sponge spics Forams	Dark grey fine sandy silt
	147 148 PQ							
151								

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CORE NO: 149/30/29 LOCATION: Prydz channell LENGTH: 25cm

LAT: 66° 47.03' S LONG: 71° 47.49' WATER DEPTH: 515

DATE: 23-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	12/13		5GY 4/1	≠				massive, dk greenish gray mud w/ sand occ. lge pebble
25								no reaction to HCl

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CORE NO: 149/30/gc30 LOCATION: Prydz Channel LENGTH: ≈94 cm

LAT: 66°47'03 LONG: 71°41.48' WATER DEPTH: 575 m

DATE: 25-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
0cm	0-4 4-10		5Y 4/4	≠		ang	X	no foraams massive ol. brn biosilic fine sand grad. change over 3 cm
								massive olive gry pebbly fine sand with silty matrix
A	50		5Y 3/2	≠		ang	X	
	88					ang		becomes more silty towds base, + incr. in compaction. pebbly.
94							Hce / ☒ no reactr / ▩ reactr	

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CORE NO: 149/31/GC31 LOCATION: Prydz Channel LENGTH:

LAT: -65° 33.3 LONG: 77° 43.35 E WATER DEPTH: 512

DATE: 23-3-95 SHEET NO:

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
4.5cm	4-5		5Y6/2			N	forams	Poorly sorted diatomaceous silty fine sand.
10			5Y5/2			N		Poorly sorted diatomaceous silty v fine sand
15	11-12					N	Sponge Spic	Poorly sorted V coarse sand. 20% 35, 30 Lithics
			5Y5/2			N		Diatomaceous silty very fine sand ~5% medium to coarse sand grains common black sand grains.
	30-31							
A 40								
57			5Y5/2			N		Diatomaceous silty fine sand as above with blobs of grey clay up to 4 cm across silty in it. Sharp irregular base
			Blobs 2.5YN4					
70	66-67		2-5YN3					Massive compact v dark grey clay 20% v fine sand + scattered 1% coarse sand grains. Clay low compressive strength 1.25 kg/cm² compared to 0.1 kg/cm² for overlying fine sand Pebbles present.
	73-74cm							

0.1
1.25 kg/cm²

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CORE NO: 109/32/32 LOCATION: Prydz Bay Trough LENGTH: 132 cm

LAT: 66° 55.163' S LONG: 71° 50.767' E WATER DEPTH: 502 m

DATE: 23-5-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
0-5	0-3		5Y 5/2	≠				massive lt olive gry. diatomaceous clay + silt → v-f-s.
	10-11		10Y 4/2	≠				mass. grayish olive v-f sandy silt
			5Y 5/2	mottled				↓ sl. coarsens/incr in sand to mass., med olv-gy med sand : silt
B	39-42							
45			5Y 3/2 alt. 5Y 5/2	= = mottled ≠				alt. 5Y 3/2 ~ 5Y 5/2 — alt. v-f sandy silt and silty v-f sand. alt. mottled + weakly bedded
	70-71		5Y 3/2	mottled				massive grayish olive fine sandy silt
	90-91		5Y 5/2					massive lt olive gy silt : pebby horizon sharp. incd.
98								massive olive gy silty v-f sand heavily compacted
1m	110-111		5Y 3/2	≠				
	PQ	/EC						
132							benthic forams - calcareous.	

ROUNDING: ☒ no reaction ☒ reaction

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149/33/gc33

CORE NO: 149/33/gc33 LOCATION: Prydz Bay Fan LENGTH: 1870cm

LAT: 66° 42.87' LONG: 71° 21.92' WATER DEPTH: 834

DATE: 23-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	23					forams	massive, olive gy. med sand with silt
C	16		5Y 5/2	≠		forams	as above, but coarsens to v.f. sand base
117						forams	massive, lt. olive gy med sand ± silt
	29/30		5Y 5/2				occasional pebbly "layers" pbls <1cm
	59/60			≠			
57						no f'm	[grad. colour change over 4cm]
B	65		patchy 5YR 5/2	≠			mass mod. med to crs g, tg sand ± silt matrix
	79/80		mod brn 5YR 4/4				mottled red brn silt.
86						no f'm	[grad. colour at 2 cm]
	99/100		5Y 5/2	≠		no f'm	massive lt. olive gy silt, grading down into olive gy med crs sand
104.20							top 2 cm same as above
	114/5		5Y 5/2 and olive gy 5Y 4/2	≠ mottled		no f'm	massive, mottled, silt blue gy) with burrows of v.f. sand (5Y 4/1).
A			↓ 5Y 4/1			no f'm	dom. massive olive gy silt with occ. v.f. sand patches <1 cm
140							
	167/168		5Y 4/2 ↓ 5Y 4/1				massive olive gy silt with thin laminae of v.f. sand
							massive, intermixed silt & v.f.s.
188							
187.5	186/187		olive gy 5Y 3/2	mottled ≠		no forams	massive, olive gy silt., extensively reworked / burrowed v.f. sand.

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144/34/gc34

CORE NO: gc34 LOCATION: Prydz Bay Fan LENGTH: 108cm

LAT: 66° 39.91' S LONG: 71°12.38' E WATER DEPTH: 1215m

DATE: 23-3-95 SHEET NO: 1/1.

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	56		Holive gy.	≠			forams	massive silty med snd with occ. pebbles. bulk: 80% ang qtz 20% silt. traces coals
18		B	5Y 5/2				forams	massive, silty mat to crs sand.
20cm	20 21	3cm	"	≠				Sim. to above, but coarsens downwards into crs to v. crs. qtz sand. traces lignite
	40 41		"	≠				bulk: 90% qtz, 5% silt 5% dk minerals (pyrite/hblend)
50	53	A	10YR 4/2 dk yellowish brn	≠ mottled + burrows			Traces lignite	sharp contact massive, sl. burrowed, yl brn silt; bioturbated
			5YR 3/2					T burrows strongly burrowed horizon scm of strongly laminated alt. vfs + silt
	86 87		10YR 4/2 5YR 3/2					?clasts of dk rd brn crs sndy silt.
95			5YR 3/2					2cm - laminate silt + sand v f sand., mottled
100cm	99 100		sed. clast 10YR 2/2	≠				3cm - sed. clast.
108	107 108							mottled yl brn, increase silt.
								20cc sample at 104-105cm to PQty.

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35/gc35

CORE NO: 149/35/gc35 LOCATION: Prydz Fan LENGTH: 32 cm

LAT: 66° 35' S LONG: 71° 00 E WATER DEPTH: 1566 m

DATE: 24-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	0-1 4-5 7-8 12 17 30 31		5Y 5/2 ↑ ↓	≠ = ≠			no foram abundant forams	massive, v-f sandy silt. layer of coarse sand (qtz dom) massive med to crs. qtz sand with biosilic ooze matrix base v-f sandy silt.
32								base of core at 32 cm

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CORE NO: 149/34/GC36 LOCATION: Prydz Bay LENGTH:

LAT: -66 27.02 LONG: 070 34.50 WATER DEPTH: 2105m

DATE: SHEET NO:

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
B 13	6-7		5Y6/2 olive	≠		M	Diatoms	Clayey silt 5% very fine sand 2 small pebbles to 5mm Biosiliceous
			Olive					Fining up very fine sand with sandy silt some medium sand and coarse sand grains 5% max. size Faint bedding
			3Y6/6			N		
44	42-43		5Y7/2			N		Light grey silt, fine sandy. Very sharp
51	50-51		10YR/4/1			W	Diatoms	Very poorly sorted fine sandy clay ≈20% sand. Clays, Diamicton 5% (c-point) Very F Coal frags. (Lignitic friable) to 2mm Compact Ragged
A	50-52		Dark grey brown			M		Dark greenish brown fine sandy silt. Pebble 4cm. Coaly fragments 2mm Friable medium sand pellets or burrow subcircular 2cm in diameter, one 4mm
	66							
	86-87		10YR/6/2					Sand pellets are angular poorly sorted fine sand. Friable
94								

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CORE NO: 149/37/GC37 LOCATION: Storegg Bank LENGTH:

LAT: 67° 04·78 LONG: 66° 42·05 WATER DEPTH: 168m

DATE: 24-3-95 SHEET NO: 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	HCl	DESCRIPTION/REMARKS
A	B		5Y 5/2	≠		Sub Ang		H	Biosiliceous, poorly sorted fine sand 5% v sand grains + pebble 0·5cm. quartzose angular
			10Y 4/2	≠			Foram & fg sponge		Biosiliceous: fine sand
165			5Y 3/2	≠					massive, olive gn v·crs to pebbles rounded. with foram. sponge spicules, biosiliceous

buzzed core at 160·5cm

Sand is subrounded and quartzose

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CORE NO: 39GC38 LOCATION: Nielsen Valley LENGTH:

LAT: 67° 09.36' LONG: 65° 45.05 WATER DEPTH: 722m

DATE: 25-3-94 SHEET NO: 1/of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	0-1		5Y5/3 Light Olive	≠	N	Sponge Hyalonema Diatoms	light olive vfs/biosilicious ooze with 1-2cm drop-stones.
29	29-39 D						
46	C-14 44-45		Dark olive grey 5Y3/2	J	M		Dark olive grey fine silt with mottles.
55			5Y4/2				
	57-60 70-71		5Y4/2 5YR3/4 Moderate Brown	=	N		laminated (3-11cm thick) dark olive grey fine silt to clay quartz and moderate brown fine to medium gritty sand beds with organic matter
100	89-90			=	N		Faintly laminated to bedded dark olive grey silty clay with rare diatoms. Laminations are colour change only not grain size.
121	115-120 C						
	149-150			J			Mottled
	179-180			=	N	Rare diatoms	
200	209-210 B						
211							
	239-240			J	N		Mottled
	269-270			=			
292	291 A						
300							Bottom of Core

Clay
Silt
Very fine sand
Fine sand
Medium sand
Coarse sand
Very coarse sand
Pebbles

HCl test

149/39/GC39

GC39 was run at Station 39 with a 6 m core barrel in an attempt to obtain a >3m section of the sediments cored by GC38. The corer struck a garnet gneiss boulder about 30 cm below the sediments surface. The cutter went most of the way through the boulder which lodged firmly in the cutter, which split beyond repair. Sediment adhering to the boulder and cutter were bagged as a core cutter sample but the small amount of sediment above the boulder was washed off the deck by the water in the core barrel upon removal of the cutter and catcher from the barrel. The cutter and boulder are on display in the bar of the *R.S.V. Aurora Australis.*

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CORE NO: 149/39/SC40 LOCATION: Ninety East Ridge LENGTH:

LAT: 67° 09.88' LONG: 065° 44.96' WATER DEPTH: 620m.

DATE: 24/3/95 SHEET NO:

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	HCl Reaction	FOSSILS	DESCRIPTION/REMARKS
2	1-1		5Y 5/4 Olive	≠			No	Nitzschia curta? Thalassiosira oestrupii Sponge spicules	Very fine sandy biosiliceous ooze [illegible] Massive. Sand [illegible] Scattered sandy ash deposits. [illegible] sand grains.
31.5	29-30			≠					
	59-60		5Y 3/2 Olive grey	≠					
68	67-68								
Part A	C+14								
	70-71								Medium to coarse gravelly sand with grey mud & minor clay mineralogy (bulk ?)
100	89-90		5YR 4/1 Brownish grey	≠		Angular	No		
118	117-118								Bottom of Core

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CORE NO: 149/40/42 LOCATION: MacR. Shelf LENGTH: 25cc
LAT: 67°04.78' LONG: 64°35.67' WATER DEPTH: 345m
DATE: 26-5-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	0-1 4-5 9-10		5Y 4/4 5Y 3/2	≠			Nuculana curta shells frags	mass. olive brn fine sand sharp colour change bet 10-11 cm. mass olive gray fine sand 25cc.

HCR Coarse

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CORE NO: 149/41/43 LOCATION: MACR-Shelf LENGTH: 23cm

LAT: 66° 55.56' LONG: 64° 43.28' WATER DEPTH: 824m

DATE: 26-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	0-1		5Y 3/2	=			forams,	1cm. dk olive gy v fine sand
	4-5 9-10 19-20	pebble shell	5YR 3/2 5Y 3/2	≠			Notocochlea [illegible] Diatoms rare frequent	5cm coarsens downwards intermixed gybrn crs sand and olive gy v crs sand + pebbles
23								box core at 23cm

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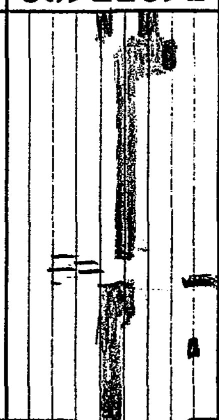
CORE NO: 149/42/~~44~~	LOCATION: MacRob. Shelf	LENGTH: 83 cm
LAT: 66° 49.42' S	LONG: 63° 56.80' E	WATER DEPTH: 364
DATE: 24-3-95	SHEET NO: 1/1	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
13–17	2-3		5Y 4/2	biota			living biota; very foss.	top 1cm = corals/bryozoans, med to crs sand
	16-17		5Y 5/2					weakly layered v. crs sand & pebbles
A	40-41							
53–56–59							v. foss	53-56cm weakly laminate silty fine sand
								56-59cm crs. sands, pebbly + fine sands
	70-71							
83	X forams ↑ 0-1cm, 4-5, 9-10 cm							Living biota (macrofauna corals, bryozoa etc in top 1cm)
								v. unsorted throughout - best described as a "carbonate rich diamicton"



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CORE NO: 149/43/gc45 LOCATION: Iceberg Alley LENGTH: 169cm

LAT: 66° 48.98' LONG: 63° 14.01' WATER DEPTH: 354m

DATE: 29-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	9-10		↑ 10Y 4/2 ↓	≠ mottling ≠ ≠		sa	Nitz. curta	No forams : ab. sponge spicules Massive greyish olive biosiliceous ooze + v. fine sand 30%
B								"
	60-61						Nitz. curta	
100			getting greyer darker	≠				Massive grey olive biosiliceous ooze + v. fine sand (30%)
A			10Y 4/2	≠ minor mottling				
	150-151			≠				
	164-165 / 168-169		N2 ↑ 5Y 3/2 ↓	= ≠			Nitz. curta	Massive olive grey v.f. quartz sand with mica, glauconite + pyrite. Thin laminae of black (coal ?)
169	C14							Foram samples at 164-165cm RQ.

Reaction with HCl Y/N

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CORE NO: 149/44/GC46 LOCATION: Ice berg Alley LENGTH: 257 cm

LAT: -66 54.25 LONG: 63 05.96 WATER DEPTH: 440m

DATE: 29/3/95 SHEET NO: 1 of 1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	20-21		5Y5/3				N. curta	Diatomaceous very fine sand becoming pale olive
C	66-68		5Y5/3					
80								
	90-91		5Y4/2					Fine sand & diatom ooze, silty
	115						N. curta	3 orangey Chaetoceros resting spore layers & dark grey layers ~3mm thick
								No clastics ooze
	125-126		5-14/2					Massive olive grey biosiliceous silty very fine sand
B	135							
	149-150		5Y4/2 2.5Y5/6					Interbedded very dark grey & olive grey fine sand & olivey brown beds all ~1cm thick
C14								Olive brown beds are Chaetoceros spore layers
	166-167							Black very sandy clay with pebbles ~20% fine to medium s.s. Pyrite
170	171							
	175-176		5Y3/1					silty v.f. sand. Burrows. Faintly bedded
	183							Black to grey clayey fine sand grading up into fine sandy clay Bedded. Burrows. Pebbles
	199							
	210-211		5Y3/2					Dark olive grey fine sandy silt with black burrow infills
			5Y3/1					Black with very dark olive grey silt Some mottling
	248-249							Black sandy clay. Faint mottling
257								Base of Core 257cm

Diatoms:

1. Abundant Chaetoceros spore layers @ ~12cm
2. 257cm Rocella naviculoides
   Actinoptychus undulatus
   Paralia architecturalis
   Stephanopyxis
   Thalassiosira oestrupii
   Thalassiosira insigna
   } Eocene
   } Upper Pliocene

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CORE NO: 149/45 /gc47 LOCATION: Iceberg Alley LENGTH: 165

LAT: 66° 48·98' LONG: 63° 14·01' WATER DEPTH: 354 m

DATE: 29-3-95 SHEET NO: 1/1

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
	1-10		5Y 3/2 → 5Y 4/4 → 10Y 4/2	≠ weak banding			No forams; Diatom cells frequent; Nitzschia curta	Massive moderate olive brown biosiliceous ooze • v.f quartz sand Fine laminations paler/darker olive brown
B	50-51			≠				
	75-77		5Y 3/2 → 10Y 4/2	≠				Gradual colour change over 4 cm Dark olive grey sandy silt 5Y 3/2
76							rare forams	Sharp colour change 1cm → 10Y 4/2
	96-97		5Y 3/2 5Y 4/4 5Y 3/2	≠ mottling ≠				Massive olive grey sandy silt Large patches (5cm) mud olive brown silt
1M	111-112		5GY 3/2 dark grey N3				bryozoan	Massive greyish black a greyish green
A	131-132		5Y 3/2			angular	rare forams	Sandier band Some pebbles 1-2 cm Massive greyish olive green sandy clay
	KA 160						Nitzschia curta	
165								Bottom of core 165cm

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CORE NO: 149/47GC48	LOCATION: Kerguelen Plateau	LENGTH:
LAT: 58° 31.0'	LONG: 81° 73.01	WATER DEPTH: 1,500
DATE: 8-4-95	SHEET NO: 1 of 2	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
Part F	5-6; 26-27; 34-35		2.5Y7/3; 5YR 7/2; 10YR6/2; 10YR 7/2				• abundant N. pachyderma. common Radiolaria; N. [illegible]	massive white to whitish-salmon nanno-foram-diatom chalky ooze; indistinct bane with inc. IRD (vfs size); 25 cm: [illegible]
38								
Part E	54-55; 75; 108-9		5YR7/2; 10YR 7/2; 5YR8/1					white to pinkish grey nannoforam ooze. IRD 38cm: [illegible]; Granite cobble (3cm); 70cm: [illegible]
126							• abundant N. pachyderma	
Part D	156-7; 200-201		5YR8/2; 5YR8/1; 5YR8/2; 5YR8/1; 5YR8/2; 5YR8/1; 5YR8/2; 5YR8/1					White nanno foram ooze
218							• abundant N. pachyderma.	
Part C	268-9; 307-8		10YR8/1; 10YR8/2					260 cm: T. vulcifera, [illegible]
308								

50
100
150
200
250
300

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CORE NO: 149/476C48 LOCATION: Kerguelen Plateau LENGTH:

LAT: 58° 31.0 LONG: 81° 73.01 WATER DEPTH: 1,500

DATE: 8-4-95 SHEET NO: 2 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
308								
350 Part B	358 g		10YR 8/1					
			10YR 7/2					IRD
398	397 g					• abundant		N. pachyderma; sig IRD: glass shards.
400			10YR 7/2					IRD
						• abundant		N. pachyderma, Radiolaria & IRD.
450	448 g		2.5Y 6/2					
489	488 g		10YR 8/1			• abundant		N. pachyderma + Radiolaria.
500								Bottom of Core

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CORE NO: 149/48GC49 LOCATION: Kerguelen Plateau LENGTH: 3.8m

LAT: 57° 36.2' LONG: 78° 18.1' WATER DEPTH: 1720

DATE: 7-4-96 SHEET NO: 1 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
Part E 21			7.5YR 7/3				Nitzschia spp.	Plnt nanno-foram ooze Part E Disturbed All scdz in ½ core only (No archive)
		Ok	10YR7/4 10YR8/1 (mix zone)	S S			A. ingens	>0.62 <1.25 Ma Burrow infilled with yo
42								<0.62 Ma >0.62 <1.25 Ma
50			2.5Y 8/3					White to pale yellow nanno-foram ooze
Part D		VOID	2.5Y 8/3 2.5Y 8/2 2.5Y 8/2	S				• Bulk = abundant N. pachyderma + lge diatoms + rare radiolaria
111								
150 Part C			5Y 8/1	S				White nanno-foram ooze
200	201						Nitzschia spp.	• abundant N. pachyderma, lge diatoms + rare radiolaria >1.2 <1.1
Part B				F				I120 (trace)
250			5Y 8/1	S				White nanno-foram ooze
				S			T. antarctica A. ingens N. kerguelensis N. pachyderma	>3.3 <3.5 Ma
291								
300								Continued on next page →

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CORE NO: 149/486C49 LOCATION: Kerguelen Plateau LENGTH: 3.8m

LAT: 57° 36.2' LONG: 78° 18.1' WATER DEPTH: 1,720

DATE: 7-4-95 SHEET NO: 2 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
291	← Sampled @ 2cm intervals →		5Y 8/1	F			No sub-sample ½ of core Core not split evenly due to settling. White nanno - Foram ooze minor IRD
300							
350							
						A. ingens N. dutertrei N. pachy	3.0 Ma 3.5 Ma
382							Bottom of Core

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115/22

CORE NO: 149/49 GC50	LOCATION: Kerguelen Plateau	LENGTH: 4.5m	
LAT: 57° 45.07′	LONG: 77° 32.06′	WATER DEPTH: 2,050	
DATE: 6-4-95	SHEET NO: 1 of 2		

DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	FOSSILS	DESCRIPTION/REMARKS
0 (Part E)	18-19	5YR8/4, 2.5Y6/3	J	• abundant N. pachyderma + common ly diatoms, + rads. Diatoms	Pink & light yellowish brown swirl 80% nanno silt/clay ~20% fine sand sized [illegible] forams w/ traces of IRD.
		2.5Y6/3			Light yellowish brown as above. Brown (clay?) infilling of foram tests.
50	65-6	2.5Y7/3	≠		Pale yellow
88	89-90	2.5Y6/4		• abundant N. pachyderma.	
92					>> 2<1.25 Ma [illegible]
100 (Part D)	94-5	2.5Y8/0		• abundant N. pachy	white nanno-foram ooze ~2.2 Ma, [illegible]
	131-132	2.5Y8/0	≠		IRD pocket
150		2.5Y7/0			Light grey
178	173-4			• abundant N. pachyderma.	
200 (Part C)	180-1	2.5Y N8/0	J	as above	White nanno-foram ooze
					large burrow
	229-30		≠		
250			J, ≠		
268					Continued on next page >
300					

Continued on next page >

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CORE NO: 149/49 GC50	LOCATION: Kerguelen Plateau	LENGTH: 4.5m
LAT: 57° 45.07'	LONG: 77° 32.06'	WATER DEPTH: 2,050
DATE: 6-4-94	SHEET NO: 2 of 2	

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
268	270–271		2.5Y N8/0	≠				~~• abundant N. pachyderma, common Rads & ab. d~~ a… white nanno - 8cm size
300 (Part B)								IRD pebbles
331.5	329–330						• abundant N. pachyderma.	- sharp colour boundary @ 331.5cm
	333–334		5Y 8/1	≠				massive, pl grey nanno-foram ooze - with inc. micro IRD.
350 / 358–362								
	380–381			≠				massive light gray calc (nanno-foram) ooze
400 (Part A)			5Y 7/1					pebble band ~ >2cm
								inc. in gravel >2mm) componant IRD.
448	438–439						• abundant N. pachyderma. ab diatoms s.s. portion IRD.	
450								Bottom of Core

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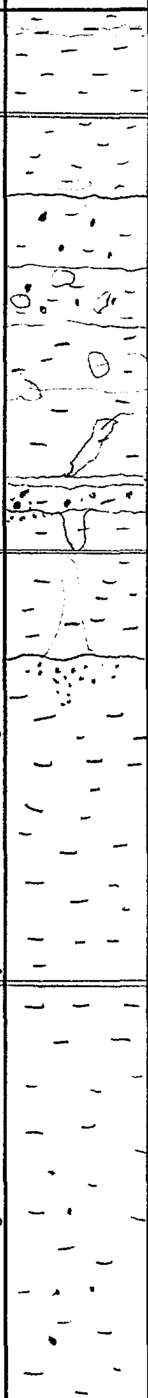
CORE NO: 149/50 GC51	LOCATION: Kerguelen Plateau	LENGTH: 4.7m
LAT: 57° 07.2'	LONG: 78° 27.2'	WATER DEPTH: 1,710
DATE: 5-4-95	SHEET NO: 1 of 2	



DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	FOSSILS	DESCRIPTION/REMARKS
Pt. F, 0–23	0-1	5Y7/4, 10YR8/4	≠	• abundant N. pachyderma – 30% dissolution. Nitzschia kerguelensis ooze <0.62Ma	faint, greenish layer. Very pale brown nanno-foram ooze, Forams dominated by N. Pachyderma
Part E, 23–113 (50, 100)	49-50; 99-100	10YR8/6; 2.5Y6/3; 2.5Y7/3; 2.5Y6/3; 2.5Y8/2; 2.5Y7/3; 2.5Y	≠; J; J; J; J		Nanno-foram ooze with scattered gravel (ice-rafted). Several gravel-sized lithics scattered throughout this layer. 40cm - N. kerguelensis dominant Actinocyclus ingens frequent >0.62<1.25 Ma. Higher gravel content here
Part D, 113–203 (150, 200)	149-150; 199-200	2.5Y7/2; 2.5Y 8/2	J; ≠	• abundant N. pachyderma + ~30% dissoln + Radiolaria	Light gray nanno-foram ooze. White nanno-foram ooze, massive. 203cm - A. ingens ..., Nitzschia ... frequent >1.25<3 Ma
Part C, 203–293 (250)	249-250	2.5Y 8/2	≠	• abundant N. pachyderma.	White, massive nanno-foram ooze (as above). Scattered gravel throughout.
293					Continued on other page →

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CORE NO: 149/50 GC51 LOCATION: Kerguelen Plateau LENGTH: 4.7m

LAT: 57° 07.2' LONG: 78° 27.2' WATER DEPTH: 1710

DATE: 5-4-95 SHEET NO: 2 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	Clay / Silt / Very fine sand / Fine sand / Medium sand / Coarse sand / Very coarse sand / Pebbles	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
293								
300	299 300		2.5Y 8/2 white	⊣				white, massive nanno-foram ooze.
							• abundant N. pachyderma; common reactidiaria.	
Part B	349 350		2.5Y 5/3	mottling.				Pebble ∴ IRD ~ 5cm.
350			2.5Y 6/3					massive, lt. yellow brn to lt. olive brn, nanno-foram 'chalk' ooze.
				⊣			• abundant N. pachyderma: Increased content of IRD vf sand - silt size.	
383			2.5Y 7/2					massive, major grade change.
							• abundant N. pachyderma, diatoms + traces of biotite, chert + plagioclase IRD (v.f. sand size).	
400	449 450		2.5Y 1/2	J				massive, bioturbated, light gray nanno-foram chalk/ooze.
Part A								Mottles
450	459-60			⊣				
	463-4							
473								Bottom of Core

Frozen sample to PG @ 459-460cm.

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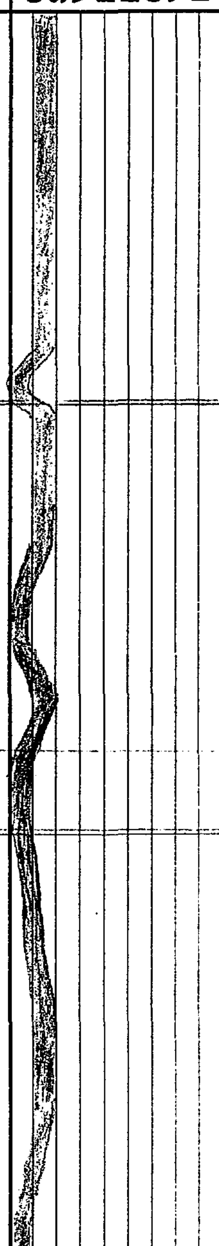
CORE NO: 149/51GC52	LOCATION: Kerguelen Plateau	LENGTH: 5.4m
LAT: 55° 45.19'	LONG: 76° 30.23'	WATER DEPTH: 2210m
DATE: 4-4-95	SHEET NO: 1 of 2	

Columns: DEPTH | SAMPLE | VISUAL LOG | COLOUR | SEDIMENTARY STRUCTURES | Clay, Silt, Very fine sand, Fine sand, Medium sand, Coarse sand, Very coarse sand, Pebbles | ROUNDING | FOSSILS | DESCRIPTION/REMARKS



DEPTH	SAMPLE	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
Part F	0-1 cm	10YR 7/3 very pale brown	≠	Y	Sponge, Plankton, forams	Very pale brown foram ooze (Ice-rafted pebble)
50	49-50	10YR 6/3 pale brown	J	Y		Pale brown foram ooze
		10YR 6/2	≠			Light brownish grey foram ooze
80		10YR 8/2		Y		white, fibrous layer ~1cm thick /degraded forams
100, Part E	99-100	10YR 6/2	≠	Y		Light brownish grey foram ooze planktonic forams well preserved in this layer
		10YR 8/2	J			Mottled bed, mottles of same
		10YR 6/2		Y		Degraded forams
150	149-150					– unconformity ? –
153	154-155 cm	10YR 8/1	J	Y	Nitzschia kerguelensis ...	white foram ooze (degraded forams)
170		10YR 7/2		Y		Light grey foram ooze
200, Part D	199-200 cm					
		10YR 6/2		Y		Light brown grey foram ooze
250	249-250 cm	10YR 8/2	J		Radiolaria + abundant Neogloboquadrina pachyderma.	Mottled bed /white foram ooze (degraded forams)
260						
300						

Continued overleaf →

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CORE NO: 149/51 GC 52 LOCATION: Kerguelen Plateau LENGTH: 5.4m

LAT: 55° 45.19 LONG: 76° 30.23 WATER DEPTH: 2,210m

DATE: 4-4-95 SHEET NO: 2 of 2

DEPTH	SAMPLE	VISUAL LOG	COLOUR	SEDIMENTARY STRUCTURES	ROUNDING	FOSSILS	DESCRIPTION/REMARKS
260			10YR 8/2 5/2				White Foram ooze Abundant N. Pachyderma Grey/ Brown layer Grain size changes may be due to relative abundance of nannoplankton component
300	300 -301		10YR 7/2 10YR 6/2 10YR 7/2				Mottled layer @ 300cm
	Part C		10YR 7/2 10YR 6/2				
350	348 -350		10YR 6/2 10YR 7/2				
400	397 -400		10YR 6/2 10YR 7/2 10YR 6/2 10YR 8/1 10YR 7/2		↓ This core is colourgram throughout & does not react with HCl vertically →		Gravel / Ice rafted material ? X-ray this core for the whole story.
	Part B						
450	449 -450		10YR 7/2 10YR 6/2				Gravel / coarse sand layer Unconformity ? N. kerguelensis, A. imgens >0.62 <1.25 Ma
500	499 -500		10YR 8/2				N. kerguelensis dominant. Actinocyclus ingens present >0.62 >1.25 Ma
	Part A						
	529 -530						Bottom of Core Abundant N. pachyderma, common G. bulloides.

Appendix 4.

Mac.Robertson Shelf/Trough Mouth Fan Samples

Patrick G. Quilty

The samples studied are biassed to those that seemed most likely to produce a non-modern fauna. Thus cores not listed here have not been examined.

Samples examined are generally from either core catcher or core cutter. They were washed, usually with a calgon spray, over a 125 micron sieve and given simple stereobinocular examination. Only a few such as that from the GC10 core catcher have been systematically and comprehensively examined and sampled.

Many samples contain what is essentially a modern fauna and it would be a relatively simple matter to relate them to the Prydz Bay associations recognised by Quilty (1985), the revision being performed by Dennis Franklin, and the faunas studied by Milam and Anderson (1981).

1. GC04

Two samples were washed, one from the base of the core and one from 51 cm above the base.

The sample from the base of the core was of the red sandstone. 12-15 gm were washed and yielded a large residue of clean, poorly sorted, apparently unimodal sand with grains to about 5 mm. Grains are almost uniformly angular, and include dominant quartz, abundant fresh feldspar, garnet and lithic fragments with rare ferromagnesians and some mica. There are rare rounded grains which are frosted suggesting a small aeolian content. It is barren of fossils. The red colour comes not from the material in the residue but from the matrix which washed out.

The sample from 51 cm above base is also from 12-15 gm but yielded a very small residue of clean, poorly sorted, angular quartz sand with subsidiary feldspar and garnet, ferromagnesians and mica. Fossil content is minor and includes fresh and broken and abraded sponge spicules, radiolaria, large diatoms, agglutinated foraminifera. Diatoms indicate that this is Late Pleistocene or younger (F.Taylor, pers. Comm., Appendix 5).

2. GC05

One large sample (50 gm?) was washed from the bottom of the core. It yielded a large residue of poorly sorted (grains to 12 mm in the residue) quartz sand with feldspar, lithic fragments, garnet etc. In addition there are very rare traces of carbonized wood and glauconite (?). Grains are angular but not as clear as similar sized grains in some other residues. Perhaps there has been minor rounding or frosting in the history. There are no obvious fossils. The sediment should be examined for reworked palynomorphs.

3. GC07

Two samples were processed, both from the core catcher. One was about 50 gm and the residue coarser than 125 microns. The other was larger and included only the fraction coarser than 250 micron in order to search for reworked foraminifera.

The large residue of the 125 micron sample consists of possibly bimodal sand. The coarser fraction consists of lithic fragments normally about 2 mm but up to 7-8 mm. These are between angular and subangular and are typical local Precambrian material. The dominant part of the residue is a moderately well-sorted angular sand of quartz, feldspar, garnet and traces of ferromagnesians and mica. There is a trace of glauconite, usually at the fine end of the size spectrum. There are rare, very well rounded and polished quartz grains.

Fossils include a foraminiferid fauna of modern species but with fine, delicate forms absent and the robust forms concentrated. Preservation is not very good with originally translucent walls turned dull white and some well burrowed. There are fresh, fine sponge spicules and broken and abraded coarse ones, rare bryozoans, echinoid spines, radiolaria and an ostracod.

The coarse residue is virtually identical, excluding the fine particles. It includes a few very large (to 20 mm) modern *Hyperammina*.

4. GC08

The terrigenous component is of fine/medium, well-sorted, angular, quartz sand. There is also a high biogenic component of both siliceous and calcareous forms. Sponge spicules, diatoms, radiolaria are common as are foraminifera (diverse and including a very significant planktonic component), bryozoans, bivalves, gastropods, serpulid worms (coiled and straight), ostracods, and minor echinoderms.

Diatoms and foraminifera present are modern.

5. GC09

The sample is from the core catcher.

Most of the sample is moderately sorted quartz/feldspar/garnet sand but with a few coarse lithic grains. Some grains show some evidence of rounding. Glauconite is present.

The biogenic component includes foraminifera, ostracods, echinoids, bryozoans, pteropods, radiolaria, sponge spicules and wood. The foraminiferid fauna is odd in containing abundant fissurine species. Much is a normal, diverse modern fauna, but *Globigerinatheka,* a Middle Eocene species, is present. It attests to a warm, normal marine salinity Eocene environment.

There are also small fragments of charcoalised wood but the specimens are very small. One of the larger lithic fragments is a brown mudstone with much larger fragments of wood and containing glauconite and is the type of lithology normally destroyed easily in processing. It is probably the source of the wood and glauconite.

There is a hint in the foraminiferid fauna that there are two modes of preservation but nothing definite has been detected in the faunas themselves. This observation is consistent with the idea of reworking or mixing indicated by the presence of wood and glauconite.

6. GC10

This sample yielded a small Paleocene calcareous foraminiferid fauna, the subject of a separate note. Two samples were processed and both through the 125 micron sieve. The first processed was a core sample and the second a cutter sample.

Each yielded a residue consisting of two parts, disaggregated sand and soft but coherent fragments of brown mudstone, some containing wood and/or glauconite. Some such fragments contain up to 20-30 % glauconite.

The residues both contain significant amounts of black charcoalised wood and bright green glauconite, sometimes in rounded pellets and sometimes in elongate 'books'.

The sand component of the residue is moderately to poorly sorted, dominantly angular quartz/garnet and feldspar is not so obvious. There are larger Precambrian lithic fragments. There are traces of ferromagnesians, mica and pyrite.

The core catcher sample was not searched systematically for foraminifera and has yielded only a few so far. It needs fuller attention back in Australia. The cutter sample gave the fauna studied so far.

In addition to the foraminifera, there are a few radiolaria that seem to be from the Paleocene rock.

Chips of the brown mudstone have been separated out for palynology and many others could be separated if needed.

Much work is indicated for this core.

Two samples have been taken for later processing. They are:

- 185-186 cm from top, and
- 218-219 cm.

The question is "Is this the same material as in the core cutter, or did the coring stop at the top of the formation?"

The reason for asking the quesion lies in the observation that the bottom part of the core consists of tough, dark brown mudstone matrix with pebbles to 8 cm diameter. Did the core catcher sample stop the core from proceeding further?

7. GC12

The cutter sample yielded only a clean, poorly sorted, angular quartz/feldspar/garnet residue with a few modern foraminiferids. It contains no evidence of admixture of older material other than a few coal fragments which may be reworked Tertiary sediments.

Particles size fraction greater than 1mm includes fragments of fine clayey sandstone which looks worth processing for palynology.

8. GC13

Unfortunately, the cutter was empty and only a small core catcher sample was available. It was black and during washing, much black material, probably finely comminuted carbon, washed out.

The residue is large, of poorly sorted quartz sand with 15-20% non quartz fraction. Fine grains are mostly angular but coarse grains are very well rounded and polished. Several percent of the residue is in the form of glauconite and charcoalised wood. In addition, there a brown pelletoid bodies (collophane?) and some glauconite is in the form of pellets. There is a significant amount of pyrite. There are rare fragments of bryozoans and some foraminifera. There is no reason to doubt that the calcareous remains are in place. Wood fragments are large enough and common enough to warrant study.

GC18

A single core cutter sample was examined. The coarse fraction (>1 mm) contains many angular lithic fragments including Precambrian and muddy sandstone suitable for palynology. This material provided the sample reported on elsewhere and initially thought to be wood. The 500 micron-1mm fraction issimilar to the + 1mm fraction. Rare radiolaria, foraminifera and sponge spicules are present. There is no evidence of anything pre-Pleistocene fossils but the sample might be suitable for palynology.

GC21

The sample is very dominantly terrigenous, consisting mostly poorly-sorted, medium to coarse, angular to subrounded sand grains. Some grains are frosted. Most grains are quartz but fresh feldspar, lithic fragments, garnet and ferromagnesians grains are present. Traces of coal and glauconite are present.

The fauna is almost entirely foraminifera but there are echinoid spines, sponge spicules and radiolaria. It is a very small fraction of the residue and dominated by *N. pachyderma.* Other important elements are similar to other faunas seen in other cores collected on this survey, such as *Angulogerina earlandi, Globocassidulina* spp. Some planktonic foraminifera show evidence of minor dissolution.

GC28

Three samples were studied, one above and one below the third which was interpreted to be a clast of firmer sediment. These residues should be studied more carefully in a search for reworked foraminifera. It probably is worth having a look for calcareous nannoplankton.

81.5-82.5 cm

The residue is dominanly of poorly-sorted, angular sand but with rare rounded and highly spherical grains suggesting some reworking. This is supported by the occasional grain of glauconite. The sand is the usual mixture of minerals typical of the area.

The biota is quite abundant and diverse, dominated by foraminifera, especially the planktonic *Neogloboquadrina pachyderma*, but with rare other species. There is an almost completely calcareous modern fauna but with a large broken *Lenticulina* that seems out of place, perhaps also consistent with reworking. Breakage is much more common than normal and may represent dissolution in part. Other elements of the fauna include sponge spicules (usually broken), echinoid spines (rare and sometimes partly dissolved), and radiolaria.

?clast

This sediment was much firmer and more sandy than the samples from above and below. The residue is dominantly a medium terrigenous sand with traces of coal and glauconite. Foraminifera are very rare and include *N. pachyderma* and a few benthics. The only other fossils consist of very rare radiolaria and broken sponge spicules.

147-148 cm

The small residue is dominated by sponge spicules in essentially pristine condition that give the appearance of being modern, which is not consistent with the sample coming from the bottom of the core. The terrigenous content is very dominantly well sorted, fine and angular but with a few coarse grains apparently from a different grain size range. The foraminiferid fauna is very much like that at 81.5-82.5 cm, even to the breakages/dissolution effects, but contains a significant number of agglutinated forms apparently missing from the higher fauna. Radiolaria are more abundant than in the higher fauna but still not very abundant. There are some brown organic fragments that are too abundant to be contaminants. Their source is unkown.

GC32

Foraminifera were reported in this sample by those working on it earlier. Diatoms indicate that the sediment is 190 Ka to 3 Ma old, and thus could be as old as Late Pliocene. The sample studied is from 124-125 cm and the residue coarser than 125 microns is very dominantly quartz sand, very poorly sorted but apparently unimodal. Grains are dominantly angular but grade through to very well rounded, including some that are frosted. There is a diverse array of heavy minerals and very rare fragments of glauconite, rare coal, and one fragment of brown organic matter.

The residue biota is dominated by foraminifera with *N. pachyderma* by far the dominant planktonic in a fauna which is about 50% planktonic. There are also echinoid spines, poorly preserved radiolaria, one fragment of bryozoan and some broken sponge spicules. No diatoms are obvious in the > 125 micron fraction. The benthic fauna is diverse but typically Antarctic, lacking *Ammoelphidiella*.

There is no evidence of reworking in the fauna but the fragment of glauconite is interesting in this regard and, with the coal, indicates that palynology is worth attempting.

GC34

The residue from 104-105 cm is barren of fossils and consists of poorly sorted medium to coarse sand, mostly angular but some grains are moderately well rounded.

GC36
The sample form 66 cm consists of moderately sorted medium sand, barren of fossils.

GC38
Two samples from the lower part of the core and one from the core cutter. The residues are very small but include agglutinated foraminifera as the only biota coarser than 125 microns. There is no carbonate. Is it possible that the CCD is shallower here?
140-141 cm
A minute residue with quite a nice little fauna of agglutinated species including several specimens of *Portatrochammina,* an *Haplophragmoides.*, and *Psammosphaera parva, Reophax fusiformis, R. scorpiurus,* and *Miliammina arenacea.*

287-288 cm
The residue is minute and very dominantly of angular quartz and garnet. A single modern looking *Portatrochammina* was seen.

Core catcher
A large residue of poorly sorted, angular, terrigenous sand with very rare sponge spongs spicules and radiolaria. No calcareous fossils were seen.

GC39
Core cutter sample
The residue is entirely of mineral matter with no fossil remains as such. It consists of poorly sorted, medium-coarse, angular sand. There is a trace of coal.

GC40
Core cutter sample
Residue consists almost entirely of terrigenous mineral matter, dominantly quartz but with feldspar and prominent garnet. Medium-coarse grained, poorly sorted, angular grains. Trace pyrite which appears to be detrital, not formed *in situ.* Exceedingly rare sponge spicule or radiolarian. No other fossils.

GC44
Core catcher sample
Most of the residue consists of the usual poorly sorted terrigenous sand but a significant proportion of the grains have some rounding and frosting. Some are highly rounded with a high sphericity. Traces of wood and glauconite suggest minor reworking and value for palynology.

The biota is very rich and diverse. It includes foraminifera (with *N. pachyderma* and large *Cibicides*), sponge spicules, common bryozoans, echinoderm fragments,

radiolaria, ostracods (some still articulated and worthy of study by a specialist), bivalves and serpulid worms.

GC45
The sample is from the outside of the core cutter.

It consists of a moderately well sorted sand dominated by angular terrigenous grains but with a few that are well rounded. Garnet and glauconite are abundant.

The glauconite is worth noting in some detail. Some is in the form of ovoid pellets and some in books. A significant portion is in the form of pseudomorphs after radiolaria (conical, spherical and flat discoid forms are clearly recognisable) and in some cases, the original skeleton is partially preserved, especially in the conical form. Others appear to be internal moulds of foraminifera.

There is enough to consider attempting a K/Ar date if the K content is high enough.

There is some wood, a few broken and rounded sponge spicules but whether or not they ar *in situ* is not clear. There are a few fragments of bone. There are brown pellets such as occur also in GC9/10 and may be collophane. A few beautiful pyritised radiolaria.

There are a few foraminifera (two planktonic specimens so far) and I have hopes of getting a result. *Globorotalia pseudomenardii* and *Globigerina* cf *pseudobulloides* suggest very strongly a Late Paleocene age.

The residue is very much like residues in Western Australia from the P4-P6b (latest Paleocene-earliest Eocene).

GC46
Two samples, one each from core catcher and core cutter were processed. They appear different from other samples in that they have a noteworthy mica content.

Core catcher
The residue is of well sorted, fine angular sand. It has a very low glauconite content and has mica. The foram fauna is different and more diverse and abundant but lacks planktonics. Radiolaria are much less common and wood is rare and small. There seems to be no collophane pellets. Boney material includes a rather spectacular small tooth which appears not to be fish (what is it?), and a chondrichthyan dermal ossicle.

The forma fauna includes *Asterigerina,* a discoid form that looks like *Sherbornina* (it could be a large radiolarian) and a mixed calcareous fauna that has not been encountered here before. Ther fauna includes a species, different from that in GC47, but probably part of the *Ammoelphidiella* plexus. The general appearance is of a Late Eocene-Early Miocene fauna but this is not based on identified species, only an impression.

The sample needs a great deal more home work.

GC47

A single core catcher sample was examined. It seemed to be from a nice coherent sample.

The coarse fraction (>1mm) is angular lithic fragments with modern looking bryozoans and a serpulid worm.

The 0.5-1mm fraction is angular mineral sand (quartz and garnet) accompanied by seemingly modern robust foram species, articulated ostracods, coiled serpulid worms etc.

The fine fraction (125-500 microns) is a mixture. It contains a modern foram fauna, a scolecodont, ostracods, sponge spicules in abundance, and an otolith (?), but it also contains older reworked forams including *Elphidium.* planktonic forms not seen before on this trip etc. *Elphidium* may be a predecessor of *Ammoelphidiella. Globigerina* thin walled, 4-5 chambers in last whorl, is as important as *N. pachyderma,* indicating a significantly older age than modern. , Fiona has found Pliocene diatoms. *Elphidium/Ammoelphidiella* may indicate older.

Glauconite and wood are present, the latter rare. This indicates some reworking.

KERGUELEN PLATEAU

GC48

Very small residue from white diatom ooze on core catcher. Washed very easily. Should have nannos. Dominantly radiolaria with IRD second, then forams (mainly *pachyderma/bulloides* minor but good, benthic fauna. Also large diatoms, echinoid spines, sponge spicules (different and more complex than those farther south), possibly acantharians. IRD angular to slightly rounded. One piece is dull yellowish brown 'glauconite'. Source?

Excellent sample for single specimen material for illustrations.

Appendix 5.

Initial observations and biostratigraphy of Anatarctic marine diatom assemblages (Prydz Bay, MacRobertson Shelf and Kerguelen Plateau).

Fiona Taylor

INTRODUCTION

The results below document the major marine diatom species observed in gravity cores obtained during Voyage 6 (marine science) of the RSV *Aurora Australis,* February - April 1995. No attempt has been made to quantify individual species at this stage, although dominant species have been noted. Biostratigraphy is based on the scheme presented by Harwood and Maruyama (1992).

METHODS

Approximately 1 g of sediment was collected from the top and bottom of all cores, and at various intervals along selected cores according to the presence of sediment boundaries. Water mount slides were prepared for initial species observations, with permanent mounts made later for a more thorough examination. Samples were placed in 200 mL beakers with approximately mL of H_2O_2 (30%) and allowed to stand for a minimum of 24 hours. The samples were then centrifuged at 2500 rpm for five minutes and rinsed with distilled water. This procedure was carried out three times to ensure the removal of salt crystals and any remaining H_2O_2. Samples were then diluted with 5 mL of distilled water and stored in 10 mL glass bottles.

Approximately two drops of each sample were further diluted in 5 mL distilled water and pipetted onto a heated microscope slide to dry. Slides were then mounted permanently in Norland optical adhesive and left to dry under a UV light for 15 minutes.

Abundance of diatom cells per sample were based on the below scale, at 400x magnification using a Zeiss standard light microscope:

Abundant - more than 1 cell observed per field of view (i.e. typical diatom ooze)
Common - one cell observed in every field of view
Frequent - one cell observed in every 5 fields of view
Rare - one cell encountered in every 5- 20 fields of view

RESULTS

Prydz Bay and MacRobertson Shelf

All cores are dominated by *Nitzschia curta* or *Nitzschia kerguelensis,* in association with the species *Nitzschia angulata, Nitzschia obliquecostata, Eucampia antarctica, Thalassiosira antarctica, Thalassiosira gracilis, Porosira glacialis, Porosira pseudodenticulata,* and *Actinocyclus actinochilus.*

Cell frustles tend to be well preserved and abundant, forming typical diatomaceous ooze at the top of all cores. Progressing down core, frustules commonly became more poorly preserved, occurring as broken fragments, and less frequent in abundance, or absent. Based on the absence of the extinct marker species *Actinocyclus ingens* (last occurrence 0.62 Ma) and *Hemidiscus karstenii* (last occurrence (0.195 Ma) (Harwood and Maruyama 1992), the majority of assemblages are Late Quaternary in age.

Evidence suggests that the following cores are older than Late Quaternary, or have undergone reworking:

149/10 GC10 (Nielson Basin)

Sediment samples contain the typical *N. curta* dominated ooze assemblage between 0 - 60 cm. Diatom frustules are rare and primarily preserved as fragments between 148 - 235 cm. Reworking is apparent at 185 cm and 235 cm (base of the core), with the *N. curta* assemblage occurring with Eocene species. Those identified were *Paralia sulcata* var. *crenulata,* and members of the genera *Hemiaulus* and *Stephanopyxis.* At 185 cm *Paralia sulcata* var. *crenulata* forms a common component of the assemblage.

149/22 GC22 (Prydz Trough Mouth Fan)

Nitzschia kerguelensis dominates the assemblage at 0 cm in a well preserved diatom ooze. This assemblage is also present at 93 cm and 184 cm with frustules being common to abundant, but poorly preserved and primarily occurring as fragments. No diatoms were observed at 275 cm (base of the core).

Rouxia (isopolica?) occurs commonly at 93 cm. This species was last observed by Harwood and Maruyama (1992) ca. 1.5 Ma. One frustule of the extinct species *Thalassiosira torokina* was also noted at 93 cm. Based on these observations GC22

, at 93 cm, is estimated to be >1.8 Ma (last occurrence of *T. torokina*) and <2.2 Ma (first appearance of *T. gracilis*) (Harwood and Maruyama 1992).

149/18 GC18 (Prydz Trough Mouth Fan)

Whole frustules and fragments of *Rouxia (isopolica?)* are frequently observed at 292 cm. Their presence was not noted at shallower core depths, or at the base of the core (305 cm). The presence of this species is probably due to reworking of the sediment.

149/32 GC32 (Prydz Channel)

Fragments of *Rouxia (isopolica?)* and *T. torokina* occur in samples from the the base of the core, suggesting a similar age to GC22 (> 1.8 <2.2 Ma). In the water mounted slide, *Hemidiscus karstenii* (last occurrence 0.195 Ma) was also noted. An unidentified, extinct species (*Denticula* ?) was frequently observed in GC22 at 93 cm, and again in GC23 (110 cm).

149/25 GC25 (Prydz Trough Mouth Fan)

The biostratigraphic marker species *Actinocyclus ingens* was observed at 246 cm (base of core), in an *N. kerguelensis* dominated assemblage. The presence of *A. ingens* indicates that the base of the core is >0.62 Ma, but <3.0 Ma (first appearance of *A. actinochilus*). The same unidentified species (*Denticula* ?) as observed in GC22 and GC23 was also noted at the base of GC25

149/34 GC34 (Prydz Trough Mouth Fan)

Sediment at 0 cm and 19 cm is dominated by *N. kerguelensis* in diatomaceous ooze. A single *T. torokina* frustule was observed at 20 cm(base of the core). Here frustules are poorly preserved, primarily occurring as fragments, and frequent in abundance. It is most likely that the *T. torokina* observed is due to reworking of the sediment as no other species were observed to support its belonging to the *N. kerguelensis* assemblage.

149/35 GC35 (Prydz Trough Mouth Fan)

Actinocyclus ingens, T. torokina and *Rouxia (isopolica?)* are present in the *N. kerguelensis* dominated ooze at 32 cm (base of core). These species suggest the core to be >1.8 Ma (last occurrence of *T. torokina)* and <3.1 Ma (first occurrence of *N. kerguelensis*).

149/44 GC46 (Iceberg Alley)

Bands of abundant, almost monospecific, *Chaetoceros* resting spores occur at 120 cm, below an otherwise *N. curta* dominated ooze. Similar bands are described by Leventer *et al.* (1993) in cores from Granite Harbour (McMurdo Sound), where they are suggested to have formed from the result of strong stabilisation of the upper water column. Jordan *et al.* (1991) also report the presence of *Chaetoceros* spore bands from continental shelf sediments around Antarctica.

149/44 GC46

The base of the core (257 cm) contains a poorly preserved flora in which frustules are frequent to rare in abundance. Eocene species such as *Rouxia naviculoides, Actinoptychus undulatus, Paralia architecturalis,* and members of the genus *Stephanopyxis* are present in the assemblage. Species commonly found in the Upper Pliocene are also observed (*Thalassiosira inura* and *T. insigna*), along with *N. curta* and *N. kerguelensis* fragments. The presence of such distinct assemblages suggests that the base of GC46 has undergone reworking.

Kerguelen Plateau

139/47 GC48

Samples from 25 cm are dominated by *N. kerguelensis.* Also common are *T. lentiginosa, T. gracilis,* and *A. actinochilus.* This assemblage is assigned to the *T. lentiginosa* Zone (<0.62 Ma) of Harwood and Maruyama (1992).

Nitzschia kerguelensis and *T. lentiginosa* dominated samples from 38 cm. *Actinocyclus ingens* is frequent in abundance. One *Hemidiscus karstenii* frustule was noted. This assemblage is estimated to be >0.62 Ma (based on the first occurrence of *A. ingens*) and <1.25 Ma (based on the absence of *Nitzschia barronii*).

Samples from 70 cm are dominated by *A. ingens,* in an assemblage otherwise similar to that observed at 38 cm. Fragments of *Thalassiosira elliptipora* were observed and the sample is therefore estimated to be >0.8 Ma (first appearance of *T. elliptipora*) and <1.25 Ma (based on the absence of *Nitzschia barronii*).

Sediment from the core catcher are dominated by *N. barronii.* The assemblage also contained *T. complicata, T. insigna, T. inura, T. striata, Actinocyclus dimorphus, N. interfrigidaria,* and fragments of *Rouxia* spp. This assemblage is assigned to the *T. insigna - T. vulnifica* Zone (3.1 Ma) of Harwood and Maruyama (1992).

149/48 GC49

Samples from 0 cm are dominated by *N. kerguelensis.* Also common are *Thalassiosira maculata, T. lentiginosa,* and *A. actinochilus.* Based on the absence of *A. ingens,* this sample is assigned to the *T. lentiginosa* Zone (<0.62 Ma) of Harwood and Maruyama (1992).

Samples from 43 cm and 115 cm are dominated by *N. kerguelensis.* Also present are *T. gracilis, T. lentiginosa, E. antarctica, A. actinochilus,* and *A. ingens.* These assemblages are assigned to the *A. ingens* Zone (>0.62 <0.8 Ma) of Harwood and Maruyama (1992).

Samples from the 201 cm are dominated by *A. ingens.* Also observed were *T. lentiginosa, N. curta, N. ritscheri, N. barronii,* and rare frustules of *N. kerguelensis.* This assemblage is estimated to be >1.25 Ma (first appearance of *N. barronii)* and <3.1 Ma (last appearance of *N. kerguelensis).*

Samples from 291 cm and 382 cm (base of core) were dominated by *A. ingens, N. barronii,* and *T. lentiginosa.* Other species observed were *T. lentiginosa, N. curta, Nitzschia praecurta,* and *Rouxia* spp.. This assemblage is estimated to be >3.0 Ma (approximate last occurrence of *N. praecurta**) and <3.5 Ma (last occurrence *N. curta).*

149/49 GC 50

At 93 cm *N. kerguelensis* dominated the diatomaceous ooze. *A. ingens* is frequent. Based on the presence of this species, and the absence of *N. barronii,* this sample is assigned to the *A. ingens* Zone (>0.62 <0.8 Ma) of Harwood and Maruyama (1992).

At 100 cm, *N. barronii, T. vulnifica,* and *A. ingens* were present. Also observed were *T. gracilis, T. lentiginosa, N, curta, N. ritscheri,* and *N. praecurta.* This sample is estimated to by approximately 2.2 Ma (last occurence of *T. vulnifica* and first appearance of *T. gracilis*), but the presence of *N. praecurta* suggests some reworking. This species last occurred 3.0 - 3.6 Ma

Samples from 178 cm are dominated to *A. ingens* and *T. lentiginosa.* Also observed were *T. lentiginosa, T. gracilis, T. elliptipora, T. vulnifica,* and *Rouxia* spp. This sample is also suspected of having undergone reworking due to the co-occurrence of *T. elliptipora* (>0.65 <1.6 Ma) and *T. vulnifica* (>2.2 <3.1 Ma).

* Harwood and Maruyama (1992) have published the last occurrence of *N. praecurta* as 3.6 Ma, however I have observed it in Harwood's refernces slides for ODP Hole 751 (2.2, 10cm), dated at approximately 3.0 Ma.

Sediment from the core catcher (~450 cm) were dominated by *N. kerguelensis, A. ingens,* and *T. lentiginosa.* Also present were *N. praecurta, Thalassiosira webbi, Thalassiosira vulnifica,* and *Rouxia* spp. This sample is assigned to the *T. insigna - T. vulnifica* "ab" Zone (2.5 - 3.1 Ma) Zone of Harwood and Maruyama (1992).

149/50 GC51

Sediment from the core surface (0 cm)is dominated by *N. kerguelensis,* in association with abundant *T. lentiginosa, T. maculata,* and *A. actinochilus.* This sample has been assigned to the *T. lentiginosa* Zone (<0.195 Ma) of Harwood and Maruyama (1992), based on the absence of the indicator species *Hemidiscus karstenii* and *A. ingens.*

Actinocyclus ingens occurs frequently observed at 40 cm, in association with an *N. kerguelensis* dominated assemblage similar to that at 0 cm. This assemblage is assigned to the *A. ingens* Zone (>0.62 <0.8 Ma) of Harwood and Maruyama (1992).

Nitzschia barronii is present at 203 cm. Other abundant species include *A. ingens, T. lentiginosa, N. kerguelensis,* and *N. ritscheri.* This sample is estimated to be older than 1.25 Ma (first occurrence of *N. barronii*) and younger than 3.1 Ma (last occurrence of *N. kerguelensis*).

The sample from the core catcher (~475 cm) is dominated by *N. barronii.* Other frequent species include *T. lentiginosa, Thalassiosira inura, Thalassiosira striata, Thalassiosira complicata,* and *Nitzschia interfrigidaria.* This assemblage is assigned to the *T. insigna - T. vulnifica* "ab" Zone (>2.5 <3.1 Ma) of Harwood and Maruyama (1992).

149/51 GC52

The entire length of the core is dominated by *N. kerguelensis* in well preserved diatom ooze. *Actinocyclus ingens* is present in frequent abundance at 499 cm and the core base (530 cm). Based on absence of *N. barronii,* these samples are assigned to the *A. ingens* Zone (>0.62<0.8 Ma) of Harwood and Maruyama (1992).

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Appendix 6.

Benthic foraminiferal assemblages of Mac.Robertson Shelf and Prydz Bay Fan areas, Eastern Antarctica: initial interpretations.

Patricia Wells

Method

Shipek grabs were deployed, together with CTD's at fifteen stations in the Nielsen Basin, MacRobertsons Shelf and Prydz Bay Trough Mouth Fan areas. Station locations are given in the grab descriptions below: CTD data is given in the Post-Cruise Report appendices. Where possible, material representative of the surface sediment layer was removed from the uppermost layers of the grabs. About 10 cc of sediment was washed through 125 µm sieves and oven dried. The whole sediment was picked for benthic forams >125 µm until 50-100 specimens were collected.

Shipboard species identification was by reference to Mackensen et al., (1990), Mackensen et al., (1993), Barker, (1960), and Echols, (1971).

Further, qualitative statistical analyses of the individual living, and dead assemblage in these grabs, and in associated gravity core tops, are in progress.

Results

Benthic foraminiferal faunas in fifteen Shipeck grab samples from the Nielsen Basin-MacRobertson Shelf, and Prydz Bay Fan areas of Eastern Antarctica contain three distinctive assemblages: two dominated by calcareous taxa and another dominated by arenaceous taxa. The former are dominated either by *Trifarina angulosa* and *Cibicides* spp., or by *Globocassidulina subglobosa*. The arenaceous assemblages are dominated by *Reophax* spp., *Hyperammina* spp., and/or *Trochammina* spp.

Calcareous assemblages dominated by *Trifarina angulosa* and *Cibicides* spp., are associated with a diverse calcareous fauna on the shelf and shelf slope, at water depths <650 m, in sandy substrates associated with moderate to high current action on the Mac.Robertson Shelf (GB04, GB05 and GB05X). A similar, *Trifarina angulosa*-dominated calcareous assemblage has been correlated with strong bottom currents and sandy sediments at the shelf break and on the uppermost continental slope in the eastern Weddell Sea (between 68° and 73°S) by Mackensen et al. (1990).

Calcareous assemblage dominated by *Globocassidulina subglobosa*, occur in very fine sands at shallow depths (<250 m) on the Mac.Robertson Shelf, in water temperatures of -1.4°C to -2.0°C (GB13, GB14). On the Prydz Channel Fan (GB09). In addition, *G. subglobosa* is the dominant benthic foram species occurring in low numbers in the radiolarian-dominated fauna in silty biosiliceous oozes, at water temperatures of 0°C, at ~2000 m (GB09).

Reophax-Trochammina dominated-assemblages occur in biosiliceous oozes at water depths >620 m in the Nielsen Basin (Mac.Robertson Shelf) in temperatures between

-1.8°C and -2.0°C (GB01, GB02, GB03, GB06, GB07 and GB08). These assemblages occur under areas of high surface productivity, in parts of the basin which are subject to low current action, and where the calcium carbonate compensation depth is above 1100 m. At similar depths and in similar substrates in the Weddell Sea, Mackensen et al. (1990) identified a benthic faunal assemblage dominated by *Bulimina aculeata*, and associated it with warm (> 0°C) Weddell Sea deep waters. This calcareous species does not occur in the Nielsen Basin grab samples, where water temperatures are lower, the sedimentation environment more sheltered.

In the Prydz Bay Fan and Channel areas, benthic foraminiferal faunas in GB10, GB11, GB12, are dominated by the arenaceous taxa *Hyperammina* and/or *Reophax*. The near-absence of calcareous forams at 1200 m in GB12 indicates the position of the CCD near 1200 m: the few specimens retrieved in GB11 and GB12 are most likely 'washed'/reworked.

References

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Echols, R.J., 1971 - *American Geophysical Union Antarctic Research Series,* 15, 93-168.
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Grab descriptions.

149/01/GB01

Nielsen Basin. 67°28'S; 64°21'E; 1100 m. Strong H_2S smell.
Amount: Full grab.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Very fine sand and biosiliceous ooze. 90% ooze, <5% quartz sand grains.
Associated biota: Diatoms, forams, sponge spicules, bryozoa, crab carapace.
>125µm fraction: 95% sponge spicules, 3% quartz grains, 2% diatoms, <1% forams. Traces of glauconite, and rounded and frosted quartz grains.
Forams > 125 µm: No planktonics. Benthic fauna dominated by arenaceous taxa: *Trochammina* spp., with *Miliammina arenacea* and *Haplophragmoides* sp. The few calcareous forms present include Miliolids and Rotalids.

149/05/GB02

Nielsen Basin. 67°16'S; 65°0'E; 805 m.
Amount: Half-full grab.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Unsorted pebbly, fine sand and biosiliceous ooze. 95% ooze; <5% quartz sand grains.
Associated biota: Forams, bryozoa, corals.
>125µm fraction: 93% quartz grains, 1% biotite, 1% lithic fragments and forams. Traces of glauconite, and rounded and frosted quartz grains.

Forams > 125 µm: Planktonics (*N. pachyderma*;) present, but rare. Benthics dominated by large arenaceous forms- *Reophax scorpiurus*, *Hyperammina* sp., *Alveolophragmium* sp., and agglutinate fragments, and attached forms on pebbles. Less numerous calcareous benthics include *Haplophragmoides* sp., *Bolivinita* sp., *Cibicides* sp. and *Pyrgo* sp.

149/06/GB03
Nielsen Basin. 66°55'87"; 64°56.25'E. 376m.
Amount: ~ 1 litre.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Fine sand and biosiliceous ooze, with minor organic matter. 90% quartz sand, with sig. calcareous component. Traces of biotite.
Associated biota: Corals, bryozoans, worms and forams.
>125µm fraction: 98% quartz grains, <1% forams. Traces of glauconite, and rounded and frosted quartz grains.
Forams > 125 µm: Planktonics (*N. pachyderma*) present. Benthics rare; dominantly arenaceous taxa: *Reophax* spp. (*R. scorpiurus, R. ovicula*), *Haplophragmoides* sp., *Trochammina* sp., *Psammosphaera fusca*. Calcareous benthics include *Cibicides* spp., *Trifarina angulosa*, *Ehrenbergina glabra*, *Globocassidulina subglobosa* and *Quinqueloculina* sp.

149/07/GB04
Slope off MacRobertsons Shelf. 66°50.7'S; 64°55.2'E. 643m.
Amount: Half a litre.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Mod. sorted, med. sand, and biosiliceous ooze. 95% clastics: med. to crs. quartz grains and fragments of biogenic calcite.
Associated biota: Echinoderm (starfish), coral, forams, molluscs, bryozoa, and ostracods.
>125µm fraction: Dominantly calcareous grits (~60%) and quartz (~40%).
Forams > 125 µm: Planktonics (*N. pachyderma*) abundant. Calcareous benthics co-dominated by *Trifarina angulosa* and *Cibicidoides* spp. Also present are *Pyrgo* sp., *Ehrenbergina glabra*, *Globocassidulina subglobosa, Pullenia* sp. and *Epistominella* sp., together with a few arenaceous taxa-*Trochammina* spp., *Haplophragmoides canariensis* and *Reophax* spp.

149/08/GB05
Storegg Bank. 67°5.1'S; 65°13.6'E. 130m.
Amount: ~3 litres.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Very fine to med. quartz sand, and biosiliceous ooze and carbonates.
Associated biota: Sponge spicules, forams and worms.
>125µm fraction: 85% quartz grains, 2% lithics, ~5% sponge spicules, ~5% forams.
Forams >125 µm: Dominantly calcareous benthics, co-dominated by *Trifarina angulosa* and *Cibicides* spp. *Fontbotia wuellerstorfi, Globocassidulina subglobosa, Pullenia* sp., *Ehrenbergina glabra* and Lagenids present, as well as *Trochammina* spp.,*Reophax scorpiurus, R. difflugiformis, Pseudobolivina antarctica, Miliammina arenacea* and *Haplophragmoides* sp.

149/09/GB5X
Nielsen Basin. 67°05.2S; 65°19.3'E. 388 m.
Amount: ~3 litres.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Very fine to med. quartz sand (dom.; 90%) and biosiliceous ooze and carbonates.
Associated biota: Sponge spicules, bryozoans, worms, forams, molluscs and ostracods.
>125µm fraction: 95% quartz grains, 1% biotite, 1% lithics, 1% sponge spicules, <2% forams.
Forams >125µm: Planktonics (*N. pachyderma*) common. Calcareous benthics include *Trifarina angulosa, Globocassidulina subglobosa, Ehrenbergina glabra, Lenticulina* sp., *Cibicides* spp. and Lagenids. Arenaceous benthics include*Trochammina* spp.,*Reophax scorpiurus, R. subdentaliniformis* and *Psammosphaera fusca.*

149/10/GB06
Nielsen Basin. 67°05.0'S; 65°27.9'E. 627 m.
Amount: ~ 5 litres.
Colour: Dark greyish olive; 10Y 4/2
Sediment: 98% biosiliceous ooze; <5% carbonates.
Associated biota: Dominantly sponges and diatoms, with rare forams.
>125µm fraction: 50% silicates (dom. sponge spicules), 40% quartz grains, 10% diatoms, <3% forams.
Forams > 125 µm: Rare *N. pachyderma.* Benthics dominantly arenaceous taxa, with *Reophax scorpiurus, R. fusiformis* and *Miliammina arenacea* dominants. *Hyperammina* sp., *Alveophragmium* sp. and *Haplophragmoides canariensis* present and rare *Trochammina* spp. Calcareous benthics rare.

149/12/GB07
MacRobertson Shelf. 76°06.7'S; 65°46.72'E. 626 m.
Amount: ~ 2 kg.
Colour: Dark greyish olive; 10Y 4/2
Sediment: Biosiliceous ooze (96%), with very fine sand (4% quartz grains and forams).
Associated biota: Sponge spicules (dominant), with forams, diatoms and worms.
>125µm fraction: 90% silica (sponge spicules), 5% quartz grains, ~5% diatoms and arenaceous forams.
Forams > 125 µm: Forams rare: dominantly arenaceous benthic taxa-*Reophax scorpiurus, Miliammina arenacea, Haplophragmoides* sp., *Hyperammina* sp. and *Trochammina* spp. No calcareous benthics. No planktonics.

149/13/GB08
MacRoberston Shelf. 67°05'S; 65°58.95'E. 413 m.
Amount: ~4 litres.
Colour: Dark grayish olive; 10Y 4/2
Sediment: 90% quartz grains, ~10% bio-ooze.
Associated biota: Forams, corals, mollusca, sponges.
>125µm: 95% quartz grains, ~5% diatoms, <3% forams.

Forams: Planktonics (*N. pachyderma*) present. Benthics dominantly arenaceous: dominated by large specimens of *Reophax scorpiurus, R. ovicula,* together with *Miliammina arenacea*, *Hyperammina* sp., *Haplophragmoides canariensis,*and *Trochammina* spp. Calcareous benthics include *Trifarina angulosa*, *Ehrenbergina glabra*, *Cibicides* spp. (many attached to sponges), *Pyrgo* sp., Miliolids and Lagenids.

149/16/GB09
Prydz Bay Trough Mouth Fan. 66°23.1'S; 73°11.1'E. 1960 m.
Amount: ~4 litres.
Colour: Light olive gray; 5Y 5/2
Sediment: Silt/biosiliceous ooze.
Associated biota: Radiolaria (dominant), sponge spicules, arenaceous foraminifera, .
>125µm fraction: 80% radiolaria, 20% quartz, <1% forams.
Forams > 125 µm: Planktonics (*N. pachyderma*) present. Benthic fauna dominated by *Globocassidulina subglobosa*. Rare *Reophax* spp. present.

149/18/GB10
Prydz Bay Trough Mouth Fan. 60° 36.0'S; 73°00.5'E; 1200 m.
Amount: ~2 kg.
Colour: Greyish olive; 10Y 4/2
Sediment: Unsorted, pebbly very fine sand (60% sand; 30% ooze).
Associated biota: Abundant radiolaria, foraminifera, sponges and (rare) ostracods.
>125µm fraction: 75% quartz, 10% biotite, 5% lithics, <1% forams, 10% radiolaria.
Forams > 125 µm: No planktonics. Benthic fauna co-dominated by arenaceous taxa: *Hyperammina* spp. and *Reophax* spp. Rare *Saccammina sphaerica*, *Oculosiphon linearis, Psammosiphonella discreta* and *Alveolophragmium scitulum.*

149/25/GB11
Prydz Bay Trough Mouth Fan. 66°18.0'S; 71°36.1'E; 2010 m.
Amount: ~ 30cc only (sediments were probably 'washed' during retrieval).
Colour: Light olive gray; 5Y 5/2
Sediment: Sandy silt (70% silt; 30% v. fine sand).
Associated biota: Dominantly radiolaria, with ostracods and arenaceous foraminifera.
>125µm fraction: 75% quartz; 10% lithics; 10% radiolaria; 5% forams.
Forams > 125 µm: Abundant planktonics (*N. pachyderma*). An abundant and diverse benthic fauna dominated *Reophax* spp. (*R. difflugiformis, R. distans, R. fusiformis)*, *Cyclammina* spp. and *Ammomarginulina foliacea* and *Alveophragmium* present, as well as typical 'deep-water' Indian Ocean intermediate water taxa: *Gyroidinoides soldanii, Laticarinina pauperata, Oridorsalis umbonatus, Bulimina aculeata* (all rare).

149/27/GB12
Prydz Channel. 66°34.1'S; 71°42.8'E; 1200 m.
Amount: ~ 50cc only (sediments were probably 'washed' during retrieval).
Colour: Light olive gray; 5Y 2/2
Sediment: Moderately sorted, fine to medium sands, with traces of silt, and some pebbles <1cm. 90% quartz; 6% biotite; 4% forams.
Associated biota: Foraminifera, radiolaria, rare sponge spicules and ostracods.

>125µm fraction: 90% quartz; 5% lithics and feldspars; 1% biotite; 2% forams. Traces of heavy minerals.
Forams > 125 µm: Planktonics (*N. pachyderma*) present. Arenaceous benthic taxa dominant-*Hyperammina/Rhabdammina* spp (dominant); *Reophax* spp., *R. spiculifer, Psammosiphonella discreta, Psammosphaera fusca, Alveophragmium* sp., and *Haplophragmoides* spp. present. Rare *Trifarina angulosa.*

149/37/GB13
Storegg Bank, MacRobertsons Shelf. 67°04.8'S; 66°42.1'E. 168 m.
Amount: Full grab.
Colour: Dusky yellow green; 5GY 5/2
Sediment: Very fine to fine sand (95% quartz; 5% bio-ooze; <1% foraminifera).
Associated biota: Foraminifera and rare sponge spicules, radiolaria and ostracods.
>125µm fraction: 92% angular quartz; 4% lithics: 2% heavy minerals: <1% foraminifera.
Forams > 125 µm: Planktonics present, but rare. Benthic fauna co-dominated by *Globosassidulina subglobosa* and *T. angulosa,* with rare *Ehrenbergina glabra,* Miliolids and Lagenids, and agglutinated fragments.

149/46/GB14
Iceberg Alley; MacRobertsons Shelf. 66°45.6'S; 63°09.9'E. 248 m.
Amount: ~ 2 litres.
Colour: Moderate olive brown; 5Y 4/4
Sediment: Fine sand. 90% quartz; ~5% lithics; ~5% bio-ooze; <1% foraminifera.
Associated biota: Foraminifera, bryozoa, sponge spicules, rare hydroids, ostracods and coral.
>125µm fraction: 95% quartz; 3% lithics; 1% each of bryozoa, forams.
Forams > 125 µm: Planktonics (*N. pachyderma*) common. Benthic fauna dominated by *Cibicides* spp. and *Globocassidulina subglobosa.* Also present (but rare) are *Pyrgo* sp., *Trifarina angulosa*, *Hyperammina* sp., *Haplophragmoides canariensis*, *Reophax difflugiformis, Psammosphaera fusca* and *Miliammina* sp.

Appendix 7.

Current Meter Deployments

The following deployment forms and figures give information on the location and mooring configurations for two current meters deployed on the continental slope about 120km NE of Mawson station, Antarctica. Recovery of the moorings is scheduled for January/February, 1996.

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Current Meter Deployment Form

Instr. Serial Number 11464 Data Storage Unit No. 7328

Sensor	Serial No.	Range		Checked by	Date
Temperature	11464	-2.6 to 5.4	°C	P. Harris	7-3-95
Conductivity	4405	0-77	mmho/cm	"	"
Pressure	N/A		psi	"	"
Transmissometer	608	25cm path		"	"
Compass	29102	360 ± 5	°	"	"
Rotor Counter	2145	1/2	revs/count	"	"

Pre-Deployment Checks

Main battery type: Alkaline 3332 Voltage: 7.54 Date: 7-3-95
Secondary battery type: 2x RS 536-555 Li Voltage: _____ Date: _____
Date/Time Switch On: 8/3/95 0900 hrs (GMT)/local/other _____
Sampling Interval: 60 minutes Transmissometer Path Blocked from: 1300 7-3-95 to 1400 7-3-95 hrs
= — (No. of Records) Check "O" ring: ✓ Check "C" Clamps: ✓ Check Zinc
Anodes: ✓ Check Case Alignment: ✓ Check Rotor Bearings: ✓ Acoustic Release
Type / Serial No.: Benthos 860A 200 Acoustic Release Frequency Code:
Release Code A Checked by: P. Harris Immediately On switch-on
Receive 11.5 Khz Transmit 12.0 Khz Records = 12 on 03.
Enable Code B

Deployment Checks

Name of Ship: [illegible] Cruise No.: 149 Location: Mac. Shelf
Check Rotor Play 0.1 - 0.5mm: ✓ Check Vane Assembly: ✓ Check RCM Cotter Pin: ✓
Check All Mooring Shackles Lock-Wired: ✓ Check Transmissometer Path Clear: ✓
Date/Time in Water: 11/3/95 1421 hrs (GMT)/local/other _____
Date/Time Mooring Complete: 11/3/95 1421 hrs (GMT)/local/other _____
Date/Time First Reading: 11/3/95 1500 hrs (GMT)/local/other _____
Latitude: 66 ° 55.58 Longitude: 64 ° 55.01 Water Depth 366m m
Geographic Setting: Nelson Basin Channel S.11
Other Instruments on this Mooring: _____
Sketch Mooring Set-up On the Back of this Page: ✓
Magnetic Deviation = 66° West

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Current Meter Deployment Form

Instr. Serial Number 11594 Data Storage Unit No. 7726

Sensor	Serial No.	Range		Checked by	Date
Temperature	1227	-2.6 to 5.6	°C	P. Harris	7-3-95
Conductivity	4502	0 - 74	mmho/cm	"	"
Pressure	N/A		psi	"	"
Transmissometer	N/A			"	"
Compass	20317	360 ± 5	°	"	"
Rotor Counter	2276	1/2	revs/count	"	"

Pre-Deployment Checks

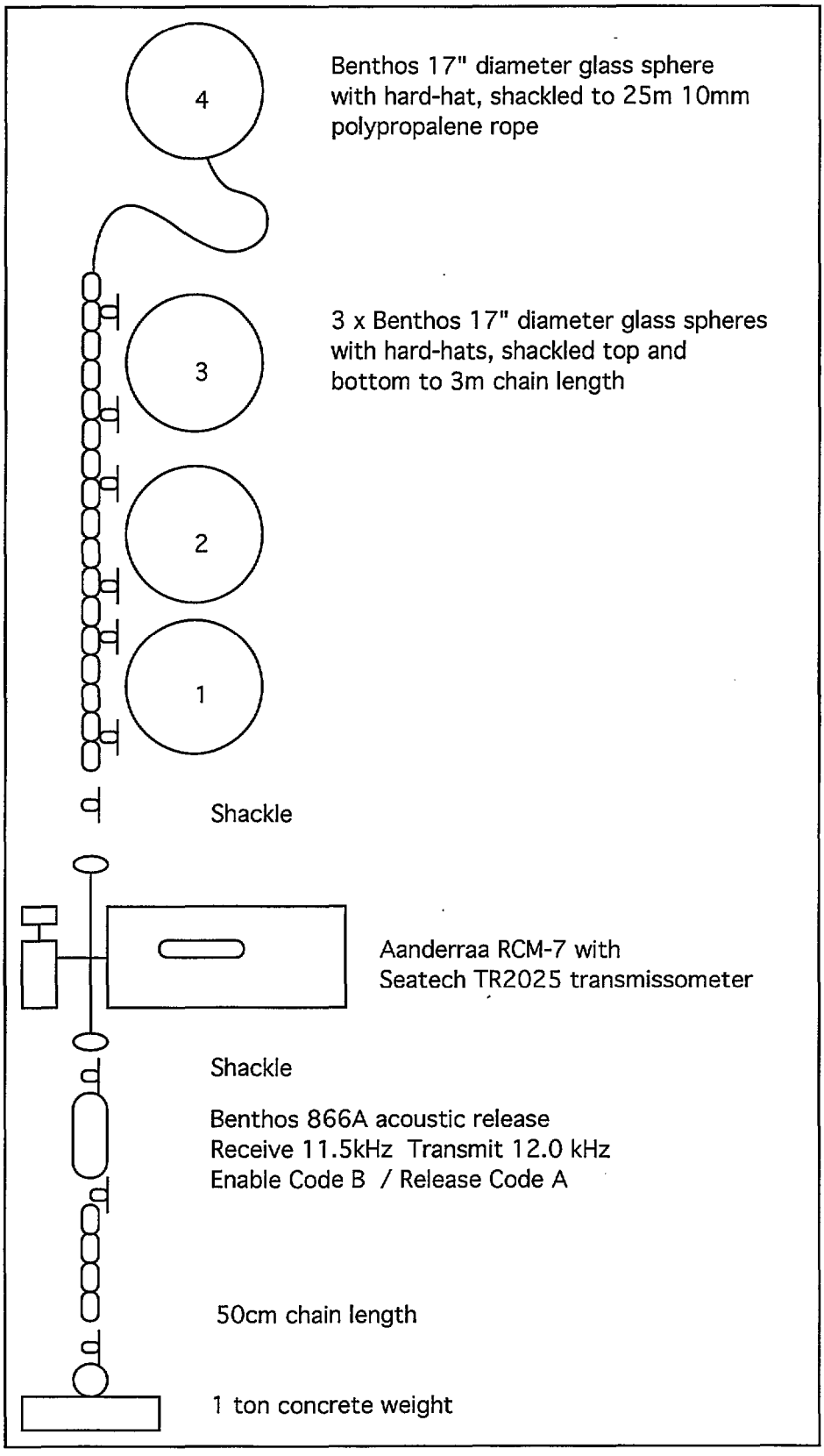
Main battery type: Andorra 3382 Voltage: 7.7 Date: 7-3-95
Secondary battery type: N/A Voltage: ____ Date: ____
Date/Time Switch On: 8/3/95 0900 hrs (GMT)/local/other ____
Sampling Interval: 20 minutes Transmissometer Path Blocked from: — to — hrs
= — (No. of Records) Check "O" ring: ✓ Check "C" Clamps: ✓ Check Zinc
Anodes: ✓ Check Case Alignment: ✓ Check Rotor Bearings: ✓ Acoustic Release
Type / Serial No.: Benthos 865A 212 Acoustic Release Frequency Code:
Release Code D Checked by: ____
Receive 11.0 kHz Transmit 12 kHz
Enable Code C

Immediately on switch-on Recorder = 12 on DSU

Deployment Checks

Name of Ship: Aurora Australis Cruise No.: 145 Location: Mac. Shelf/Slope
Check Rotor Play 0.1 - 0.5mm: ✓ Check Vane Assembly: ✓ Check RCM Cotter Pin: ✓
Check All Mooring Shackles Lock-Wired: ✓ Check Transmissometer Path Clear: —
Date/Time in Water: 11/3/95 1754 hrs (GMT)/local/other ____
Date/Time Mooring Complete: 11/3/95 1804 hrs (GMT)/local/other ____
Date/Time First Reading: 11/3/95 1820 hrs (GMT)/local/other ____
Latitude: 66 ° 51.22 Longitude: 64 ° 52.96 Water Depth 620 m
Geographic Setting: Cont. Slope off Mac. Shelf.
Other Instruments on this Mooring: —
Sketch Mooring Set-up On the Back of this Page: ___

CM 11464
66° 55.58'S 64° 55.01'E
Depth = 366m



CM 11594
66° 51.22'S 64° 22.96'E
Depth = 620m