POST CRUISE REPORT - PRYDZ BAY & MAC. ROBERTSON SHELF, ANTARCTICA, JANUARY-MARCH, 1993

by
P E O'Brien, D Franklin & M O'Loughlin

Record 1993/78

AGSO
AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

1993/78

POST CRUISE REPORT- PRYDZ BAY & MAC. ROBERTSON SHELF, ANTARCTICA, JANUARY-MARCH, 1993

P.E. O'BRIEN[1], D.FRANKLIN [2] & M. O'LOUGHLIN[3]

[1] Australian Geological Survey Organisation and Co-operative Research Centre for Antarctic and Southern Ocean Environments.
[2] Co-operative Research Centre for Antarctica and Southern Ocean
[3] Museum of Victoria.

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. Michael Lee, MP
Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Harvey Jacka

ISSN: 1039-0073

ISBN: 0 642 19814 4

CONTENTS

	Page
INTRODUCTION	4
GRAB SAMPLES	12
CORE SITES	27
SITES THAT DID NOT RETURN SAMPLES	33
REFERENCES	34
APPENDIX A	35
APPENDIX B	36

INTRODUCTION

The Natural Variability Sub-program of the Co-operative Research Centre for Antarctic and Southern Ocean Environments aims to study past environmental change by examining ice core and sedimentary records in Antarctica and the Southern Ocean. As the first stage in marine sedimentological studies, Voyage 7 of the Australian National Antarctic Research Expeditions (ANARE) 1992/1993 shipping season included a geoscience program comprising echo sounder traverses, gravity coring and grab sampling of the Antarctic continental shelf and slope on the Mac. Robertson Shelf and in Prydz Bay. This record describes the preliminary results of the voyage and presents location information for core and grab samples and preliminary descriptions of grab samples and lists of subsamples taken by associated research programs.

Study area

Prydz Bay and the Mac.Robertson Shelf are part of the East Antarctic continental shelf between Longitudes 60o E and 80o E (Fig. 1). Prydz Bay is the discharge area of a major ice drainage system, the Lambert Glacier, and the Mac. Robertson Shelf is an area of complex shelf topography with deep basins and areas of calcareous sediments. Major morphological features of the continental shelf are shown in Figure 1 after Quilty (1985). A detailed rationale for the sampling program, including a deglaciation model for Prydz Bay, is set out in O'Brien (1992). Grab samples were taken to give a picture of modern sedimentation patterns in the area and to assess the suitability of sites for gravity coring.

The choice of Prydz Bay and the Mac. Robertsonland continental shelf for this first stage of CRC Antarctic marine geoscience activities stems from:

(i) the proximity to the Amery Ice Shelf.

(ii) the presence of deep basins nearshore on the Mac. Robertson Shelf.

(iii) the availability of an extensive data set that defines suitable successful sampling sites on the shelf and upper slope.

Prydz Bay is a re-entrant in the Antarctic coastline that overlies a sedimentary basin, the Prydz Bay Basin (Fig. 1; Stagg, 1985). This structure is occupied by the Amery Ice Shelf -Lambert Glacier ice drainage system, which drains up to 1.09 million km^2, or about 22% of the East Antarctic ice sheet (Allison, 1979). The 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 features on these bedrock features and sedimentary or morphological evidence at the downstream end of the Lambert Glacier-Amery Ice Shelf system in Prydz Bay. During Cainozoic glacial episodes, the Amery Ice Shelf probably advanced across Prydz Bay to the shelf edge (Cooper & others, 1991, Hambrey & others, 1991). Therefore, the study of the sediments and morphology of the continental shelf in Prydz Bay will enable better modelling of the East Antarctic ice sheet.

In contrast to Prydz Bay, the Mac. Robertson shelf to the west of the Amery Ice Shelf is underlain by crystalline basement at shallow depth. This results in rugged topography. It has been suggested that the area has not suffered extreme glacial erosion because the ice sheet adjacent to the Mac. Robertson shelf has diverging flow lines so that ice may not have advanced far across the shelf during glacial maxima (Domack, pers. comm. 1990). On the nearshore part of this rugged shelf are deep coast-parallel topographic basins that are deep enough for sediments on their floors to be undisturded by iceberg keels. Such sites could provide a detailed palaeoclimate record for comparison with ice cores and Antarctic lakes.

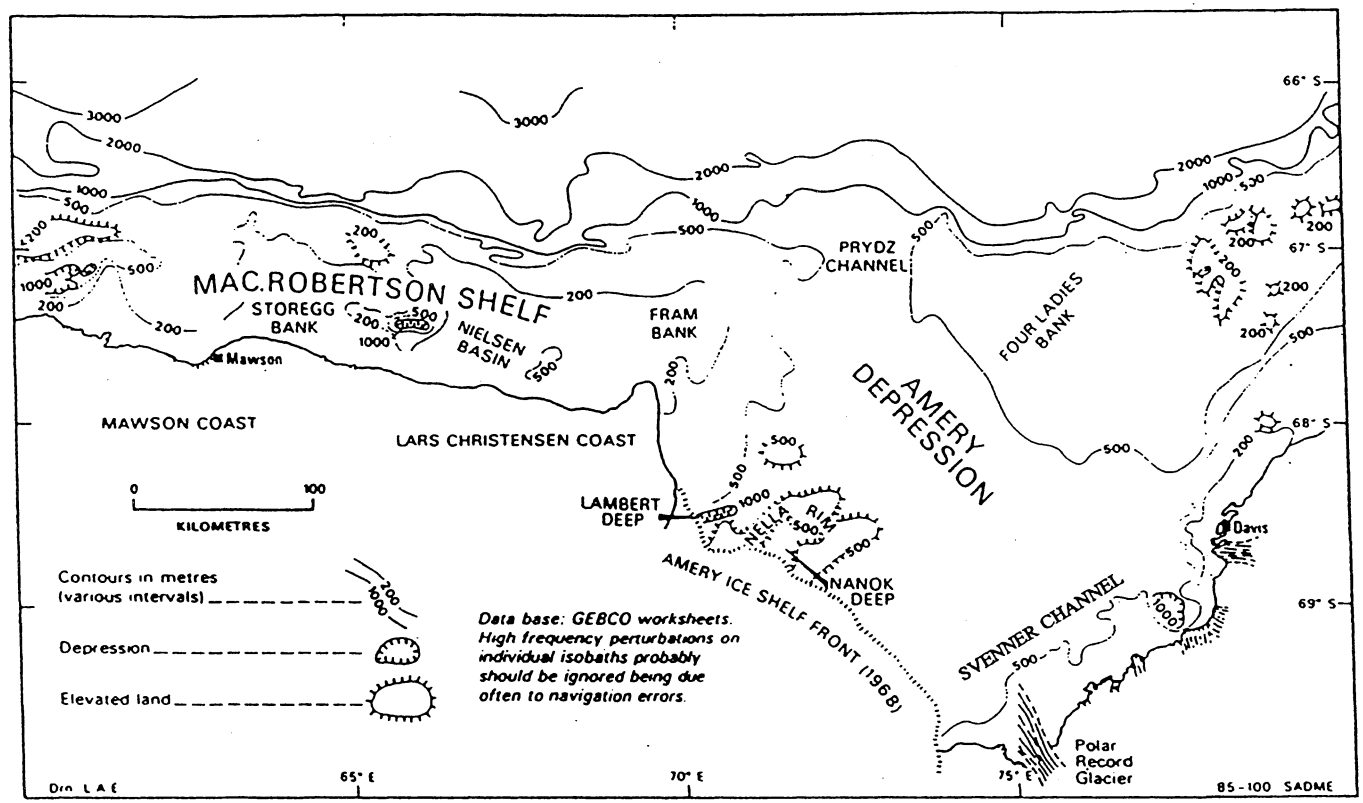

FIGURE 1. Bathymetry and location names in Prydz Bay and the Mac. Robertson Shelf after Quilty (1985).

Pre-Existing Data

Seismic Data - Prydz Bay and the Mac. Robertson shelf have received 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 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 along a systematic grid (Stagg, 1985). Russian and Japanese expeditions have also obtained multichannel seismic data in the area. An additional line was shot by the Ocean Drilling Program (ODP) in 1988 to aid siting of ODP holes 739 to 743 that were situated on line PB-021 of the ANARE/BMR survey (Barron & others, 1989). Since 1990, ANARE cruises by the R.S.V. *Aurora Australis* have collected 12, 35 and 120 kHz echo sounder records.

Sediment Sampling- Only a few sediment samples were collected from the region prior to the 1982 marine geoscience cruise, firstly by H.M.S. Challenger in 1873 (Murray & Renard, 1891), then by the Soviet Marine Antarctic Expedition in from 1955 to 1957 (Litzin, 1960). McLeod & others, (1966) describe a few samples from the approaches to Mawson Station. The 1982 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 (Fig. 2; Quilty, 1985). Ocean Drilling Program Leg 119 drilled five holes up to 486m deep in a transect across Prydz Bay (Fig. 3). These holes were drilled using conventional rotary techniques because the ODP piston coring equipment could not penetrate the glaciomarine diamictites encountered. Consequently, the Quaternary sediments obtained were badly disturbed (Barron & others, 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.

Of particular importance is the Holocene section in ODP Hole 740A. Domack & others (1991b) identified a clay interval interbedded with diatomaceous ooze. They interpreted the silt as representing deposition beneath an expanded the Amery Ice Shelf. They argue from C-14 dates that this expansion took place during the Holocene warm phase around 7000 yrs BP. Similar Holocene stratigraphy around East Antarctica led Domack & others, (1991a) to conclude that east Antarctic outlet glaciers expanded during past warm periods.

Methods

The R.S.V. Aurora Australis is equiped with Differential GPS navigation system and 12, 36 and 120 kHz echo sounders. Bathymetry is recorded from the 12 kHz and stored on the data logging system against date and Greenwich Mean Time and Latitude and Longitude. Depths were mostly calculated using a seawater sonic velocity of 1500 m/sec. The ship's track is shown in Figure 3, grab sites in Figure 4 and core locations in Figure 5.

Grab samples were taken using two galvanised steel Van Veen grabs built by the Engineering Services Unit, Australian Geological Survey Organisation. Each grab weighs about 80 kg and has a gape of 0.56 m by 0.45 m. They were deployed on the 6 mm diameter wire on the hydrological winch in the CTD room of the R.S.V. Aurora Australis. The grabs were stored at the Antarctic Division Store on completion of the voyage. A set of operating and safety instructions are included as Appendix B of this record. The success of these grabs compared to those used by previous programs in the area probably stems from their large size and weight allowing them to take a better

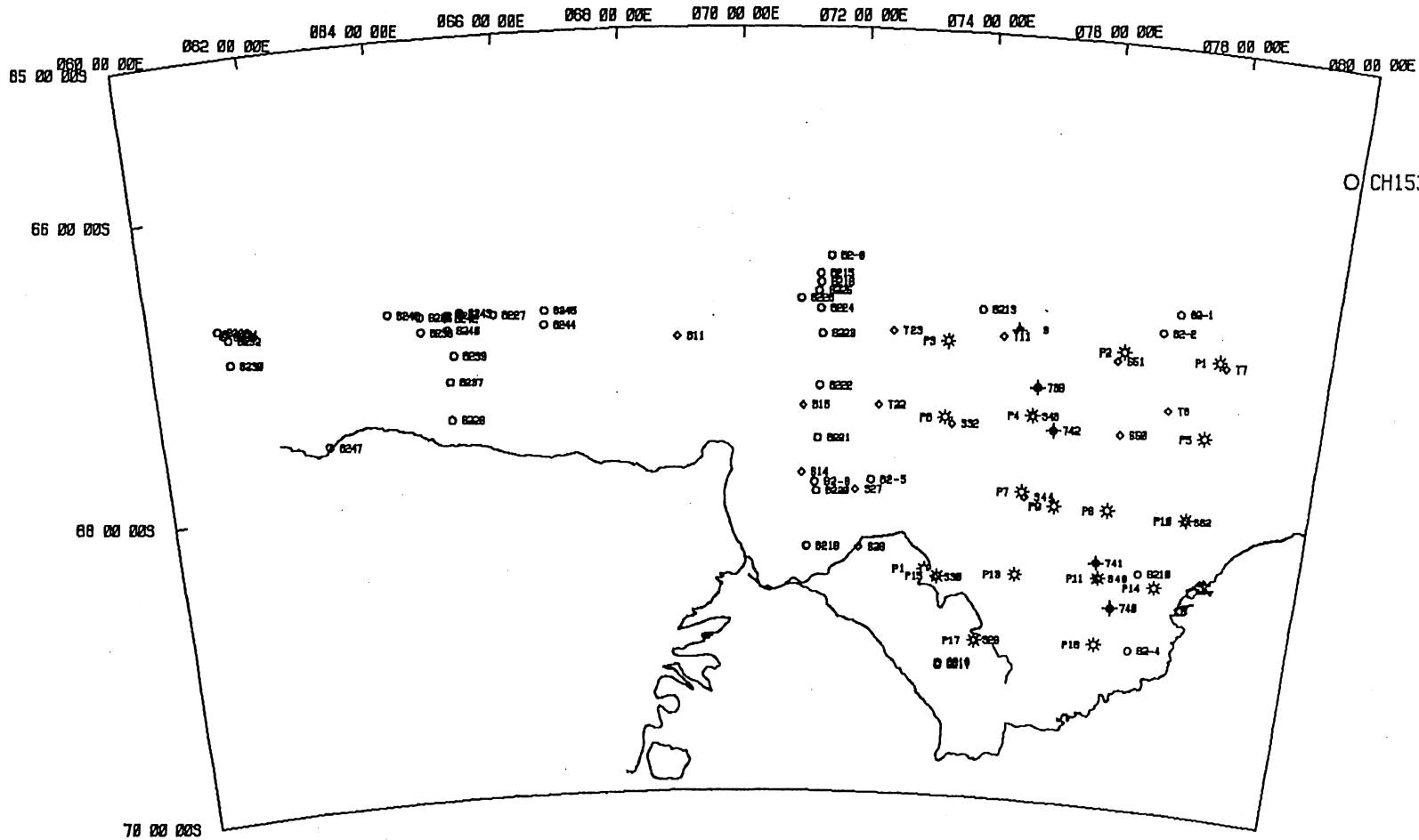

FIGURE 2. Bottom samples from Prydz Bay and adjacent areas. Sample sets are as follows:
CH153 - HMS Challenger, 1874.
82-1 to 8244 - ANARE/BMR 1982 (Quilty, 1985)
S1 to S62 and T7 to T23 -ANARE 1990 (Franklin, 1991)
P1 to P17 - ANARE bottom photos (Quilty, pers comm., 1991)
739 to 743 - ODP holes (Barron, Larsen & others, 1989).

"bite" of the sea floor. Care was also taken to ensure the jaws sealed well to prevent washing away of fines during ascent.

Sediment samples were treated as follows:

1. If the sample was large enough, small (about 100 ml) subsamples were taken of the sediment surface for investigations of live foraminiferal populations. From each grab, one sample was preserved in formalin and one frozen.

2. Two bulk sediment samples of about 500 ml. were placed in plastic bags, sealed and stored at 4°C.

3. One small sample was placed in a vial for shipboard description of particle size which is reproted here.

4. The remaining sample was washed through sieves of 10 mm, 4 mm, 1 mm and 0.5 mm diameter to extract benthic organisms. Clasts greater than 4 mm were retained.

Shipboard description consisted of recording the colour using a Munsell colour chart, examination under binocular microscope and visual estimates of percentages retained on 300, 250, 125 and 63 μm sieves. Some samples were prepared as smear slides and examined under transmitted light using both biological and petrographic microscopes. Pebble counts of 50 to 100 granules and pebbles were made on samples with a substantial coarse fraction.

Coring was carried out using an 8cm diameter gravity corer constructed by AGSO. Core barrels 6 meters long were used for most sites but in areas of hard bottom, barrels 3 meters long were used and found to be less prone to bending. The corer weighed 1100kg when a 6 m barrel was used. It was deployed using the 20 mm starboard trawl wire on Aurora Australis using a cradle designed and constructed by AGSO Engineering Services Unit. The core cutters were case hardened steel. The presence of hard boulders at many coring sites resulted in considerable flaking of the case hardening. This material represents a significant source of potential chemical contaminants in some cores. Coring equipment was stored at Antarctic Division, Kingston on completion of the voyage.

The cores were stored by removing the PVC liners and cutting them into lengths, usually 1 meter, and the segment ends sealed. Cores were stored at 4°C. Cores will be stored at the Antarctic CRC, University of Tasmania and AGSO marine program core repository. Core 34 was split and sampled on recovery because of the special requirements of the program for which it was collected. Core logs and descriptions will be published later. An additional source of sediment samples was the epi benthic sled designed to sample benthic organisms for another program. It returned pebbles and boulders from some sites and fine sediment from others.

Sample Numbering and Location Information

The initial sample numbering is based on Antarctic Division marine science Data Logging System conventions. Samples are labelled as follows:

Voyage acronym/Station/Sample number

The voyage is designated by the acronym KROCK, denoting Krill and ROCKs, indicating krill biology and geoscience as the two voyage determining programs. Station number is an unique integer defined for each station occupied during the voyage and the grab number given by the prefix Gr, for grab, and an integer. No grab number was

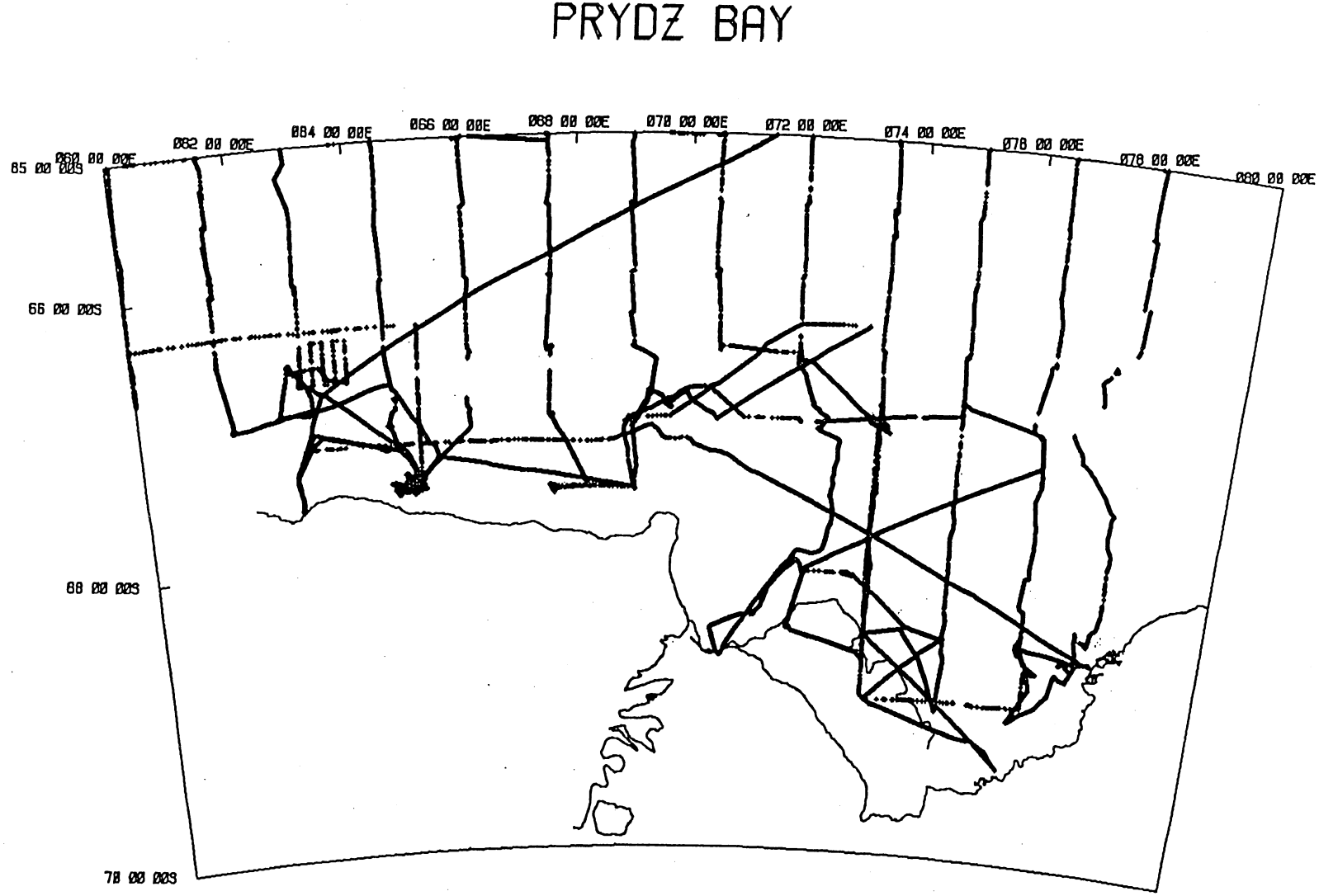

FIGURE 3. Ship's track for Voyage 7, 1993.

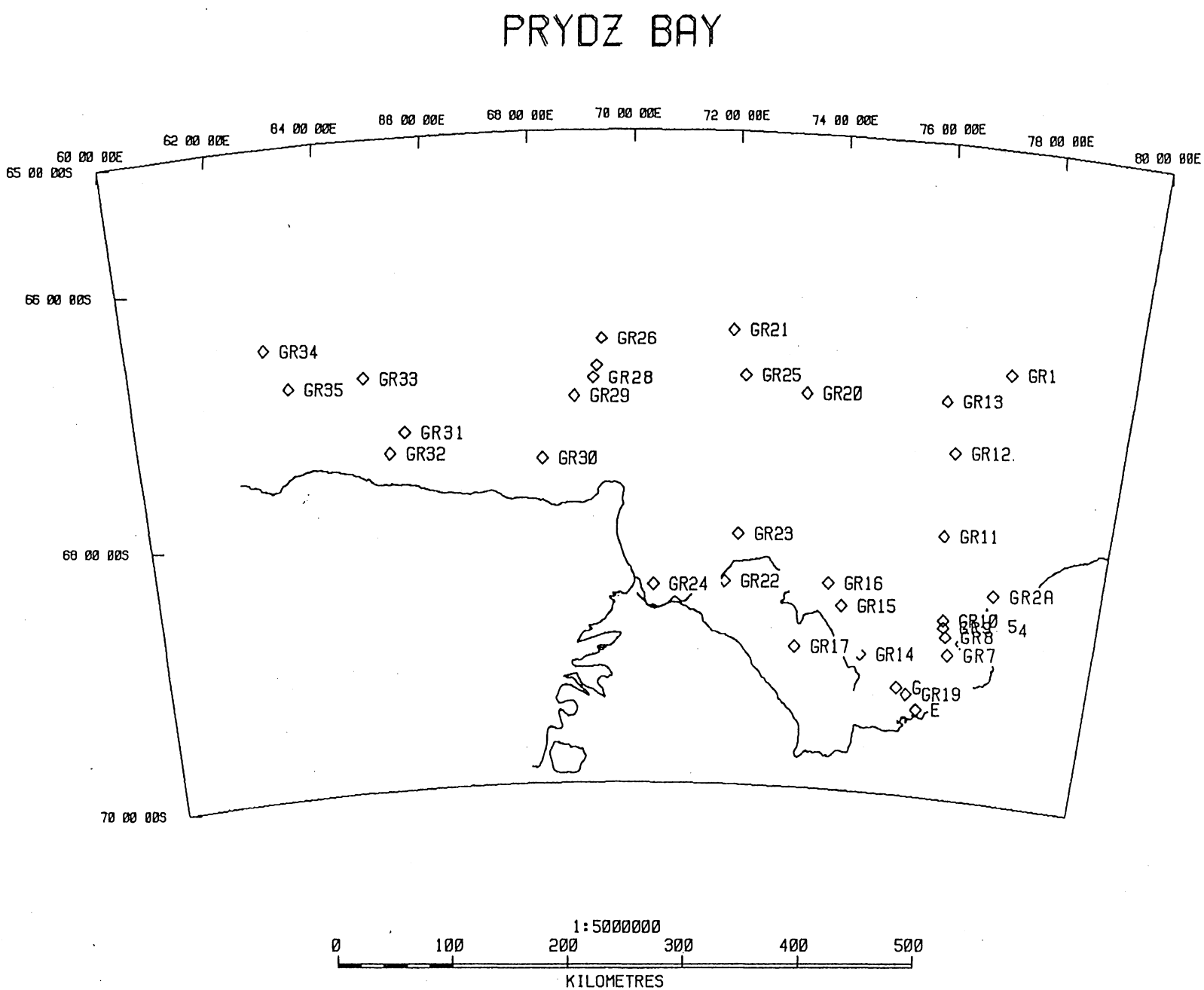

FIGURE 4. Locations of grab samples collected during Voyage 7, 1993.

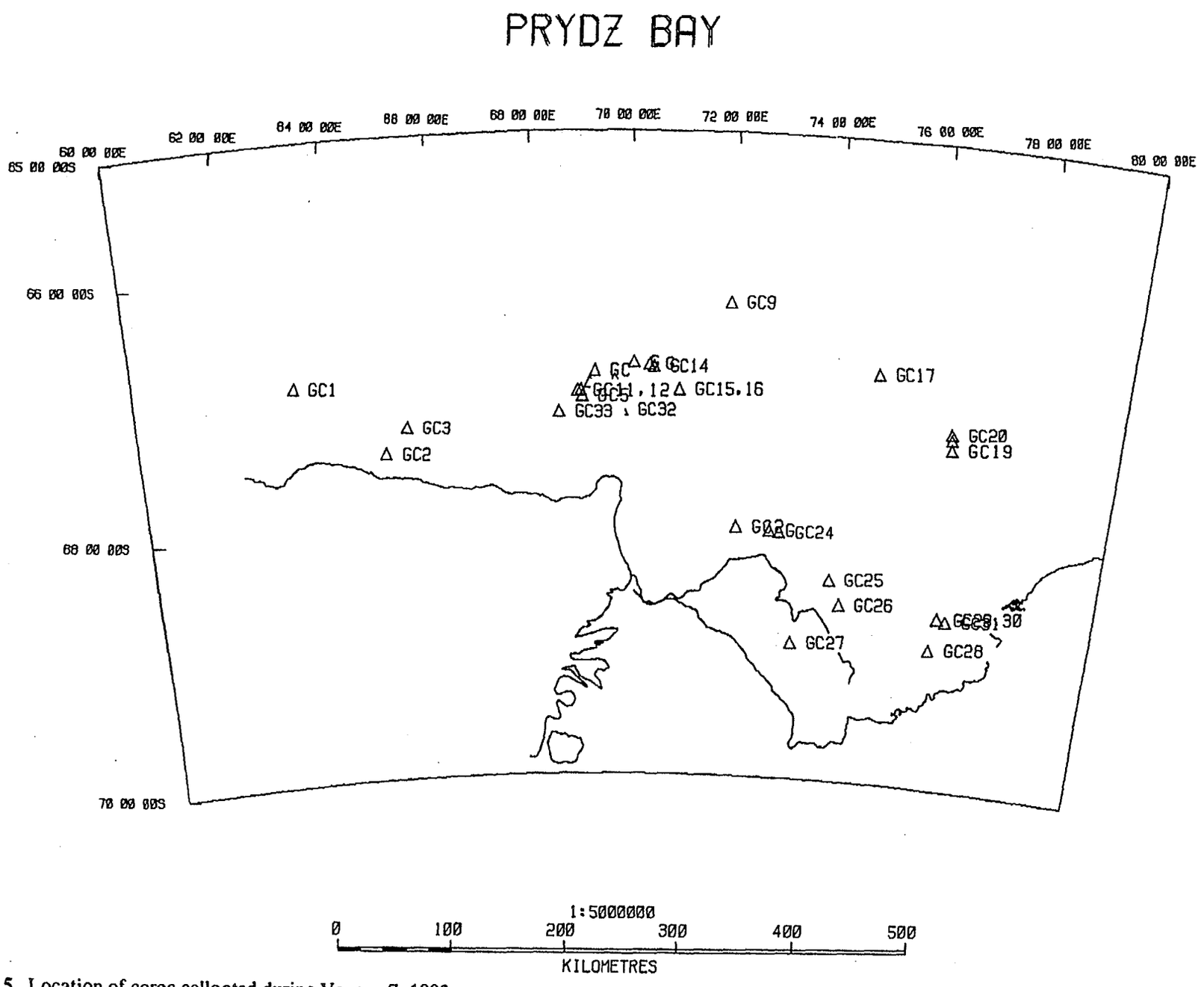

FIGURE 5. Location of cores collected during Voyage 7, 1993.

assigned to sites where no sediment was recovered because of hard sea floor, however, they were assigned station numbers. Gravity cores have the prefix GC. Locations are given as degrees and decimal minutes and date and Greenwich Mean Time the sample was taken are recorded. These can be related directly to Data Logging System ship track maps and echo sounder paper records.

The decision to place archive samples in the AGSO core library in Canberra necessitated the addition of an archive number to each sample because the numbers based on the Antarctic Division conventions were incompatable with the AGSO core library data base. These numbers consist of a cruise number, in this case 901 and a sample number which is the same as the original sample number, using GR for grab samples and GC for gravity cores.

RESULTS

Grab sampling - Grab samples were collected during the marine biological phase of the voyage. Thirty five grab samples were obtained (Fig. 4).

GRAB SAMPLES

Station Number KROCK/6/GR1

Archive Number 901/GR1

Grab/core	Grab	Depth	803 m
Time	1211	Latitude	66 43.45 S
Date	16/1/93	Longitude	77 31.18 E

Station Description: The site was chosen to sample the upper continental slope above the probable lysocline but below the depth of iceberg gouging. Echo sounder data suggests that the area feeds into a submarine canyon system.

Sample Description

Colour: Olive grey (5Y/5/2 to 5Y/4/2)

Texture: Silty fine sand with scattered granules and small pebbles (Fine diamicton). Silt-sized material causes the greenish colouration and is thought to be glauconite.

>30 µm	15%	>63µm	20%
>250 µm	15%	<63µm	20%
>125µm	20%		

Binocular: Sediment consists of 60 percent subrounded to angular clear quartz grains, 10 percent dark grains consisting of amphiboles and rock fragments, 20 percent fine olive grey glauconitic material and 10 percent bioclastic fragments including sponge spicules and calcareous fragments. Rich in calcareous organisms including benthic foraminifera and ostracodes.

Fauna >2mm: Fauna dominated by small gastropods. Also present are small to very small brittle stars, bivalves, crustacea, and polychaetes.

Station Number KROCK/6/GR2A

Archive Number 901/GR2A

Grab/core	Grab	Depth	179 m
Time	1314	Latitude	68 25.87 S
Date	17/1/93	Longitude	77 48.38 E

Station Description: Close in to Davis Station adjacent to Sorsdahl Glacier and Ice cliff influence. Area surrounded by many grounded icebergs.
Sample Description: Boulder and small amount of biogenic material on grab jaws. Boulder encrusted with bryozoa. Holothurians.
Colour: 5Y 4/2+ black sandy patches.
Texture: Fine to medium sand and abundant bryozoa and mollusc fragments

>300 µm	60%	>63 µm	10%
>250 µm	10%	<63 µm	10%
>125 µm	10%		

Binocular: Terrigenous component >95% angular to subrounded Quartz with small amounts of biotite and other dark minerals (amphibole?). Biotic component rich in calcareous organisms including bryozoa, both benthic and planktonic forams in addition to many diatoms (mostly centrales)

Station Number KROCK/6/GR2B

Archive Number 901/GR2B

Grab/core	Grab	Depth	173 m
Time	1314	Latitude	68 25.87 S
Date	17/1/93	Longitude	77 48.38 E

Station Description: Close in to Davis Station adjacent to Sorsdahl Glacier and Ice cliff influence. Area surrounded by many grounded icebergs.
Sample Description: 1 Boulder + 5 pebbles + fine material between boulders. Boulder encrusted with bryozoa. Holothurians.
Colour: 5Y/4/2 + black sandy streaks.
Texture: Fine to medium sand and abundant bryozoa and mollusc fragments

>300 µm	60%	>63 µm	10%
>250 µm	10%	<63 µm	10%
>125 µm	10%		

Binocular: Terrigenous component >95% angular to subrounded Quartz with small amounts of biotite and other dark minerals (amphibole?). Biotic component rich in calcareous organisms including bryozoa, both benthic and planktonic foraminifera in addition to many diatoms (mostly centrales)

Station Number KROCK/11/GR3

Archive Number 901/GR3

Grab/core	Grab	Depth	388 m
Time	1426	Latitude	68 34.4 S
Date	17/1/93	Longitude	77 38.4 E

Station Description: Close in to Davis Station adjacent to Sorsdahl Glacier. Area surrounded by many grounded icebergs.
Sample Description: a. Gneiss boulder - 30 cm longest dimension
b. Sandy Gravel. Bottom possibly gravelly sand as some fines were lost on return of the grab. Matrix glauconitic olive grey sand.
Colour: Olive grey, 5Y/2/2
Texture: Medium sandy diamicton

>300 µm	55%	>63 µm	5%
>250 µm	20%	<63 µm	+
>125 µm	20%		

Fauna >2mm Predominantly epifauna characteristic of rocky substrates with bryozoa dominant and a few polychaetes, hard corals.

Station Number KROCK/12/GR4

Archive Number 901/GR4

Grab/core	Grab	Depth	707 m
Time	1605	Latitude	68 42.2 S
Date	17/1/93	Longitude	77 30.7 E

Station Description Site chosen to sample offshore from the Sorsdahl Glacier.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Silty fine sand with low clay content.

>300 µm	20%	>63 µm	30%
>250 µm	10%	<63 µm	20%
>125 µm	20%		

Binocular Terrigenous component 99% angular to subrounded quartz. Depauperate biota with some large agglutinated foraminifera, diatoms, and radiolaria(?).

Fauna >2mm Dominated by polychaetes with tubes, with a few small bivalves and crustacea.

Station Number KROCK/13/GR5

Archive Number 901/GR5

Grab/core	Grab	Depth	538 m
Time	1733	Latitude	68 40.34 S
Date	17/1/93	Longitude	77 16.31 E

Station Description Site chosen as part of transect from shallow to deep water off the Sorsdahl Glacier.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Silty fine sand with low clay content.

>300 µm	20	>63 µm	30%
>250 µm	10%	<63 µm	20%
>125 µm	20%		

Binocular Terrigenous component 99% angular to subrounded quartz. Depauperate biota with some large agglutinated foraminifera, diatoms, and radiolaria(?).

Fauna >2mm Dominated by polychaetes with tubes. Also one large gastropod, small crustacea, nemerteans and molluscs.

Station Number KROCK/14/GR6

Archive Number 901/GR6

Grab/core	Grab	Depth	760 m
Time	1906	Latitude	68 49.0 S
Date	17/1/93	Longitude	77 10.0 E

Station Description Site chosen as part of transect from shallow to deep water off the Ranvick Glacier.

Sample Description

Colour Olive, 5Y/4/3
Texture Fine sandy silt.

>300 µm	7%	>63 µm	20%
>250 µm	10%	<63 µm	48%
>125 µm	15%		

Binocular Terrigenous component >95% angular to subrounded quartz with rare biotite and small rock fragments. Biota relatively rich with benthic calcite fauna (Triloculina fauna after Franklin, 1991). Diatoms include Centrales and two species of triangular (benthic) diatom.

Fauna >2mm Abundant polychaetes with tubes (dominant), a few small crustacea, sponge, bivalves, and large foraminifera.

Station Number KROCK/15/GR7

Archive Number 901/GR7

Grab/core	Grab	Depth	700 m
Time	2107	Latitude	68 54.72 S
Date	17/1/93	Longitude	76 53.61 E

Station Description Site chosen as part of transect from shallow to deep water off the Ranvick Glacier.

Sample Description
Colour Olive grey, 5Y/4/2
Texture Clayey coarse to medium sand with common rock fragments.

>300 µm	50%	>63 µm	3%
>250 µm	10%	<63 µm	22%
>125 µm	15%		

Binocular Terrigenous component approximately 75% angular to subrounded quartz and 25% rock (probably gneiss) fragments. Depauperate fauna composed of single large *Reophax sp.*

Fauna >2mm Fauna dominated by sponge, also polychaetes, crustacea, and bivalves.

Station Number KROCK/17/GR8

Archive Number 901/GR8

Grab/core	Grab	Depth	798 m
Time	0140	Latitude	68 46.92 E
Date	18/1/93	Longitude	76 48.25 S

Station Description Part of transect offshore from the Ranvick Glacier to the Svenner Channel.

Sample Description
Colour Olive grey, 5Y/5/2
Texture Coarse sandy diamicton.

>300 µm	80%	>63 µm	3%
>250 µm	3%	<63 µm	6%
>125 µm	8%		

Binocular Lithic component 95% angular to subrounded quartz and 4% rock fragments (probably gneiss). Depauperate fauna comprising one large *Reophax sp.* Diatoms (centrales) common and sponge spicules abundant.

Fauna >2mm Sponges dominant, with bryozoa, polychaetes, hydroids, soft coral, pycnogonids, crustacea, brittle stars, anemone, and gastropod.

Station Number KROCK/18/GR9

Archive Number 901/GR9

Grab/core	Grab	Depth	820 m
Time	0303	Latitude	68 42.61 S
Date	18/1/93	Longitude	76 44.66 E

Station Description Site chosen to sample the axis of the Svenner Channel as part of a transverse transect of the channel.

Sample Description Clayey, diatomaceous ooze with black (bacterial?) mats

Colour Olive Grey, 5Y/5/2

Texture Diatomaceous ooze. (Massive mud of Franklin, 1991)

>300 µm	+	>63 µm	5%
>250 µm	+	<63 µm	90%
>125 µm	5%		

Binocular Diatoms and radiolaria abundant.

Fauna >2mm A few polychaetes and bivalve only.

Station Number KROCK/19/GR10

Archive Number 901/GR10

Grab/core	Grab	Depth	775 m
Time	0408	Latitude	68 39.32 S
Date	18/1/93	Longitude	76 43.00 E

Station Description Site chosen to sample substrate prior to coring a large body of sediment identified using 3.5 kHz echosounding.

Sample Description

Colour Olive, 5Y/4/4

Texture Silty Diatomaceous ooze

>300 µm	< 1%	>63 µm	10%
>250 µm	Very little	<63 µm	80%
>125 µm	5%		

Binocular Terrigenous component (>63mm) 95 % angular to subrounded quartz. Rich fauna including *Triloculina trigonula, T. rotunda, Reophax pulifer, R nodulosis, Globigerina pachyderma* and many others. Abundant diatoms including *Thallasiosira spp.* and *Actincyclis spp.*

Fauna >2mm Sponges and polychaetes dominant. Also a few small molluscs, large foraminifera, amphipod, and nemertean.

Station Number KROCK/21/GR11

Grab/core	Grab	Depth	460 m
Time	1532	Latitude	68 00.74 S
Date	19/1/93	Longitude	76 32.83 E

Station Description: Second sample in transect form the Svenner channel to the Four Ladies Bank.

Sample Description

Colour: Olive, 5Y/5/4

Texture: Diatomaceous ooze with very fine worm burrows. Top few cms has fibrous yellowy algal mats and some sulfurous black patches. One red clay fragment (geothite?). Three dropstones of dark metamorphic rock.

>300 µm	+	>63 µm	20%
>250 µm	+	<63 µm	60%
>125 µm	10%		

Binocular: Some large agglutinated foraminifera, abundant radiolaria, and sparse diatoms.

Fauna >2mm: Small numbers of small species (except one large holothurian), including polychaetes, nemerteans, crustacea, foraminifera, bivalves, and very small brittle star.

Station Number KROCK/23/GR12

Archive Number 901/GR12

Grab/core	Grab	Depth	318 m
Time	1933	Latitude	67 21.27 S
Date	19/1/93	Longitude	76 35.28 E

Station Description: Test of substrate prior to coring the top of the Four Ladies Bank in an area ungouged by icebergs.

Sample Description

Colour: Olive grey, 5Y/5/2

Texture: Sandy clay with pebbles (fine diamicton) and large sponge spicules.

>300 µm	50%	>63 µm	15%
>250 µm	5%	<63 µm	10%
>125 µm	20%		

Binocular: Sparse assemblage including some diatoms (centrales) abundant radiolaria, and some agglutinated foraminifera (*Reophax nodulosis, Triloculina spp.*).

Fauna >2mm: Fauna dominated by sponges and brittle stars. Also bivalves, polychaetes, and foraminifera.

Station Number KROCK24/GR13

Archive Number 901/GR13

Grab/core	Grab	Depth	330 m
Time	2352	Latitude	66 58.16 S
Date	19/1/93	Longitude	76 18.63 E

Station Description: Final sample in transect from Svenner Channel to Four Ladies Bank. This sample is from the shallow part of the Four Ladies Bank on the shelf edge.

Sample Description
Colour Olive grey, 5Y/4/2
Texture Sediment consists of surface approximately 5 - 10 cm of silty fine sand underlain by gravel lens and silty medium sand (fine grained diamicton).

>300 µm	40%	>63 µm	20%
>250 µm	15%	<63 µm	15%
>125 µm	20%		

Binocular Diatoms abundant, some radiolaria, few foraminifera.

Fauna >2mm Fauna dominated by brittle stars, and polychaetes. Also foraminifera, bivalves, sponge and crustacea.

Station Number KROCK/37/GR14

Archive Number 901/GR14

Grab/core	Grab	Depth	740 m
Time	0927	Latitude	68 58.00 S
Date	22/1/93	Longitude	75 11.1 E

Station Description Sample obtained from the upper continental slope.
Sample Description
Colour Olive, 5Y/5/4
Texture Diatom ooze (Massive mud per Franklin, 1991)

>300 µm	+	>63 µm	20%
>250 µm	+	<63 µm	60%
>125 µm	10%		

Binocular Abundant diatoms and radiolaria.

Fauna >2mm Fauna dominated by polychaete worms (with tubes) and including very small bivalves, irregular echinoid, crustacea, and foraminifera.

Station Number KROCK/38/GR15

Archive Number 901/GR15

Grab/core	Grab	Depth	667 m
Time	1348	Latitude	68 36.87 S
Date	22/1/93	Longitude	74 31.29 E

Station Description Sample to test substrate prior to coring of a surface on ridge and swale topography within the Amery Depression.
Sample Description
Colour Olive, 5Y/4/4
Texture Diatomaceous ooze, (Massive mud per Franklin, 1991)

>300 µm	+	>63 µm	10%
>250 µm	+	<63 µm	80%
>125 µm	10%		

Binocular Abundant diatoms and Radiolaria.

Fauna >2mm Fauna dominated by polychaete tube worms and including sponge, bivalves, foraminifera, crustacea, and asteroid.

Station Number KROCK/39/GR16

Archive Number 901/GR16

Grab/core	Grab	Depth	665 m
Time	1615	Latitude	68 27.1 S
Date	22/1/93	Longitude	74 12.52 E

Station Description Test of substrate for core site 7.

Sample Description

Colour Olive, 5Y/4/4

Texture Sandy diamicton.

>300 µm 20% - includes pebble 2cm	>125 µm 10%
>250 µm 5%	>63 µm 10%
	<63 µm 45%

Binocular Abundant diatoms and radiolaria with rare large agglutinated foraminifera.

Fauna >2mm Polychaete tube worms dominant, also bivalves foraminifera, and brittle star.

Station Number KROCK/41/GR17

Archive Number 901/GR17

Grab/core	Grab	Depth	792 m
Time	2153	Latitude	68 56.66 S
Date	22/1/93	Longitude	73 34.43 E

Station Description Sample of seabed formerly covered by the Amery Ice Shelf.

Sample Description

Colour Olive grey, 5Y/5/2

Texture Diatomaceous ooze with dropstones, (Massive mud per Franklin, 1991)

>300 µm 15%	>63 µm 10%
>250 µm +	<63 µm 65%
>125 µm 10%	

Binocular Common Diatoms (large centrales), Radiolaria abundant, and rare large agglutinated foraminifera.

Fauna >2mm Dominated by polychaete tube worms and including bivalves, foraminifera, sea mouse, and brittle star.

Station Number KROCK/42/GR18

Archive Number 901/GR18

Grab/core	Grab	Depth	695 m
Time	0326	Latitude	68 11.08 S
Date	23/1/93	Longitude	75 52.53 E

Station Description Site chosen as first in a transect from the Amery Depression to the Larsmann Hills.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Diatomaceous ooze

>300 µm	+	>63 µm	10%
>250 µm	+	<63 µm	90
>125 µm	+		

Binocular Diatoms abundant, some radiolaria.

Fauna >2mm One polychaete worm only; otherwise devoid of macroscopic invertebrates

Station Number KROCK/43/GR19

Archive Number 901/GR19

Grab/core	Grab	Depth	548 m
Time	0512	Latitude	69 13.68 S
Date	23/1/93	Longitude	76 05.98 E

Station Description Site chosen as second in a transect from the Amery Depression to the Larsmann Hills.

Sample Description

Colour Olive, 5Y/4/4

Texture Silty fine sand (massive mud of Franklin, 1991)

>300 µm (biogenic)	10%	>125 µm	15%
		>63 µm	15%
>250 µm (biogenic)	10%	<63 µm	50%

Binocular Mostly algae and many diatoms.

Fauna >2mm One polychaete worm only; otherwise devoid of macroscopic invertebrates.

Station Number KROCK/47/GR20

Archive Number 901/GR20

Grab/core	Grab	Depth	490 m
Time	0256	Latitude	66 59.72 S
Date	24/1/93	Longitude	73 29.82 E

Station Description Site chosen to sample seafloor on the shelf near the shelf break on the eastern edge of Prydz Channel.

Sample Description Three attempts yielded one very sandy clay sample on the arm of the grab and some washed fine sand in the grab.

Approximately 4cm^3 of sediment recovered.

Colour Black (2.5Y/2/0)

Texture Probable overcompacted bottom with sand and some organisms on the surface. Some hard black material may have been in the grab to begin with. Insufficient sample to conduct grain size analysis.

Fauna >2mm No bulk sediment supplied but fragments show traces of sponge, bryozoan, and hard coral.

Station Number KROCK/56/GR21

Archive Number 901/GR21

Grab/core	Grab	Depth	1030 m
Time	1532	Latitude	66 32.1 S
Date	26/1/93	Longitude	72 00.05 E

Station Description Site chosen to investigate proposed core site 6 which is to sample the trough mouth fan associated with the Prydz Channel. Very hard bottom, two attempts yield very small sample.

Sample Description
Colour 5Y/4/2
Texture Insufficient sample to conduct grain size analysis but appears to be silty, fine sand with granules and rare pebbles.

Station Number KROCK/59/GR22

Archive Number 901/GR22

Grab/core	Grab	Depth	509 m
Time	2042	Latitude	68 28.45 S
Date	27/1/93	Longitude	72 00.49 E

Station Description Site chosen to sample seafloor adjacent to the Amery Ice Shelf and which was beneath the Amery Ice Shelf prior to 1965.

Sample Description
Colour Olive grey, 5Y/4/2
Texture Sandy damicton

>300 µm	70%	>63 µm	10%
>250 µm	10%	<63 µm	+
>125 µm	10%		

Binocular Diatom and radiolaria abundant.

Fauna >2mm Very small sediment sample provided yielded brittle star, compound ascidian, bryozoan, bivalves, polychaete tube worms, and hard coral.

Station Number KROCK/60/GR23

Archive Number 901/GR23

Grab/core	Grab	Depth	788 m
Time	11.45	Latitude	68 06.16 S
Date	28/1/93	Longitude	72 15.03 E

Station Description Site chosen to sample the floor of the Prydz Channel.

Sample Description
Colour Olive grey, 5Y/5/2
Texture Sandy mud.

>300 µm	5%	>63 µm	10%
>250 µm	5%	<63 µm	75%
>125 µm	5%		

Binocular Diatomaceous and radiolarian ooze.

Fauna >2mm Fauna dominated by small bivalve and gastropod molluscs. Also brittle stars, holothurians, crustacea, foraminifera, and polychaete tube worms.

Station Number KROCK/62/GR24

Archive Number 901/GR24

Grab/core	Grab	Depth	1060 m
Time	0800	Latitude	68 30.58 S
Date	28/1/93	Longitude	70 29.96 E

Station Description Site chosen to sample the bottom of the Nella Deep, near McKenzie Bay.

Sample Description

Colour Olive, 5Y/4/3

Texture Coarse sandy diamicton.

>300 µm	30%	>63 µm	10%
>250 µm	10%	<63 µm	20%
>125 µm	30%		

Dropstone Lithology

Pebble type	Number	%
Hornfels (dark, fine grained, hard, metased.)	5	3
Grey Granite (granite gneiss? granodiorite?)	47	32
As above + garnets	5	3
Dark Gneiss	46	31
Grey Mudstone	2	1
Granite pink Feldspar	5	3
Gneiss pink Feldspar	3	2
Quartzite	29	20
Red Sandstone or Siltstone	6	4

Binocular Radiolaria common, diatoms rare, and foraminifera absent.

Fauna >2mm Fauna dominated by polychaete tube worms and including bivalve and gastropod molluscs, cumacean crustacean, foraminifera, sponge, and holothurian.

Station Number KROCK/63/GR25

Archive Number 901/GR25

Grab/core	Grab	Depth	532 m
Time	0040	Latitude	66 52.79 S
Date	29/1/93	Longitude	72 16.12 E

Station Description Site chosen to sample the floor of Prydz Channel near the shelf edge.

Sample Description

Colour Olive grey, 5Y/5/2

Texture Coarse sandy diamicton

>300 µm	30%	>63 µm	15%
>250 µm	20%	<63 µm	20%
>125 µm	15%		

Dropstone Lithology

Pebble type	Number	%
Dark fine grained metasediment	1	1.37
Grey granite / granite gneiss	22	30.14
Granite - pink Feldspar	7	9.59
Dark gneiss	14	19.18
Quartz	16	21.92
Black amphibolite	1	1.37
Reg Gneiss - garnet rich	1	1.37
Black Mudstone	1	1.37
Garnet gneiss	4	5.48
Dark meta Sandstone	5	6.85
Grey Mudstone	1	1.37

Binocular Diatoms and Radiolaria abundant, foraminifera (agglutinated) rare.

Fauna >2mm Diverse fauna with no obvious dominant taxon. Contains planarian and polychaete and nemertean worms, brittle stars, gastropods, foraminifera, sponge, hard coral, crustacean and bryozoan.

Station Number KROCK/73/GR26

Archive Number 901/GR26

Grab/core Grab
Time 1546
Date 30/01/93

Depth 1435 m
Latitude 66 36.85 S
Longitude 69 23. 8 E

Station Description Continental slope offshore from Fram Bank.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Gravelly diamicton.

>300 µm 70%
>250 µm 10%
>125 µm 5%
>63 µm 5%
<63 µm 10%

Dropstone Lithology

Pebble type	Number	%
Gabbro /ultra mafic	2	3.28
Dark mafic / metavolcanic?	21	34.43
Granite - pink Feldspar	5	8.2
Grey diamictite	4	6.56
Quartz	10	16.39
Light grey gneiss + garnets	7	11.48
Red Sandstone and Siltstone	2	3.28
Fine metasediment / black	2	3.28
Grey gneiss, granite	5	8.2
Dark fine grn volcanic + white feldspar	3	4.92

Binocular Radiolaria common, Foraminifera rare, Diatoms rare, single small crustacean (amphipod).

Fauna >2mm Limited sample available. Contains brittle stars, polychaete worms, hard coral and sponges.

Station Number KROCK/74/GR27

Archive Number 901/GR27

Grab/core	Grab	Depth	907 m
Time	1956	Latitude	66 49.42 S
Date	30/01/93	Longitude	69 17.77 E

Station Description Check of substrate of core site on the continental shelf off Fram Bank.

Sample Description

Colour Olive grey, 5Y/5/2 (matrix)

Texture Coarse sand with gravel.

>300 µm	80%	>63 µm	5%
>250 µm	5%	<63 µm	+
>125 µm	5%		

Binocular Foraminifera abundant (planktonic and benthic forms), diatoms and radiolaria abundant.

Fauna >2mm Limited sample available. Present are brittle stars, polychaetes, gastropods, regular echinoid, bryozoan, pychnogonid, hard coral, and sponge.

Station Number KROCK/75/GR28

Archive Number 901/GR28

Grab/core	Grab	Depth	512 m
Time	2146	Latitude	66 54.89 S
Date	30/01/93	Longitude	69 13.23 E

Station Description Check substrate of core site on the shelf edge, Fram Bank.

Sample Description

Colour Olive, 5Y/4/3

Texture Coarse sandy gravel.

>300 µm	80%	>63 µm	5%
>250 µm	5%	<63 µm	+
>125 µm	5%		

Binocular Foraminifera abundant (planktonic and benthic forms), diatoms and radiolaria abundant.

Fauna >2mm Limited sample containing echinoids (regular and irregular), holothurians, crustacea, polychaetes, foraminifera, and sponges.

Station Number KROCK/76/GR29

Archive Number 901/GR29

Grab/core	Grab	Depth	200 m
Time	2359	Latitude	67 2.79 S
Date	30/01/93	Longitude	68 50.82 E

Station Description Sample from the top of the Fram Bank.

Sample Description

Colour Olive grey, 5Y/2/2

Texture Coarse sandy gravel.

>300 µm	80%	>250 µm	5%

>125 µm 5% <63 µm +
>63 µm 5%

Binocular Foraminifera abundant (planktonic and benthic forms), diatoms and radiolaria abundant.

Fauna >2mm Limited sample containing polychaetes, gastropods, crustacea, hard coral, and regular echinoids.

Station Number KROCK/77/GR30

Archive Number 901/GR30

Grab/core	Grab	Depth	460 m
Time	1213	Latitude	67 30.91 S
Date	31/1/93	Longitude	68 11.74 E

Station Description Deep trough on Mac. Robertson Shelf.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Fine silty sand.

>300 µm	15%	>63 µm	20%
>250 µm	15%	<63 µm	20%
>125 µm	20%		

Fauna >2mm Rich fauna with bryozoa, polychaetes, and brittle stars dominant. Also present: gastropods, bivalves, crustacea, foraminifera, sponge, pycnogonid, and irregular echinoid.

Station Number KROCK/92/GR31

Archive Number 901/GR31

Grab/core	Grab	Depth	110 m
Time	1433	Latitude	67 16.17 S
Date	2/2/93	Longitude	65 25.38 E

Station Description Shallow bank, Mac. Robertson Shelf.

Sample Description

Colour Olive grey, 5Y/4/2

Texture Sandy bryozoan carbonate.

>300 µm	70% #	>63 µm	5%
>250 µm	10%	<63 µm	+
>125 µm	7%		

(mostly biogenic carbonate and sponge spicules)

Binocular Diverse fauna with abundant foraminifera (planktonic and benthic) bivalves, bryozoans, gastropods, ostracodes, diatoms and radiolaria.

Fauna >2mm Very rich fauna with bryozoa dominant. Also present are polychaetes, and brittle stars brachiopods, gastropods, crustacea, pycnogonids, foraminifera, bivalves, sponge, and holothurians.

Station Number KROCK/93/GR32

Archive Number 901/GR32

Grab/core	Grab	Depth	1057 m
Time	1603	Latitude	67 25.18 S
Date	2/2/93	Longitude	65 06.14 E

Station Description

Comments Very deep trough in the Mac. Robertson Shelf called the Neilsen Basin. While depth on echo sounder read 1057m, the grab did not trigger at that depth. It was necessary to run out 1500m of wire before the grab closed. Four attempts necessary.

Sample Description Fluid ,dark grey to black anoxic ooze, with some burrowing evident in undisturbed sample. Hydrogen sulphide odour.

Colour Black (5Y/2/1) - Colour changes to Olive - Olive grey with oxidation over time.

Texture Fine ooze

>300 µm	+	>63 µm	5%
>250 µm	+	<63 µm	95%
>125 µm	+		

Binocular Smear slide shows mostly dead diatoms, scattered quartz grains and greenish amorphous material thought to be glauconitic clay. Some well preserved fecal pellets.

Fauna >2mm Sample (25kg) almost devoid of macroscopic invertebrate fauna. Single brittle star only.

Station Number KROCK/95/GR33

Archive Number 901/GR33

Grab/core	Grab	Depth	1520 m
Time	0352	Latitude	66 50.43 S
Date	3/2/93	Longitude	64 39.63 E

Station Description Side of canyon on continental slope.

Comments Substitute for Core site 14 - unsuitable for coring.

Sample Description

Colour Very dark greyish brown, 2.5Y/3/2

Texture Coarse sandy gravel.

>300 µm	80%	>63 µm	+
>250 µm	10%	<63 µm	+
>125 µm	10%		

Binocular Uncommon sponge spicules only bioclastic material.

Fauna >2mm No fauna recovered due to limited sample.

Station Number KROCK/105/GR34

Archive Number 901/GR34

Grab/core	Grab	Time	0633

Date 5/2/93
Depth 1882 m
Latitude 66 33.58 S
Longitude 62 44.4 E

Station Description Continental slope off Mac. Robertson Shelf.

Binocular Diatoms and radiolaria common, some sponge spicules.

Fauna >2mm Limited sample containing sponge, polychaetes, brittle star, and gastropods.

Station Number KROCK/106/GR35

Archive Number 901/GR35

Grab/core	Grab	Depth	434 m
Time	0914	Latitude	55 52.03 S
Date	5/2/93	Longitude	63 09.6 E

Station Description Trough in Mac. Robertson Shelf (Ice Berg Alley).

Sample Description

Colour Olive grey, 5Y/4/2

Texture Fine sandy mud.

>300 µm	5%
>250 µm	5%
>125 µm	20%
>63 µm	20%
<63 µm	50%

Binocular Foraminifera common (*Triloculina spp., Orbulina sp. Globigerina pachyderma, Reophax spp.*), diatoms (some possilbly benthic) and radiolaria common, sponge spicules.

Fauna >2mm Fauna dominated by polychaetes and sponge also containing gastropod and bivalve molluscs, planarian worms, crustacea, and foraminifera.

GRAVITY CORES.

Core samples were recovered from the following stations.

Station Number KROCK/125/GC1

Archive Number 901/GC1

Grab/core	Gravity core	Depth	478 m
Time	1127	Latitude	66 53.95 S
Date	11/2/93	Longitude	63 09.26 E

Station Description Planned core site C12

Sample Description

Core length

Catcher - 12cm

Cutter - 19cm

Core - 375 cm

Comments Collected pebbles of weathered basalt and sedimentary rock from benthic sled.

Station Number KROCK/128/GC2

Archive Number 901/GC2

Grab/core	Gravity core	Depth	1091 m
Time	0143	Latitude	67 28.46 S
Date	13/2/93	Longitude	64 58.36 E

Station Description Planned core site C11

Sample Description
Core length
Catcher - 21cm
Cutter - 15cm
Core - approx 300 cm
Comments Neilsen Basin. Surface of core very liquid and smelling of H_2S. Bottom of core a fine sandy clay.

Station Number KROCK/129/GC3

Archive Number 901/GC3

Grab/core	Gravity core	Depth	134 m
Time	0410	Latitude	67 16.18 S
Date	13/2/93	Longitude	65 25.07 E

Station Description Corer swale between two ridges on shallow shelf. Planned core site C19
Sample Description
Core length
Catcher - 10cm
Cutter - 10cm

Station Number KROCK/131/GC4a

Archive Number 901/GC4a

Grab/core	Gravity core	Depth	210 m
Time	1609	Latitude	67 05.12 S
Date	13/2/93	Longitude	68 58.81 E

Station Description Planned core site C10
Sample Description
Core length
Catcher - 10cm
Comments Compacted sand, diamicton. Very hard bottom.

Station Number KROCK131/GC4b

Archive Number 901/GC4b

Grab/core	Gravity core	Depth	210 m
Time	1609	Latitude	67 05.12 S
Date	13/2/93	Longitude	68 58.81 E

Station Description Planned core site C10
Sample Description
Core length
Catcher - 10cm

Comments Compacted sand, diamicton. Very hard bottom.

Station Number KROCK132/GC5

Archive Number 901/GC5

Grab/core	Gravity core	Depth	320 m
Time	1750	Latitude	67 03.55 S
Date	13/2/93	Longitude	69 00.98 E

Station Description Planned core site C10a
Sample Description
Core length Core - 212 cm

Station Number KROCK/133/GC6

Archive Number 901/GC6

Grab/core	Gravity core	Depth	489 m
Time	2007	Latitude	66 57.53 S
Date	13/2/93	Longitude	69 09.81 E

Station Description Planned core site C10b

Station Number KROCK/134/GC7

Archive Number 901/GC7

Grab/core	Gravity core	Depth	628 m
Time	2200	Latitude	66 51.97 S
Date	13/2/93	Longitude	69 16.57 E

Station Description Planned core site C9
Sample Description Small amount of pebbly sand.
Comments Cutter bent

Station Number KROCK/136/GC8

Archive Number 901/GC8

Grab/core	Gravity core	Depth	433 m
Time	0141	Latitude	66 56.38 S
Date	14/2/93	Longitude	69 40.94 E

Station Description Planned core site C8a
Sample Description 15cm of overcompacted diamicton grading into 10cm of greenish (5Y) normal compacted diamicton.
Core length25 cm
Catcher - 10 cm
Cutter - 15 cm

Station Number KROCK/139/GC9

Archive Number 901/GC9

Grab/core	Gravity core	Depth	1879 m
Time	1604	Latitude	66 20.16 S
Date	14/2/93	Longitude	71 58.59 E

Station Description: Planned core site C6. Sampled surface sediments of trough mouth fan offshore of the Prydz Channel.

Station Number KROCK/140/GC10

Archive Number 901/GC10

Grab/core	Gravity core	Depth	1257 m
Time	2257	Latitude	66 48.15 S
Date	14/2/93	Longitude	70 04.96 E

Station Description Planned core site C26
Sample Description
Core length
Core - 46 cm
Comments Sample retrieved from sled. Dark grey (5Y) mud from outside of sled. Very carbonate rich at top.

Station Number KROCK/141/GC11

Archive Number 901/GC11

Grab/core	Gravity core	Depth	402 m
Time	0525	Latitude	67 00.99 S
Date	15/2/93	Longitude	68 54.89 E

Station Description Planned core site D1
Sample Description
Core length
Core - 53 cm

Station Number KROCK/141/GC12

Archive Number 901/GC12

Grab/core	Gravity core	Date	15/2/93
Time	0525	Depth	402 m

Latitude 67 00.99 S Longitude 68 54.89 E
Station Description Planned core site D1
Sample Description No core recovered.
Comments A few bryozoan fragments in core catcher

Station Number KROCK/142/GC13

Archive Number 901/GC13
Grab/core Gravity core Depth 880 m
Time 1146 Latitude 66 48.59 S
Date 15/2/93 Longitude 70 23.52 E
Station Description Planned core site E1
Sample Description
Core length
Catcher - approx 15 cm
Core - 59 cm
Comments Core barrel bent. Carbonate sand severly washed up and down liner therefore stratigraphy unreliable. Sled full of huge barnacles, corals, and brittle stars with scattered pebbles and boulders. Bioclastic carbonate.

Station Number KROCK/143/GC14

Archive Number 901/GC14
Grab/core Gravity core Depth 430 m
Time 1340 Latitude 66 50.13 S
Date 15/2/93 Longitude 70 29.04 E
Station Description Planned core site E2
Sample Description
Core length
Core - 31 cm

Station Number KROCK/144/GC15

Archive Number 901/GC15
Grab/core Gravity core Depth 480 m
Time 1522 Latitude 67 00.5 S
Date 15/2/93 Longitude 71 00.24 E
Station Description Planned core site E3
Sample Description
Core length
Core - 37 cm

Station Number KROCK/144/GC16

Archive Number 901/GC16
Grab/core Gravity core Depth 480 m
Time 1833 Latitude 67 00.23 S
Date 15/2/93 Longitude 71 00.03 E
Station Description Planned core site E3
Sample Description
Core length
Catcher - 14 cm
Cutter - 10 cm
Core - 40 cm
Comments Transition from fluid mud at top to compacted diamicton in core cutter.

Station Number KROCK/146/GC17

Archive Number 901/GC17
Grab/core Gravity core Depth 1668 m
Time 0330 Latitude 66 49.09 S
Date 16/2/93 Longitude 74 59.22 E
Station Description: Planned core site C25. Aimed at slump scar on continental slope offshore of the Four
Ladies Bank.

Sample Description: Diamicton with approx. 1cm ooze on top.
Core length
Core - 15.5cm

Station Number KROCK/148/GC18

Archive Number 901/GC18

Grab/core	Gravity core	Depth	320 m
Time	0940	Latitude	67 17.00 S
Date	16/2/93	Longitude	76 34.22 E

Station Description: Planned core site C23. Aimed at ungouged part of Four Ladies Bank.
Sample Description
Core length
Cutter - 23 cm
Core - 60 cm
Comments Compressive strength of sample 1kg cm $^{-1}$ at top of cutter, too hard to measure in bottom.

Station Number KROCK/149/GC19

Archive Number 901/GC19

Grab/core	Gravity core	Depth	324 m
Time	1116	Latitude	67 21.65 S
Date	16/2/93	Longitude	76 35.45 E

Station Description Planned core site
Sample Description
Core length
Cutter - 17.5 cm

Station Number KROCK/150/GC20

Archive Number 901/GC20

Grab/core	Gravity core	Depth	318 m
Time	1249	Latitude	67 14.15 S
Date	16/2/93	Longitude	76 33.31 E

Station Description Planned core site E4
Sample Description
Core length
Core - 45 cm

Station Number KROCK/151/GC21

Archive Number 901/GC21

Grab/core	Gravity core	Depth	761 m
Time	2315	Latitude	68 03.9 S
Date	16/2/93	Longitude	72 16.56 E

Station Description: Planned core site C5, targetting the floor of the Prydz Channel.
Sample Description
Core length
Core - 330cm
Comments Red brown sediment at base. May have penetrated sufficiently to lose sediment through top of the corer.

Station Number KROCK/151/GC22

Archive Number 901/GC22

Grab/core	Gravity core	Depth	766 m
Time	2315	Latitude	68 03.9 S
Date	16/2/93	Longitude	72 16.56 E

Station Description Planned core site C5
Sample Description
Core length
Core - 440cm

Station Number KROCK/152/GC23

Archive Number 901/GC23

Grab/core	Gravity core	Depth	661 m
Time	0308	Latitude	68 04.91 S
Date	17/2/93	Longitude	72 59.04 E

Station Description Planned core site C4

Sample Description

Core length

Catcher - 10 cm
Cutter - 13 cm
Core - 300cm

Station Number KROCK/153/GC24

Archive Number 901/GC24

Grab/core	Gravity core	Depth	705 m
Time	0509	Latitude	68 05.63 S
Date	17/2/93	Longitude	73 11.36 E

Station Description Planned core site C3

Sample Description

Core length

Catcher - 11 cm
Cutter - 20 cm
Core - 413cm

Station Number KROCK/154/GC25

Archive Number 901/GC25

Grab/core	Gravity core	Depth	676 m
Time	0823	Latitude	68 26.19 S
Date	17/2/93	Longitude	74 18.47 E

Station Description Planned core site C7

Sample Description

Core length

Cutter - 15 cm
Core - 137 cm

Station Number KROCK/156/GC26

Archive Number 901/GC26

Grab/core	Gravity core	Depth	676 m
Time	1318	Latitude	68 37.43 S
Date	17/2/93	Longitude	74 33.85 E

Station Description Planned core site C7

Sample Description

Core length

Catcher - unmeasureable lump
Cutter - unmeasureable lump
Core - 208 cm

Comments Liner cut 13 cm below top of sediment causing some ooze to leak out.

Station Number KROCK/157/GC27

Archive Number 901/GC27

Grab/core	Gravity core	Depth	776 m
Time	1600	Latitude	68 56.80 S
Date	17/2/93	Longitude	73 35.14 E

Station Description Planned core site C24

Sample Description

Core length

Catcher - unmeasureable lump
Cutter - unmeasureable lump
Core - 460 cm

Station Number KROCK/158/GC28

Archive Number 901/GC28
Grab/core Gravity core Depth 710 m
Time 2251 Latitude 68 54.92 S
Date 17/2/93 Longitude 76 35.36 E
Station Description Planned core site C21
Sample Description
Core length
Catcher - 9 cm
Cutter - unmeasureable lump
Core - 172 cm

Station Number KROCK/159/GC29

Archive Number 901/GC29
Grab/core Gravity core Depth 789 m
Time 0136 Latitude 68 39.78 S
Date 18/2/93 Longitude 76 41.73 E
Station Description Planned core site C2
Sample Description
Core length
Catcher - unmeasureable lump
Core - 300 cm

Station Number KROCK/159/GC30

Archive Number 901/GC30
Grab/core Gravity core Depth 789 m
Time 0136 Latitude 68 39.78 S
Date 18/2/93 Longitude 76 41.73 E
Station Description Planned core site C2
Sample Description
Core length
Core - 105 cm
Comments Stainless steel barrel, 70 mm diameter core.

Station Number KROCK/160/GC31

Archive Number 901/GC31
Grab/core Gravity core Depth 806 m
Time 0447 Latitude 68 40.91 S
Date 18/2/93 Longitude 76 52.59 E
Station Description Planned core site EX1
Sample Description
Core length
Core - 152cm
Comments Labelled incorrectly as GC30. Relabelled correctly.

Station Number KROCK/162/GC32

Archive Number 901/GC32
Grab/core Gravity core Depth 279 m
Time 0645 Latitude 67 10.28 S
Date 21/2/93 Longitude 69 50.87 E
Station Description Planned core site EX2
Sample Description
Core length
Catcher - 10 cm
Cutter - 14 cm
Core - 30 cm

Station Number KROCK/163/GC33

Archive Number 901/GC33
Grab/core Gravity core
Time 1144
Date 21/2/93
Depth 376 m
Latitude 67 10.88 S
Longitude 68 32.30 E
Station Description Planned core site
Sample Description
Core length
Catcher - 12 cm
Cutter - 17 cm
Core - 240cm

Station Number KROCK/167/GC34
Archive Number 901/GC34
Grab/core Gravity core
Time 1853
Date 26/2/93
Depth 1676 m
Latitude 62 20.40 S
Longitude 81 14.89 E
Station Description Saddle on BANZARE Bank.
Sample Description
Core length
Core - 570 cm
Comments Calcareous ooze.

STATIONS THAT DID NOT RETURN SAMPLES

Station 44
Lat 69 20.38S **Date** 23/01/1993
Long 76 20.86E **GMT** 0749
Depth 500 m

Grab dropped twice. Second attempt yielded algal material that washed out of the jaws on leaving the water. The location is close to the Larsmann Hills so it is likely that the sea bed is metamorphic basement with algal growth on it.

Station 123
Lat 62 45.39S **Date** 11/02/1993
Long 66 34.12E **GMT** 0025
Depth 1924 m

Corer dropped three times. Barrel penetrated up to 1 m as indicated by fine sand on grease on the outside of the barrel. Coarse sand grains and granules lodged in catcher blades. Probable coarse sandy bottom.

Station 124
Lat 66 53.95S **Date** 11/02/1993
Long 62 33.28E **GMT** 0638
Depth 112 m

Corer dropped twice. Failed to recover sediment when wire tension indicated that it had hit the bottom. Probably hard bottom caused by ice berg scour of the bank.

Station 130
Lat 67 31.46S **Date** 13/02/1993
Long 69 01.75E **GMT** 1313
Depth 116 m

Corer dropped twice. No sample recovered, significant damage to the core cutter. Epibenthic sled recovered diatomaceous ooze and abundant encrusting organisms suggesting a thin ooze layer on bouldery substrate.

Station 135
Lat 66 50.21S **Date** 13/02/1993
Long 69 18.93E **GMT** 2327
Depth 710 m

No sample recovered, cutter bent. Probable hard bottom.

Station 166
Lat 62 29.83 S **Date** 26/2/93
Long 81 02.31 E **GMT** 1626
Depth 1649 m

Terrace on south western side of southern BANZARE Bank. No sample recovered. Probable hard bottom.

Acknowledgements

We would like to acknowledge the assistance of the Engineering Services Unit, AGSO for their work in constructing the sampling equipment, Brian Dickinson of AGSO for his expert operation and repair of the equipment and the Master and crew of the Aurora Australis for their cheerful co-operation throughout the voyage. Voyage leader Dr. Graham Hosie of Antarctic Division provided helpful advise and co-operation. Dr. Tony Rathburn of Australian National University was an integral part of the sampling program and Dr. Helen Cooley sieved tonnes of mud in all weather and at all times of the day and night. John Marshall reviewed the manuscript.

REFERENCES

FRANKLIN, D., 1991 - The marine environment of Prydz Bay, Antarctica: microbiota and facies distribution. B.Sc Hons thesis, Department of Geology, Australian National University (unpublished).

O'BRIEN, P.E., 1992 - Cruise preview report, Prydz Bay and Mac. Robertson Shelf, Antarctica, January-March 1993. Australain Geological Survey Organisation Record 1992/93.

QUILTY, P.G., 1985 - Distribution of foraminiferids in sediments of Prydz Bay. South Australian Department of Mines and Energy Special Publication, 5, 329-340.

APPENDIX A

PROCEDURE TO DEPLOY AND RECOVER GRAVITY CORER

This document describes the methods used to deploy and retrieve the gravity corer used on M.V. Aurora Australis during the 1993 Geoscience sampling program.

Pre-survey

Assemble hanging frames on the gantry traveller and attach sheave assembly. A land-based crane is required for installation of the sheave. Assemble the cradle and position it in the hanging frame.

Deployment

1. Assemble the gravity corer in the cradle.
2. Move the gantry traveller with cradle and gravity corer over the stern until it is underneath the sheave. The cradle will pivot into a vertical position. A rope attached to the lower part of the cradle can be pulled to aid locking of the cradle into a vertical position.
3. Raise the gravity corer from its seat in the cradle and move the gantry traveller forward so that the corer clears the cradle.
4. Lower the corer using tension control and a motor speed of about 30 rpm. Use motor speed and not wire out speed.
5. Stop the corer about 100 meters from the sea floor and wait 1 minute to ensure the corer is vertical.
6. Let the corer fall, using the tension control, building up to about 50 rpm, until the bottom is reached. A faster speed will only pay out wire faster than the corer is falling which will tip the corer over. Arrival at the bottom will be indicated by a drop to about 20 rpm in winch speed and a marked change in pitch of the sound coming from the hydraulic winch motor. Wire tension reduces by about 1 tonne. The wire out reading tends to be an unreliable guide to the position of the corer relative to the bottom. Differences of 200 m between water depth and wire paid out were recorded during the 1993 program.
7. The corer is retrieved at a speed of about 30 rpm.
8. Position the corer above the level of the cradle seat and move the gantry traveller and cradle so that the corer can be lowered into the cradle seat.
9. Move the gantry traveller forward, unlocking the cradle locks by pulling on the locking lanyard until the cradle is touching the deck and rotating towards the horizontal. The winch rope should be released during this operation.
10. Remove the core cutter and, if a core is present, remove the core liner, placing its lower end in a canvas bag secured by ropes to prevent the liner accidentally sliding down the trawl deck. This arrangement can be used to insert the next core liner.

NOTE: 1. If moving sea ice is present, it may be advisable to bring the cradle back on deck while the wire is running out to prevent it being damaged. If this is necessary, the winch hand rail may need to be removed to prevent interference with the wire.
2. The ship should be held as close to station as possible during coring, with no wire angle or bent core barrels will result. In heavy pack ice, this can be achieved by using the ships propeller to keep a small patch of open water at the stern.

APPENDIX B

USE OF VAN VEEN GRAB ON AURORA AUSTRALIS

1. Hose out grab through trapdoors in top before seting trigger arm and lifting it off the deck. **NEVER HOSE OUT GRAB WHILE IT IS SET AND SUSPENDED ABOVE THE DECK. IF IT TRIGGERS WITH YOUR HAND IN OR BELOW IT, IT WILL EASILY CUT OFF YOUR ARM.**

2. Set grab by slowly taking up slack on the cable while holding the trigger arm in place. Allow plenty of slack on CTD cable to prevent cable damage or CTD movement while moving grab out of the room.

3. Once suspended and set, the grab can be moved out of CTD room. Cautiously locate wire stop in sheeve guide with low hydraulic setting at winch control to prevent excess load on cable. Ensure there is enough wire to allow the grab to run out.

4. Lower grab gently into the water to prevent tripping. Once in the water, check to see if it has triggered. If so, try again, if not lower away.

5. Lower grab quickly to the required depth, 60 m per minute is fine. Usually add 50m to the echo sounder depth estimate. More cable may to be needed if steep seabed slopes are suspected.

6. Bring the grab up slowly till it is clear of the bottom. This allows the lever action of the grab a chance to bite into the sea bed. Once clear of the bottom, it can be wound in quickly (about 30 m per minute).

7. Once the grab is visible, it should be wound in slowly to allow wire stop to locate without excess force (ie. breaking the cable and loseing the lot).

8. When the grab is brought up to the CTD room step, **personnel handling it should have safety line attached to their harnesses.** The grab may be rested on the step, the chains shortened by slackening the wire and attaching quick release clips on the grab arms to higher links on the chain. It may be swung over the step if it is not too full, but this requires at least 2 people and they should have attached safety lines. **Even in calm seas, the grab is heavy enough to swing someone out the door and you only fall in once down here.**

9. Once landed, the contents can be inspected through the upper trap doors and emptied into steel tray.

10. **ENSURE GRAB IS TIED DOWN WHEN NOT IN USE. Once sliding around the deck, the grab is very hard to stop.**

FIGURE 1. Bathymetry and location names in Prydz Bay and the Mac. Robertson Shelf after Quilty (1985).

Figure 2. Sea floor sample sites collected before Voyage 7, 1993.

FIGURE 3. Ship's track for Voyage 7, 1993.

FIGURE 4. Locations of grab samples collected during Voyage 7, 1993.

FIGURE 5. Location of cores collected during Voyage 7, 1993.