

K041
1992/93

LOGISTIC REPORT

K041: UV and Antarctic Skies

New Zealand Antarctic Programme 1992/93

Event Personnel: D.Beaglehole
G.G.Carter

October 1992-November 1992

1 Aims

Our measurements during 1990 identified low maximum polarisation of sky light and strong low-azimuth back-scattered light as two characteristic features of the Antarctic skies. We suggested in our analysis of these features that they came about by multiple reflections from the snow-ice surfaces surrounding the Tent Island site (and most of Antarctica). Our hypothesis was that the skies over the Dry Valleys would differ, since the amount of back-scattering would be very much reduced. The two sites have essentially the same latitude, and the same unpolluted air, so a direct comparison should put in evidence the effects of surface albedo.

We planned to look for enhancement of UVB radiation at these sites associated with any ozone hole. We planned to study algae sensitivity to UV radiation.

2 Planning

iv Tekapo training course. The Tekapo course comes at a time when university staff are very busy (exam deadlines and marking of tests). For returning people, the present arrangement involves more time than is warranted which is not good for moral. Meeting the Scott Base staff is very worthwhile, and the event briefings are essential. These could be done in a one day session in Christchurch.

3 Cargo

5 no-freeze boxes weighing approx 500kg. All transport arrangements went well.

4 Personnel

Professor David Beaglehole and Grant G.Carter, Physics Department, Victoria University of Wellington, PO Box 600, Wellington, New Zealand.

5 Scott Base preparations

We were very pleased with the cooperation and assistance given by Scott Base staff, which enabled us to move out to the Tent Island site very quickly. Haskell with Scott Base personnel had already transported our laboratory wannigen and tent to the site, and set up the electrical supply.

6 Field transport

Again all went very smoothly. We were particularly grateful for the cooperation we were given in arranging the helicopter flights to Vanda and back to Scott Base at unplanned times - earlier than expected due to the excellent weather we encountered.

7 Event Diary

October 21 to Scott Base

October 23 to Tent Island site

October 31 helicopter to Lake Vanda

6 November helicopter to Scott Base with stop at Bull Pass

8 November to Christchurch

14 Lake Vanda Station

The overall condition was excellent. We were unable to get any clear charging of the battery bank by the solar cells, and the voltage was low, so we used our own generator and batteries. The diesel heater smoked badly, but the oven went well and provided sufficient heat and melting of ice.

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IMMEDIATE SCIENTIFIC REPORT

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October 1992-November 1992

1 Abstract

Measurements were made between October 26 and November 6, 1992 of properties of the Antarctic skies at two sites, one near Tent Island, and the other at Lake Vanda, the first site being surrounded by sea-ice, while the second site was surrounded over a substantial distance by bare rock. The measurements at Tent Island confirmed the general trends observed during the same period in 1990, and the differences between the two sites confirmed the interpretation suggested by the earlier work, that the distinctive features of skylight over ice (and snow) are due to the high albedo environment. No enhancement of the UVB was observed during this time, and this was consistent with the generally high ozone levels measured at Arrival Heights.

2 Proposed Programme

Our measurements during 1990 identified low maximum polarisation of sky light and strong low-azimuth back-scattered light as two characteristic features of the Antarctic skies. We suggested in our analysis of these features that they came about by multiple reflections from the snow-ice surfaces surrounding the Tent Island site (and most of Antarctica). Our hypothesis was that the skies over the Dry Valleys would differ, since the amount of back-scattering would be very much reduced. The two sites have essentially the same latitude, and the same unpolluted air, so a direct comparison should put in evidence the effects of surface albedo.

We planned to look for enhancement of UVB radiation at these sites associated with any ozone hole. We planned to study algae sensitivity to UV radiation.

3 Scientific Endeavours and Achievements

The 3/4 channel sky monitor was essentially the same as used in the earlier 1990 study at Tent Island, but the data-logger now used a PC laptop driven from 12V external batteries and could run for a 12 hour period unattended. The computer control of the spectrometer had been substantially altered, and now was much more convenient to use, and could take sky

spectra more quickly. A diffuse reflectance attachment had been made to allow measurements of the colour of sea-ice algae.

We joined Haskell and colleagues at the camp site near Tent Island, and with good weather we were able to establish our sky monitor and our polarisation spectrometer and start measurements immediately (October 23, 1992). The polarisation and sky light distribution showed very similar behaviour to that observed during 1990. The maximum polarisation in the sun-zenith plane in a direction 90° away from the sun reached 40%, which was the value observed in 1990 and contrasts with a typical value of 70-80% observed in New Zealand. The UVB levels were not enhanced, and this was consistent with the preliminary ozone levels recorded by Sylvia Nicol.

There was very little algae under the sea-ice at the Tent Island site at that time. It was clear that we would not be able to get sufficiently dense samples to reliably measure their colour in situ (the intention had been to study the colours and UV sensitivity without artificial concentration), and this part of the programme was dropped.

We were able to accumulate sufficient sky data within 5 days, and with the improved data programmes we were able to analyse for preliminary results immediately. Bad weather then held up our move to Lake Vanda for 2 days, but we spent time continuing our data analysis and helping with the Haskell event.

We travelled to Lake Vanda by helicopter on 31 October. We spent a few hours opening the station. We were unable to get power from the local battery system (which hovered around 10V), and found the switches to the solar panels confusing- in no position did they appear to produce a charging current. We used our own generator and batteries.

We started our measurements during the evening of the first day there. The weather was very settled, showing the same pattern each day: fine clear skies during the evening and night, but very thin high cloud from mid morning to mid afternoon. On the 4 November the thin high cloud held off till noon so we were able to measure through the maximum of the sun's altitude. The preliminary analysis showed that the maximum sky polarisation was between 50 and 60%, which was substantially higher than at Tent Island, and this confirmed our hypothesis about the effects of the surface reflection (surface albedo).

The high walls of the Wright Valley restricted the north and south horizons, and reduce the total intensity of sky light falling onto the surface. We measured the horizon, and will make corrections for this effect when we determine the total surface intensities. On the last day the helicopter stopped at Bull Pass for an hour around noon, and we took total intensity measurements there to compare with those at the Lake Vanda site. The horizon at the Bull Pass site was substantially lower.

We returned to New Zealand earlier than we had planned. This shortening of the event was the result of the fine weather encountered at both sites. In all we only lost a couple of days due to cloud coverage.

4 Publications

Two papers describing our earlier study at Tent Island have been published :

Antarctic skies I : Diurnal variations of the sky irradiance, and UV effects of the ozone hole, spring 1990, D.Beaglehole and G.G.Carter, J.G.R.Atmospheres D2, 97, 2589-2596, 1992

Antarctic skies II: Characterisation of the intensity and polarisation of skylight in a high albedo environment. D.Beaglehole and G.G.Carter, J.G.R.Atmospheres D2, 97, 2597-2600, 1992.

We are preparing one further report Antarctic skies III : Comparison of high and low albedo sites, which will be submitted to J.G.R.

Some preliminary discussion of our comparison between Vanda and Tent Island has been given in our article

Ultraviolet radiation and Sea Ice Algae in Antarctica, K Ryan and D.Beaglehole, to be published in Ultraviolet radiation and biological research in Antarctica, eds S. Weiler and P. Penhale, Antarctic Research Series 1993.

6 Future Research

We have now characterised the Antarctic skies sufficiently for reasonable radiative-transfer models to be applied to the problem with reliability. No one else has made a polarisation and sky intensity distribution study, so we feel that we have made a significant contribution here. The UV monitoring by the NSF network is better than our Victoria group can do with our the limited resources, so while the long term variations in UVB radiation are important, there seems little point in competing with the US who are measuring at McMurdo.

7 Management of Science

We were very pleased with the way we were able get on with our measurements with the shortest delays at Scott Base and the helicopter support. This was at a particularly difficult

time following the accident and helicopter shortage, and the assistance we were given was very much appreciated. We also appreciated the help given in opening Lake Vanda.

8 Acknowledgements

We very much appreciate the help and cooperation given by all the Scott Base staff, and especially Paul Chaplin, Dave Bryce and Eric Saxby who helped with the logistics and the equipment. The support of Tim, Bob and Joe at the Tent Island camp was also appreciated. Paul Woodgate's efforts at Christchurch were also much appreciated.

K042
1992/93

LOGISTICS REPORT

K042 : Last Retreat of the Antarctic Ice Sheet

in the Ross Region

New Zealand Antarctic Programme 1992/93

Event Personnel: A.R. Pyne (Leader)
 J. Carter
 E. Gee
 B. Anderson
 P. Grube (NZ Army Plant Operator)

 S. Henrys (Ice Breaker only)

November 1992 - December 1992. February 1993.

Aims

The project will determine the timing and rate of retreat of the edge of the Antarctic ice sheet across the Ross continental shelf since the last glacial maximum 20,000 years ago to resolve the present substantial differences of opinion. This will involve coring from fast sea ice off the Victoria Land coast in Granite Harbour and northwards, and from a ship in the central Ross Sea.

The cores will penetrate the recent layer of mud, deposited under sea ice/open water conditions like today's, and into diamictite beneath, deposited when the shelf was covered by the extended ice sheet. The corer has been designed to penetrate and recover up to 6 m of both soft mud and diamictite in water depths to 1000 m. The timing of glacial retreat is obtained from carbon dating contemporaneous shell material and organic carbon in organic rich sediment just above the diamictite. Thorium 230 dating by mass spectrometry on suitable carbonate materials may also be attempted.

The main objective of the 1992-93 sea ice based programme was to obtain cores from the sea floor in Granite Harbour. This part of the programme was not successful because of deployment and operational problems with our new coring equipment (vibracorer). The corer performed correctly in 700 m deep water but was unstable on the very soft sea floor and no useful core was recovered.

A ship based programme in February 1993 was very successful, with over 450 nautical miles of 3.5 kHz sea floor profiling data collected from the USCGC Polar Star off the South Victoria Land Coast (Figure 1). Data collected in Granite Harbour and off the Nordenskjold Ice Tongue will be used to map the extent and thickness of the Holocene mud blanket. The data collected offshore of Cape Roberts will be used to characterise the sea floor and compile a high resolution bathymetry map for future proposed drill sites in the area.

Planning

The planning of the sea ice part of the programme was relatively straight forward with no significant problems, although testing of the corer occurred later than planned. We also did not get a chance to test our winch with the NZAP Nodwell in New Zealand as it had been sent to Scott Base by ship the previous season. Shipping the event cargo went well due to NZAP efforts and good communication.

Planning the ship based programme to core from a USCGC Icebreaker was difficult because NSF, which controls the ship operations, appears not to have a well developed icebreaker programme prior to the start of the season and could only offer 1-2 days ship time during tanker refuelling. This was insufficient for our programme. Our enquiries via NZAP about the Icebreaker's coring and 3.5 kHz profiling equipment were not passed on to the ship. If our enquiries had been answered then we would have been better prepared to take full advantage of the USCGC Polar Star in February 1993 by digitally recording the 3.5 kHz profiling data.

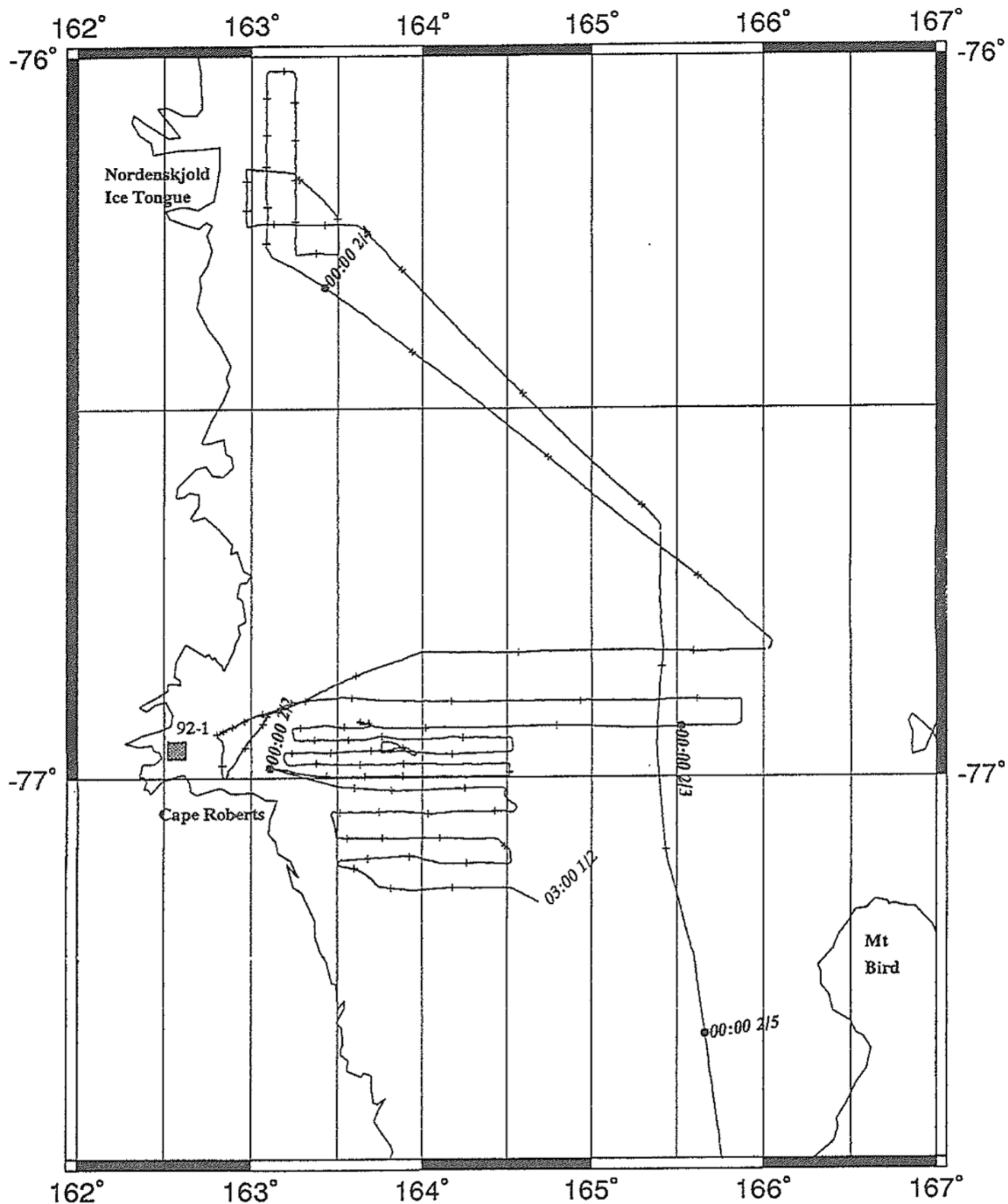


Figure 1. Ship track, 3.5 kHz profile lines from USCGC Polar Star and sea ice coring site 92-1 in Granite Harbour.

We hope that in the future better communications will be developed with NSF-OPP and NZAP to enable realistic planning of ship based programmes. It is still necessary where technical questions arise to be able to go directly to the ship or ship operators. The last lesson from this seasons experience is that a ship programme should be ready to go at short notice if an opportunity should arise later than the date when normal planning is finalised. It is a credit to the NZAP operation and flexibility that our February 93 Ice Breaker programme was supported with 3 days notice.

Operating at the Nordenskjold Ice Tongue is still contemplated for the the future. A helo reconnaissance this season showed suitable fast ice was present along the coast to travel and operate around the ice tongue. We did not have time to travel by skidoo to the Nordenskjold for the bathymetry as planned this season. Based on this seasons reconnaissance it would probably take up to 4 days to travel by bulldozer from Scott Base to the Nordenskjold. This is clearly too long to then give sufficient working time in the area within our safe sea ice operating window. Operating at the Nordenskjold would however be practical if faster vehicles (Challenger and Nodwell) were used or if the vehicles were staged and returned to Cape Roberts in a future season. In this case the one way trip would be only 95 km and possible in 1 to 1.5 days travel.

The NZAP medicals changed significantly this season with a marked increase in the number of blood and other tests required, at a time when Government directed costs of these tests rose dramatically. We question whether these tests are necessary, especially when some of them are only voluntary in the USAP programme.

Cargo

Unaccompanied to Scott Base: 10,447 lb (4750 kg); 527 ft³ (14.8 m³). In 9 boxes up to 6.1 m long, winch and rope drum.

Accompanied to Scott Base: 280 lb (127 kg). Delicate electronic equipment.

Cargo returned to New Zealand by air and the majority by sea, same as above.

Personnel

A. Sea Ice Programme

Leader, Alex R. Pyne ,Antarctic Research Centre VUW

John Carter,Geology Dept. VUW

Emily Gee, Geology Dept. VUW

Bruce Anderson, Geology Dept. VUW

Plant operator, Peter Grube (BEAR),NZ Army (Scott Base)

B. Ice Breaker Programme

Leader, Alex R. Pyne, Antarctic Research Centre VUW

Stuart Henrys, Antarctic Research Centre VUW

Scott Base Personnel:

Paul Chaplin (Operations Manager)

Dave Comber (SENZREP)

Brian Green (Electrician)

Greg Harris (Mechanic)

Mike Mahon (Lab Technician)

Dave Milne (Asst. Stores Officer)

Preparations for the Field

Management for this event was carried out efficiently and generally smoothly by Scott Base staff. One unexpected change to the Helo plan was the replacement of two of our party (scientist and plant operator) were replaced by 2 Scott Base staff (operations manager and FTC leader) for their familiarisation of the area. Most of our event people are new each season and this helo reconnaissance provides a quick and reliable means for them to become familiar with the sea ice route and area of operation which I consider is vital for event operation and safety. If this familiarisation is also considered necessary for Scott Base staff then the helo time should be programmed as part of base operation and not be taken from the event allocation.

Ten days were required to prepare the scientific, field equipment and cargo train. This was about 3 days longer than planned and was caused by a combination of factors including first time assembly of the vibracorer at Scott Base and setting up of the Nodwell ice drill and winch in Antarctica. In future seasons the preparation period will be shortened to increase time on the sea ice. We are modifying our equipment to make it easier and faster to assemble in Antarctica but we will still require some help from the mechanics, engineers and plant operators during this period. Work could be identified by us and NZAP (technical services) that could be done prior to the event personnel arriving on the ice.

Some Scott Base equipment required work before being serviceable for the journey to Granite Harbour. The D5 required a new alternator, a Cantago sledge required rewelding the drawbar and the Nodwell ice drill needed commissioning and modifications. The Nodwell HIAB crane pressure relief was also increased to the design specifications. The Nodwell tasks were anticipated and did not cause significant delay.

Field Transport

NZAP Vehicles

All vehicles were generally in good condition when allocated to the event and the only problems were minor, (see para. on the D5 and Cantago sledge above). The D5 towed 3 Cantago sledges (incl. NZ1) and a TAE sledge. Consumption of JP8 was 230 l/100 km. Detailed checks of these sledges is time consuming but should be done at the end of summer by an engineer so that repairs can be made during as part of the winter work programme.

The NZAP Nodwell performed well in the field especially considering the age and history of the chassis (1962). The new Isuzu engine started easily was fuel efficient and with about 3000 lb on the deck and no towed load consumed JP8 at 125 l per 100 km. The only major problem we encountered with this vehicle was the lack of spare tyre and wheel. USAP use special foam filled tyres for their Nodwell vehicles which eliminates the need to carry a spare. Perhaps NZAP should adopt this practice also.

Two Alpine II skidoos (AL1, AL2) were used by the event. The machines performed very well for all the purposes we required and no breakages occurred. The use of a low sledge (TAE) for towing the skidoos when they are not in use with the slow moving cargo train is a useful option.

Some fuel (JP8 and MOGAS) was supplied from Scott Base but the majority of JP8 was supplied from USAP at Marble Pt. into 11 209 l empty drums hauled from Scott Base. This reduced cargo loading to Marble Pt. by 5,000 lb (2270 kg) which is clearly advantageous. The disadvantage is that an extra day was required to traverse over rough ice into Marble Pt., onto land to the air facility to fill the drums. It would be a significant advantage if fuel was pre positioned on sea ice north of Gneiss Pt. to avoid the normal rough ice in Marble Pt. bay (Arnold Cove) and the land travel to the Helo fuelling facility.

Bridging equipment for heavy plant and sledges operating on the sea ice is still required in the NZAP programme. Bridging should be quick and easy to setup to provide safe operation and crossing of several vehicle and sledge types. A long low sledge with drop ramps towed behind heavy plant could be a relatively low cost option. Such bridging equipment will be required for the Cape Roberts programme.

Aircraft Operations

The helicopter sea ice reconnaissance to the Nordenskjold Ice Tongue was straightforward and went smoothly. Skidoo fuel positioned on this flight was later returned to Scott Base by a passing Helo (Italian) after we cancelled that part of the programme due to a lack of field time. The fuel in 20 l containers was documented and carried with passengers without difficulty. Equipment and resupplies available to us on an opportunity basis were also appreciated. The only concern with helo operations is discussed in the previous Preparations for the Field section.

Ship Operations

The Icebreaker Cruise (1-5 February) went very smoothly and the help from the 6 Scott Base staff was appreciated. The ships crew were also very helpful and pleased to be doing some useful science. The dry lab with the 3.5 kHz profiler and GPS receiver were the only ship facilities used. Helicopter operation was not required as part of the scientific plan and the SENZREP's short familiarisation. was not part of the scientific programme. No scientific work was carried out on deck in this cruise and normal clothing issue was sufficient. Deck work would require water and wind proof anoraks, salopettes and gloves over which a "Mustang jacket" could be worn. Planning ship operations is discussed previously in section on Planning.

Event Diary

Sea Ice Programme

5 November Arrive Scott Base. (Pyne, Carter, Gee, Anderson.)

6 November Field Training. (Carter, Gee, Anderson.)
Bucket auger tests with Nodwell (Pyne.)

7 November Field Training. Auger modifications and tests.

8 November Attach winch on Nodwell and GPS receiver in garage.

9 November Helo Recce. to Granite Harbour and Nordenskjold Ice Tongue. (Pyne, Carter, Gee.) Skidoo fuel cached at ice tongue (76 14 99,162 47 75).

10 November Battery housings fitted on Vibracorer in garage. Checked field equipment. Spliced winch rope.

11 November Vibracorer outside with loader on forks, erect mast tubes, chains and returned vibracorer inside.

12 November Batteries and Electronics tested on vibracorer.

13 November Electrical problems with to shipping.

14 November Electrical problems, (limit switches), packed up sledges.

15 November Final packing and moving out from Scott Base at 1500 hrs. Camp Position: 77 40 83 / 165 28 28 at 2200hrs (38 km from Scott base).

16 November Marble Point at 2030 hrs, weather poor.

17 November Refuelled at helo facility. Bad winds and poor visibility.

18 November Travelling to Cape Roberts, arrived at 2030 hrs.

19 November Cape Roberts; skua count, restocked emergency box. New wind speed/direction and 2nd temperature sensors fitted to Met. tower, down loaded data and checked wiring on Vibracorer, travelled onto Granite Harbour.

20 November Drilled sea ice hole at site 92-1, 736 m deep in Granite Harbour.

21 November Continuity problems with Vibracorer, removed battery housing and batteries (transport damage ?), checked out winch with large weights.

22 November Problems with data logger power, katabatic winds in the evening.

23 November Dead batteries data logger, transducer fault with rev counter, chuck jamming after lowering into water, winch capstan creeping backwards and banging in neutral and braked.

24 November Removed capstan to check on air in the system, replaced it and tested again with weights. Then ran a test using the TAE sledge as a weight.

25 November Tested the winch using the TAE sledge plus the weights to 100 m. At 1830 hrs started to lower the Vibracorer, stopping every 100 m to readjust the Hiab which was sagging. At above 600 m the comms. cable broke, winched the Vibracorer to the surface by 220 hrs. Repair comms cable.

26 November Broken comms cable (D5), repaired. Lowered the Vibracorer down at 1500 hrs, reached the bottom at about 700 m and ran the Vibracorer through coring programme but the barrel did not retract the last 2 m. Vibracorer winched to surface to find the core barrel had been bent about 30 degrees. It took from 2200 hrs to 2400 hrs to remove the bent core barrel from the vibracorer.

27 November DVs visit started drilling new hole about 30 m west of 1st hole, used the winch cable of D5 to saw between the holes. Katabatic winds in the evening.

28 November Prepared the Vibracorer for lowering, started lowering at 1600 hrs. Lowered to the bottom and ran through the same procedures to find that the barrel would not retract. Returned to the surface to find another bent core barrel.

29 November Packed and moved to Cape Roberts.

30 November Science DVs visit, drilled hole for current meter, unloaded the vibracorer for the DVs, surveyor arrived and did local topo survey. Repacked the corer.

1 December Skua count, surveyors permanent staff erected for tide gauge levelling.

2 December Bathymetry and sea ice measurements made along seismic line off shore Cape Roberts to the Ice Edge.

3 December Reprogrammed data logger on Met. tower, repacked sledges, survey of glacier edge Granite Harbour.

4 December Started travelling south at 1000 hrs, complex crack system south east of Spike Cape negotiated. Nodwell flat tyre removed and all deck cargo. Stopped at New harbour at 0130 hrs next day.

5 December Travelling back to Scott Base, large crack in sea ice early in the day (New Harbour Crack), arrived back at Scott Base at 0130 hrs.

6 December Brought tractor train back to Scott Base.

7 December	Started dismantling Vibracorer.
8 December	Packed up Vibracorer returned cleaned field equipment.
9 December	Finished packing.
10 December	Carter return to NZ.
11 December	Pyne, Gee, Anderson return to NZ.

Ice Breaker Cruise (1993).

31 January	Pyne, Henrys to Chch and Scott Base.
1-5 February	Embark USCGC Polar Star 0900 hrs departure and begin 3.5 kHz survey. Disembark 1700 hrs at McMurdo Pier.
6 February	Pyne, Henrys return to NZ.

Weather

The weather was good for most of the sea ice programme and little field time was lost. A day of blowing snow and poor visibility occurred while refuelling at Marble Pt. and 2 katabatic events, each of a few hours duration where experienced in Granite Harbour, (see diary).

Field Equipment

Two "sleepy" box sledges were used by this event. Repairs were required in the field to the part where the ski attaches to the sledge which had become damaged due to metal fatigue. This is the result of a design weakness which should be remedied in the future. The plywood sides and ends were in a poor state of repair when the sledges were allocated and should be renewed.

The field food is generally good quality and continues to be upgraded each year. Living and cooking in a Wannigan means that more exciting food can be prepared than in a basic tent camp if the appropriate food items were available. Some new occasional "luxury" items could be introduced such as cans of fruit (pineapple, peaches etc.) mushrooms and other vegetables. The other suggestion is that items should be small and usefully packaged for field use, for example chicken pieces instead of whole chickens, small tins items. The new bags of lamb/ pork strips available this season is an example to develop. Some bulk items can be usefully pre processed/packaged at Scott Base, for example grated cheese in ziplok bags. More insulated containers/boxes are still needed for frozen food storage in warm areas (sea ice).

NZ1 was used for cooking and messing between 5 to 7 people. The wannigan is very crowded and the cooking area should be redesigned to provide more useful bench space, a LPG oven/ grill top burner combination in addition to the newly installed microwave. The microwave, cutlery and dishes needs to be secured better for travelling especially over sea ice. The layout of a galley on a small boat could provide a suitable model for redesign. A table in addition to the dining table still should be retained for instruments. Extra seating that doubles as inside rubbish containers are also required. Large containers (210 l drums or plastic drums) with locking lids are also needed for cargo train rubbish handling.

A 200 mm Fin auger was used to make holes in the sea ice. the cutting edges of these augers are in need if careful machine grinding because hand stoning can't make a sharp lasting edge and new cutting heads could also be purchased.

Radio Communications

Radio communications were not very satisfactory during the sea ice season especially in the Granite Harbour area 150 km from Scott Base. Communication was established when needed although with some difficulty. The HF Codan equipment installed in NZ1 is normally good enabling comms with Scott Base using the roof mounted whip aerial but this season it worked satisfactorily only with a dipole aerial from Granite Harbour. The whip aerials and mounting should be checked by an electronics technician before next season. The small "butter box" HF sets were inadequate even from New Harbour (70 km).

The VHF communication is also inadequate. The blind coastal area from Marble Pt. northwards on the Mt. Newall repeater (channel 5) appeared to be larger than in previous years. The Mt. Erebus repeater (channel 3) did not work at all for us this season and was intermittent at best the previous season. We suggest NZAP investigate the siting of a repeater on Mt. Marston which should give good coverage within Granite Harbour and probably southwards along the coast about to Marble Pt.

The VHF equipment is also becoming dated and less reliable. NiCad batteries are always difficult to charge properly in the field and a field discharger may help improve performance. A connector to 12 VDC lead acid cells would also be an advantage for any party with vehicles. The connections to the Hi-Gain aerials also need regular checking, could be replaced with reusable fittings and a flexible cable better suited to field use should be used. New equipment should be less bulky to keep warm inside clothing, still retain the remote aerial option and have a suitable charger/discharger if powered by NiCad batteries.

The Scott Base radio schedule system has almost become too efficient and easy to initiate from the Scott Base end. It is more difficult however in the field especially when travelling and working on tasks requiring concentration over several hours.

Environmental Impact

Human waste and grey water was returned to the sea via holes drilled in the sea ice. All other waste was returned to Scott base for processing or disposal. An NZAP environmental return is appended.

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S. Henrys (Ice Breaker only)

November 1992 - December 1992. February 1993.

Abstract of Scientific Work Achieved

The objective of the sea ice based programme was to obtain cores from the sea floor in Granite Harbour. This part of the programme was not successful because of deployment and operational problems with our new vibracorer. The corer itself performed correctly in the 700 m deep water, the frame tilted on the soft sea floor and no useful core was recovered.

A ship based programme in February 1993 was very successful, with over 450 nautical miles of 3.5 kHz sea floor profiling data collected from the USCGC Polar Star off the South Victoria Land Coast. Data collected in Granite Harbour and off the Nordenskjold Ice Tongue are being used to map the extent and thickness of the Holocene mud blanket. The data collected off Cape Roberts will be used to characterise the sea floor and compile a high resolution bathymetric map for selecting drill sites in the area.

Proposed programme

The project is to determine the timing and rate of retreat of the edge of the Antarctic ice sheet across the Ross continental shelf since the last glacial maximum 20,000 years ago to resolve the present substantial differences of opinion. This involves coring from fast sea ice off the Victoria Land coast in Granite Harbour and northwards, and from a ship in the central Ross Sea.

The cores will penetrate the recent layer of mud, deposited under sea ice/open water conditions like today's, and into diamictite beneath, deposited when the shelf was covered by the extended ice sheet. The corer has been designed to penetrate and recover up to 6 m of both soft mud and diamictite in water depths to 1000 m. The timing of glacial retreat is obtained from carbon dating contemporaneous shell material and organic carbon in organic rich sediment just above the diamictite. Thorium 230 dating by mass spectrometry on suitable carbonate materials may also be attempted.

The first stage is to check the local retreat history from cores with that developed from terrestrial ages in the McMurdo Sound area. The second stage of this programme extends the study north of Granite Harbour and out into the Ross Sea using a ship and the sea ice where appropriate.

The volume and extent of the Antarctic ice sheet at the height of the last glaciation is still virtually unknown, as is the history of the retreat of its margin to its present position. The question is of interest to those studying the structure of the earth (Lambeck 1990) as well as those concerned with the Antarctic contribution to past and future sea level change (SCAR 1989). There is a widely held view that the Antarctic ice sheet expanded to the edge of the continental shelf, increasing in volume by some 30% (Kellogg *et al.* 1979, Denton *et al.* 1989, 1991). This is based partly on numerical modelling and partly on the wide extent of over-compacted diamictite beneath a metre or so of mud on the continental shelf (Anderson and Molnia 1988). Others cite evidence of the old beaches on the Victoria Land coast and in Prudz Bay which are raised only a few metres to indicate past ice volumes were only a few percent larger than today (Calhoun *et al.* 1992).

The only attempt that we know which uses this approach to establish the retreat history of the ice sheet anywhere on the Antarctic continental shelf has been by Domack et al. (1990, 1991) from the Oates Coast. They obtained ages from piston cores for the beginning of post-glacial mud accumulation there ranging from 9000 to 3000 years ago. However, there were problems with either the dating procedure or the coring as the pattern of ages with core depth was irregular and inconsistent. Piston corers are known to blow away the top few centimetres (and more at times) of surface sediment, and occasionally disturb sediment as it pierces the sea floor in a few seconds. Our vibracoring system has been designed to take undisturbed core by vibrating its way down over a period of 15 minutes. Thus we should from the outset have better quality core material to date.

The Ross continental shelf is an area of particular interest because of concern over the behaviour of the West Antarctic Ice Sheet (Bindschadler 1990). West Antarctic ice may have reached the edge of the continental shelf 20,000 years ago, though Drewry (1979) has argued for much more limited extent of the ice in the Ross Sea at that time, which he considers is more in keeping with the relatively small negative regional gravity anomaly over the Ross continental shelf.

In the last few years research by VUW personnel (Barrett et al. 1983; Ward, 1984; Ward et al. 1987; Macpherson 1987; Pyne et al. 1991.) has substantially improved our understanding of sedimentary processes along the Victoria Land coast, and has led to the development of techniques and expertise for sampling the sea floor from the fast ice. We are now interested in using these skills to acquire data on the retreat history of the ice margin since the last glacial maximum.

This season's programme was to plot the retreat of grounded ice, firstly by coring from the sea ice in the area of Granite Harbour and secondly by coring from an ice breaker in McMurdo Sound and northward in the Victoria Land basin. It became clear during the year that the ice breaker support could not be guaranteed. At best we could only expect 1-2 days ship time during tanker refuelling and the details of the ship's coring and echo-sounding equipment were not forthcoming from NSF via NZAP for our planning. Consequently we cancelled the ship based programme. However an opportunity arose at short notice to use the ice breaker in early February 1993. Our revised programme objectives were to collect 3.5 kHz data (with the ice breaker's echosounder) in Granite Harbour and around the Nordenskjold Ice Tongue to determine the bathymetry and thickness of the "post glacial mud blanket". The second objective was to collect 3.5 Khz data offshore of Cape Roberts to determine detailed bathymetry in the area of proposed drill sites for the Cape Roberts Project.

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Scientific Endeavours and Achievements

1992-93 Sea Ice Season.

In November and early December 1992 we attempted to recover sea floor cores from Granite Harbour to study the Holocene Retreat of MacKay Glacier- Antarctic Ice sheet in the Ross Sea. We were using new vibracoring equipment and winch mounted on the NZAP Nodwell/HIAB crane. The Vibracorer had successfully recovered sandy mud core from Petone wharf on a firm substrate (mussel bed) and had been successfully pressure tested to 500 m in Cook Strait. The winch had been load tested in Wellington but could not be operated to design depth until coupled to the Nodwell in Antarctica.

We set up in the inner basin of Granite Harbour to recover core from 700 m water depth approximately 4 km east of the MacKay Glacier Tongue terminus (Figure 1). A 2.5 m long gravity core had been recovered in 1989 at this site by colleagues from Rice University and showed that 0.5-1.0 m of soft mud (diatomaceous ooze) was present on the sea floor and that the marine-glacial transition was deeper than the 2.5 m base of this core.

Assembly of the equipment at Scott Base took 1-2 days longer than expected and also longer in the field to recheck the systems in Granite Harbour. Some minor problems were identified during assembly and after the 150 km cargo train transport to Granite Harbour which require minor modifications. We also had minor problems with the winch/HIAB systems which were overcome in the field by adjusting hydraulic settings and an increased familiarity with the equipment capabilities.

Two coring attempts were made in a depth of 700 m . The process which was controlled by a computer at the surface involved pushing and vibrating the core tube 5 m down below the vibracorer frame in two 2.5 m runs, and then retracting the core tube. On

both occasions retraction of the core tube was not completed, leaving 2.5-3 m extending below the corer frame. When the corer returned to the surface we found that the 101 mm diameter steel core tube was bent between 30 to 45 degrees 2.5-3.0 m from the cutter end. The corer was also covered in mud on one side indicating it was lying on its side on the sea floor. This probably happened before the coring process began because no stiff mud was recovered, suggesting that the core tube had penetrated "horizontally" and not below 1-1.5 m depth where stiff mud is known to occur at this site. This also accounts for the incomplete retraction of the core tube which is not designed for "horizontal" operation. When the corer was then lifted off the sea floor it became upright and bent the core tube.

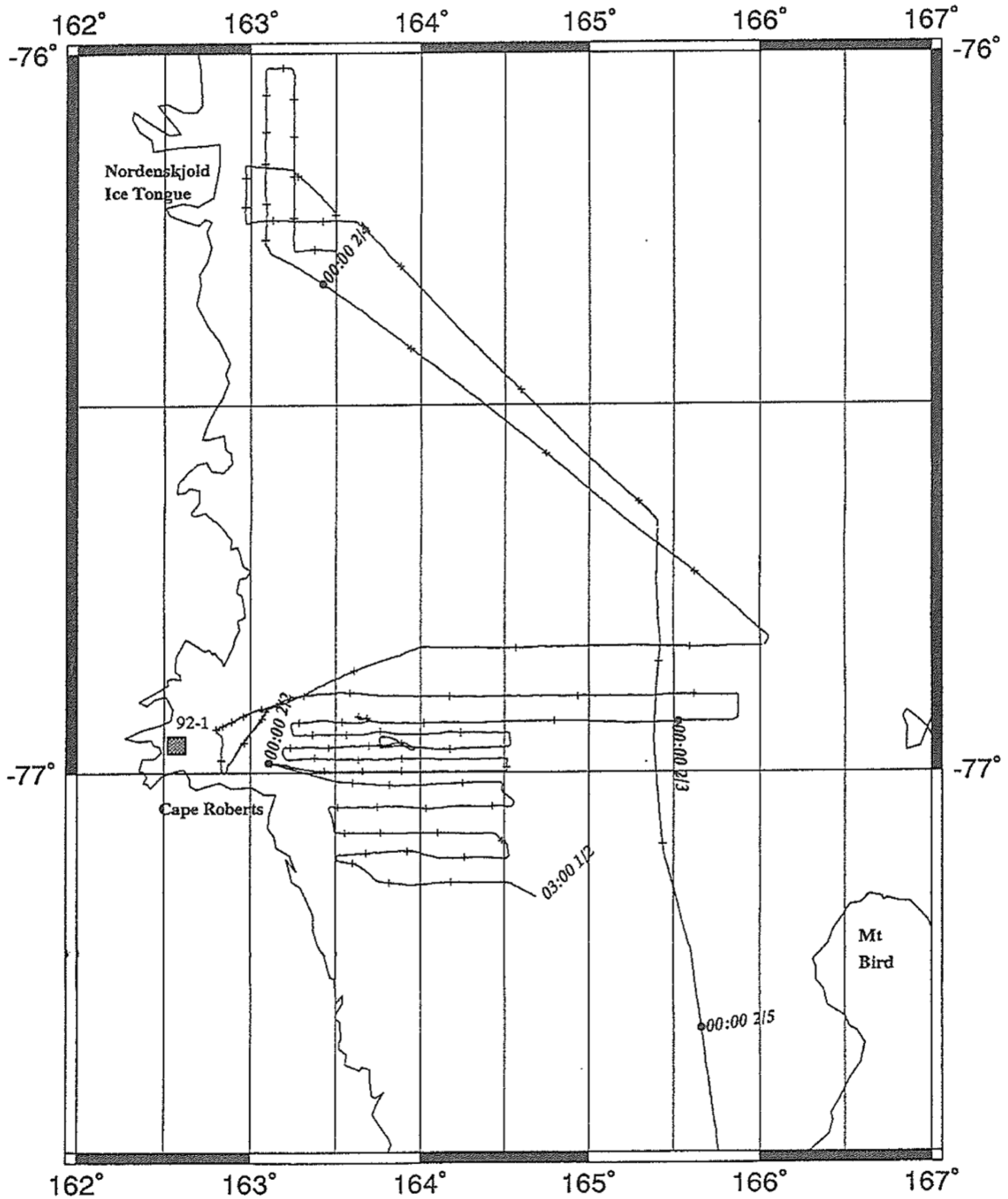


Figure 1. Ship track, 3.5 kHz profile lines from USCGC Polar Star and sea ice coring site 92-1 in Granite Harbour.

It is clear that the present three feet supporting the coring frame do not provide sufficient stability on a soft muddy sea floor. The computer/datalogger controlled operation however went very well. We are redesigning the feet and testing the corer in the muddy sea floor in the deeper parts of Wellington Harbour in June. For the 1993-94 antarctic field season we would also expect to carry out modifications to the winch and build a sledge/lifting frame to deploy the corer in conjunction with Nodwell/crane to increase the efficiency and safety of the operation from sea ice in Antarctica.

Several other small programmes were successfully completed during this sea ice season in the Cape Roberts area. Two counts of nesting Skuas at Cape Roberts were done on 19 November and 1 December to establish the nesting pattern for the Cape Roberts Project CEE. Approximately 45 pairs were distributed over the entire area of Cape Roberts with 9 pair in the south bay area.

A detailed topographic survey of the south bay area was also completed by the NZAP Surveyor to help planning of equipment storage for the Cape Roberts Project.

Data from the tide gauge at Cape Roberts was collected for the period 4 Dec. 91 to 3 Dec. 92. The wind speed and direction sensors were replaced and a new temperature sensor added to the instrument array in an attempt to recalibrate the original temperature sensor. The tide gauge was also levelled over a 25 hour period by the surveyor.

Sea ice thickness and bathymetry data were collected for the Cape Roberts project at four potential drillsites between 10 and 15 km offshore. Sea ice thickness ranged between 2.3 to 2.5 m at the sites and the ice edge was 22 km offshore. This survey was carried out using 2 Alpine II skidoos, box sledges with echosounder and a Magellan NavPro 1000 GPS receiver.

Ice Breaker Support, 1-5 February 1993.

The USCGC Polar Star was used to collect approximately 450 nautical miles of 3.5 Khz bottom profile data off the south Victoria Land coast during 1-5 February 1993 (figure 1). This data was collected for two purposes.

Offshore Cape Roberts 11 east-west lines between 14 and 17 nautical miles long and spaced 1 and 2 nautical miles apart were run in the area of future drilling (Cape Roberts Project). A detailed bathymetry map will be prepared from this data to better define potential drill sites. Over most of the area of potential drill sites very little sub sea floor structure was imaged indicating that no soft (gravel?) sediment is present and in many areas "hard sea floor" reflections indicate that the sedimentary basement outcrops at the sea floor.

The second purpose was to look in the deep basins of Granite Harbour and the Nordenskjold Ice Tongue for Holocene sediments deposited by ice retreat since the Last Glaciation (Figure 2). In Granite Harbour the presence of fast ice and time constraints restricted the planned survey and a line to the MacKay Glacier Tongue was not completed. Good data was recovered from the previously known basin of Avalanche Bay about 800 m deep where several metres of soft sediments drape over hummocky sea floor.

Offshore of the Nordenskjold Ice Tongue a (granitic?) basement high (570 m) has a "hard" sea floor reflection and a "glaciated" shape probably cut by northwards moving ice. Closer towards the ice tongue a high area averaging 500 m deep and about the same width (10 km) as the present tongue is present. This structure in contrast has a hummocky "soft" surface that is interpreted to be grounding zone sediments deposited beneath the ice tongue probably when sea level was 120 m lower during the last glaciation. On the south side this structure a east-west trending basin up to 1050 m deep is present and contains layered sediments several tens of metres thick (figure 2).

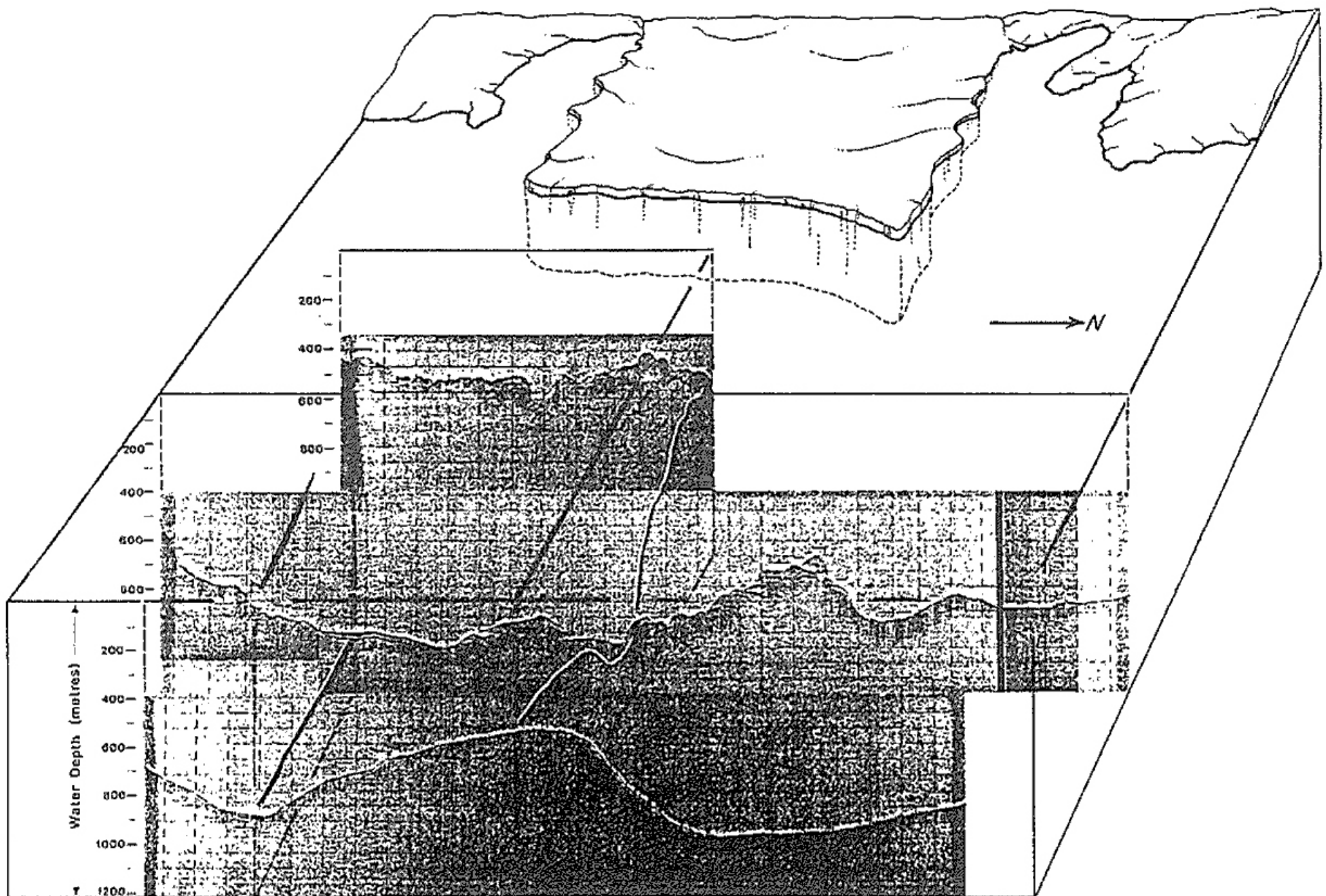


Figure 2. Block diagram showing 3.5 kHz profiles offshore of the Nordenskjold Ice Tongue.

The profiles in Granite Harbour and at the Nordenskjold Ice Tongue will be used to identify sites for future sea floor sediment coring (vibracoring).

Publications

The 3.5 KHz data will be processed and a map compiled of the area offshore of Cape Roberts to plan future drillsites. This data will be published in conjunction with results from 1993-94 programmes planned by US and Italian investigators. The data in Granite Harbour will be analysed to identify coring sites for the 1993-94 season.

Environmental Impact

The sea ice operation made no significant or lasting impact. Human waste and grey water was consigned to the sea via holes in the sea ice. All other wastes (burnable and nonburnable) were returned to Scott Base for disposal as per NZAP policies. A NZAP Environmental Return is appended to this report.

Future Research

1993-94 Proposal Revision.

Programme (1993-94)

(1) Complete the coring programme in Granite Harbour that was unsuccessful in 1992-93. Also core at Blue Glacier in conjunction with Powell's ROV study (NSF proposal) if funded.

(2) Bathymetry around the Nordenskjold Ice Tongue (Skidoo and helo only). A helo reconnaissance this season showed suitable fast ice was present along the coast to travel and operate around the ice tongue. We did not have time to travel by skidoo to the Nordenskjold for the bathymetry as planned this season. Based on this seasons reconnaissance it would probably take up to 4 days to travel by bulldozer from Scott Base to the Nordenskjold. This is clearly too long to then give sufficient working time in the area within our sea ice operating window. Operating at the Nordenskjold would however be practical if faster vehicles (Challenger and Nodwell) were used or if the vehicles were staged and returned to Cape Roberts in a future season. In this case the one way trip would be only 95 km and possible in 1 to 1.5 days travel.

(3) Ship -based programme. Depends primarily on availability of a suitable ship and successful sea ice operation.

Management of Science in the Ross Dependency

Planning the original ship based coring programme did not proceed easily. The difficulties appeared to occur because NSF would only programme a very short time window for NZAP use of the ice-breaker even though previous years experience indicated that the ice-breaker could be available in the McMurdo area for several weeks during normal tanker and cargo ship support. Our technical enquiries via NZAP regarding ice-breaker coring and 3.5 Khz equipment also were not passed on to the Coast Guard. This made planning very difficult and ultimately caused us to cancel the ship request. We hope with improved communications between NZAP and NSF-OPP in the future that these difficulties can be overcome.

Our experience with the ice-breaker in February has shown us that we would need to build some special deployment equipment for the vibracorer if we used the ice-breaker in the future. The ice-breaker's inability to stay precisely on station in open water remains a major problem in utilising this ship for open water coring but it is a very suitable platform in pack and fast ice.

Acknowledgements

We are grateful to the following people and groups who have contributed to the development of the new coring equipment: VUW Mechanical Workshop (especially Alan Rennie and Mike Turner), Eric Broughton (VUW Geophysics Institute), VUW Works and Services Carpentry Workshop, Peter Dennet (Capital Hydraulics), Steve Mercer (MAF).

Garth Varcoe is fondly remembered for his confidence and support for the project, and during the abysmal testing conditions at Petone Wharf in early October 1992. Also Ron Rodgers (NZAP) and Ross Major (Works Consultancy) were responsible for design and refitting the NZAP Nodwell.

The Scott Base summer staff led by Dave Comber provided much appreciated support during the season and special thanks to Peter Grube (Bear) our field plant operator. Scott Base staff, Paul Chaplin, Dave Comber, Brian Green, Greg Harris, Mike Mahon, Dave Milne, stood watches on the ice-breaker cruise. Lastly we thank Captain Hagstrom and the crew of the USCGC Polar Star for their efforts to complete the 3.5 kHz survey programme.

NZAP ENVIRONMENTAL RETURN 1992-93 SEASON

K042

Complete all relevant sections and include in both Immediate Science And Logistics Reports

Use of chemicals including radionuclides in Antarctica.

Complete the following for each chemical and Radionuclide taken to Antarctica

<u>Chemical form</u>	<u>Locations used</u>	<u>Quantity (μ Curies where applicable)</u>
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NOT USED

Were all chemicals returned to New Zealand..... Yes No
If NO detail why, location, quantities of material released or stored

Use of explosives.

Detail any use of explosives.

<u>Date</u>	<u>Location (inlc reference)</u>	<u>Explosive type</u>	<u>Size of charge kg</u>	<u>Number exploded</u>
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NOT USED

Details of entry to Protected Areas.

List any protected area, Specially Protected Area (SPA) or Site of Special Scientific Interest (SSSI) or Specially Reserved Area (SRA), you entered.

<u>Permit No.</u>	<u>Name of SSSI, SPA or SRA</u>	<u>Date Visited</u>	<u>Party size</u>	<u>Total person-days in Area</u>
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NO SITES VISITED

Other impacts

Detail any

HUMAN & GREY WATER WASTES CONSIGNED TO THE SEA VIA SEA ICE HOLES

Summary of locations occupied

Complete the following for each site occupied by your event

	Sites Occupied or visited	Field Camp Location For field camps give longitude and latitude or map reference.		Dates Occupied		Total Days	Number of people	Total man-days at location	Previously used camp site
		Latitude	Longitude	Map and Ref	From				
1.	Scott Base	77°51.0S	166°46E						
2.	Vanda	77°31.4S	161°40.4E						
3.	Cape Bird	77°14.0S	166°28.0E						
4.	Sea Ice	77°40.8S	165 28. SE		15-11-92	16-11-92	6	3	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
5.	Sea Ice, Marble Pt	77° 25 S	163°45 E		16-11-92	18-11-92	6	12	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
6.	Sea Ice, Cape Roberts	77° 01.95	163° 10.96E		18-11-92	19-11-92	6	6	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
7.	Sea Ice, Granite Hbr	76° 57.7S	162° 35.5E		20-11-92	29-11-92	5-6	48	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
8.	Sea Ice, Cape Roberts	77° 01.95	163 10.96E		29-11-92	4-12-92	5-7	31	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
9.	Sea Ice, New Hbr	77° 35 S	164° 15 E		5-12-92		7	3.5	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
10.									<input type="checkbox"/> Yes <input type="checkbox"/> No
11.									<input type="checkbox"/> Yes <input type="checkbox"/> No
12.									<input type="checkbox"/> Yes <input type="checkbox"/> No

Notes:

K-048
1992/93

LOGISTICS REPORT
K-048: ANTARCTIC ROSS SEA LITHOSPHERE
STUDY (ARSLS)

NEW ZEALAND ANTARCTIC PROGRAMME 1992/93

Event Personnel:
J.A. Gamble (Event Leader)
R.J. Wysoczanski
J. Brooker
November 1992 - December 1992

Aims

The objectives of the 1992/93 season for the K-048 party were to collect xenoliths from a number of key localities in the vicinity of Ross Island and the foothills of the Transantarctic Mountains. The localities had all been visited previously by Gamble (1982/82, 83/84, 84/85 seasons) but sample sets were incomplete as the visits (in some cases) were helicopter supported and of short duration. The aim therefore, was to add to and expand our xenolith collections so that we could begin to make meaningful comparisons with the extensive collections made in West Antarctica (Marie Byrd Land) as part of the WAVE project (field seasons 1989/90; 90/91).

Planning

Planning for the Antarctic Ross Sea Lithosphere Study (ARSLS) was a logical extension of the successful work in West Antarctica on the WAVE programme and began in 1990 and led to a science proposal being submitted to RDRC.

Following approval of the project, further planning was undertaken at the Tekapo orientation meeting in August 1992. There, field and helicopter requirements were discussed and put in sites detailed.

Medicals were undertaken in September 1992 in the Student Health Centre of Victoria University.

Travel to Antarctica was organised via the Antarctic Research Centre of VUW and NZAP. We experienced a delay of 1 day owing to poor weather conditions in McMurdo Sound.

Cargo

A sealed box of cargo accompanied the VUWAE equipment for K-042 to the ice. This was unpacked for us by the K-042 personnel and store personnel had set it aside for our arrival. We encountered no difficulties with cargo handling at Scott Base and congratulate the two base staff on the efficient manner in which they handled helicopter loads and rock samples to be returned to New Zealand. In all we packaged some 12 rock boxes (~1000lbs) of samples for return to New Zealand. These boxes were numbered, addressed, weighed, sealed and banded before being loaded into a large carton and palletised for transport.

Event Personnel

Members of the K-048 party for the 1992/93 season were as follows:

1) John Gamble (Event Leader, principal investigator) Dept. of Geology, Victoria University of Wellington.

2) Richard Wysoczanski (PhD student) Dept. of Geology, Victoria University of Wellington.

3) Jonathan Brooker (BSc Hons student) Dept. of Geology, Victoria University of Wellington.

4) Vivienne Taylor (Scott Base Staff) casual field assistant, Cape Bird only.

Preparations for the field

The K-048 party assembled in Christchurch on Sunday 8th November 1992 and kitted out at NZAP headquarters in preparation for a flight south on Monday 9th November. This flight was subsequently delayed by 1 day owing to bad weather in McMurdo Sound. We flew south on Tuesday 10th November and began preparations of our field gear that evening. On 11th - 12th November, Wysoczanski and Brooker attended field training. Gamble participated in the rope work, crevasse extraction and shelter building exercises but otherwise continued with field gear preparations. During field training all tents were pitched and stoves and radios (both HF and VHF) tested. This course was extremely well presented by knowledgeable, patient and enthusiastic instructors. For field programmes it is an important reminder of the ever present hazards on the ice.

We had excellent and valued support from the Scott Base field store throughout our preparations.

Field Transport

Transport to and from Antarctica was by LC-130 Hercules transport aircraft operated by VXE-6 (to the ice) and RNZAF (from the ice), both trips were event free.

Field transport on Saturday 14th November 1992 was via two Bombardier Alpine II skidoos to a number of localities along Hut Point Peninsula. These vehicles performed faultlessly.

Transport to and from other field locations was by helicopter (either VXE-6 or RNZAF) and on the ground, by foot.

Event Diary

8th November 1992	Gamble, Wysoczanski and Brooker (K-048) to Christchurch.
10th November 1992	K-048 to McMurdo after delay of one day due to bad weather at destination.
11th - 12th November	K-048 attend field training and prepare field equipment, food, etc.
13th November	Official briefing at Scott Base with SENZ Rep, Ops Manager and Base Manager. Finalising field preparations.

14th November K-048 to Sulphur Cones, Turtle Rock by Alpine II's over sea ice. return via Hut Point Peninsula and ski-field. Weather excellent.

15th November Gamble packed rock boxes from previous day. Wysoczanski and Brooker on "Fam" trip to Cape Evans and Cape Royds.

16th November K-048 to Black Island Camp by Helo. Weather, cloudy with 20 knot wind.

17th November Sampling xenoliths. Weather; Light snow overnight. Wind from south around 20 - 25 knots.

18th November Sampling xenoliths. Weather; high cloud with wind to 25/30 knots from south. Return to Scott Base in late afternoon by Helo.

19th November Scott Base, drying tents, sleeping bags and reorganising food for next field put in. Packing rock boxes.

20th November K-048 to Foster Crater (early p.m.) by Helo. Setting up camp and early exploration of field area. Evening calm and clear.

21st November Xenolith search at Foster Crater. Weather high scattered cloud clearing through day to cloudless. Wind increasing overnight.

22nd November Xenolith search at Foster Crater. Clear sky but blowing snow and winds increasing throughout day to 30 - 40 knots by 20.00 hrs.

23rd November Tent Day. Wind and blowing snow continued to increase overnight to a constant 60 - 70 knots by 05.00. By 08.00 it was impossible to stand outside the tent and gusts were estimated at in excess of 80 knots. Polar tents began to show effects with guys loosening (impossible to tighten up), snow and food boxes being blown off tent valances. One tent suffered a badly bent pole on the up wind side. Stitching on the guy joins later showed evidence of beginning failure. K-048 personnel evacuated from site at 16.45 by VXE-6 helicopter piloted by Cmr Keho.

24th November	Scott Base. Gamble returned by Helo to Foster Crater site with Saxby and colleague to retrieve camp. Wind had dropped to around 20 knots. Tents survived the battering and all camp was intact apart from a few rock box lids, some flags and sample bags.
25th November	Scott Base. Verbal report to Ops Manager and SENS Rep on the Foster Crater pull out. Preparation for Cape Bird.
26th November	Scott Base. Foster Crater rock boxes packed for return to N.Z.
27th November	K-048 party (+ Vivienne Taylor) to Cape Bird Camp (Cinder Hill), by Helo. Weather fine, high cloud with gentle northerly wind to 10 knots. Evening hike around Cinder Hill, new xenolith locality discovered in lava flow south of Cinder Hill.
28th November	K-048 party to Cape Bird Hut and return, examining coastal volcanic exposures en route. Weather; clear skies, gentle 10 knot northerly.
29th November	Visited cones south of Cinder Hill up to level of Cape Bird Ice Cap. Weather; clouded over during day.
30th November	Helo anticipated at ~11.00, delayed to 13.30 then 15.00, then 16.30 and then cancelled due to fog bound at Black Island.
to	
1st December	Helo arrived at 10.00 for return to Scott Base. Day spent cleaning and returning field gear.
2nd December	Scott Base. Day spent cleaning and returning field equipment. JAG undertook task of having clearance form validated by various section heads, filed "event debrief form" and completed article for "Antarctic Times". Party "bag dragged" to McMurdo at 19.40 for the ritual weigh in.
3rd December	K-048 return to NZ on RNZAF LC-130 Hercules. Excellent Flight.

Event Map

The sketch map below shows the localities visited and camp sites used by the K-048 party during the 1991/92 season.

Weather

The K-048 party was working out of Scott Base and was not issued with a standard "Met Book". In general the weather we experienced was similar to that at the Scott Base, however on the upper Koettlitz Glacier (Foster Crater) we encountered winds of quite extraordinary velocity over a 36 hour period.

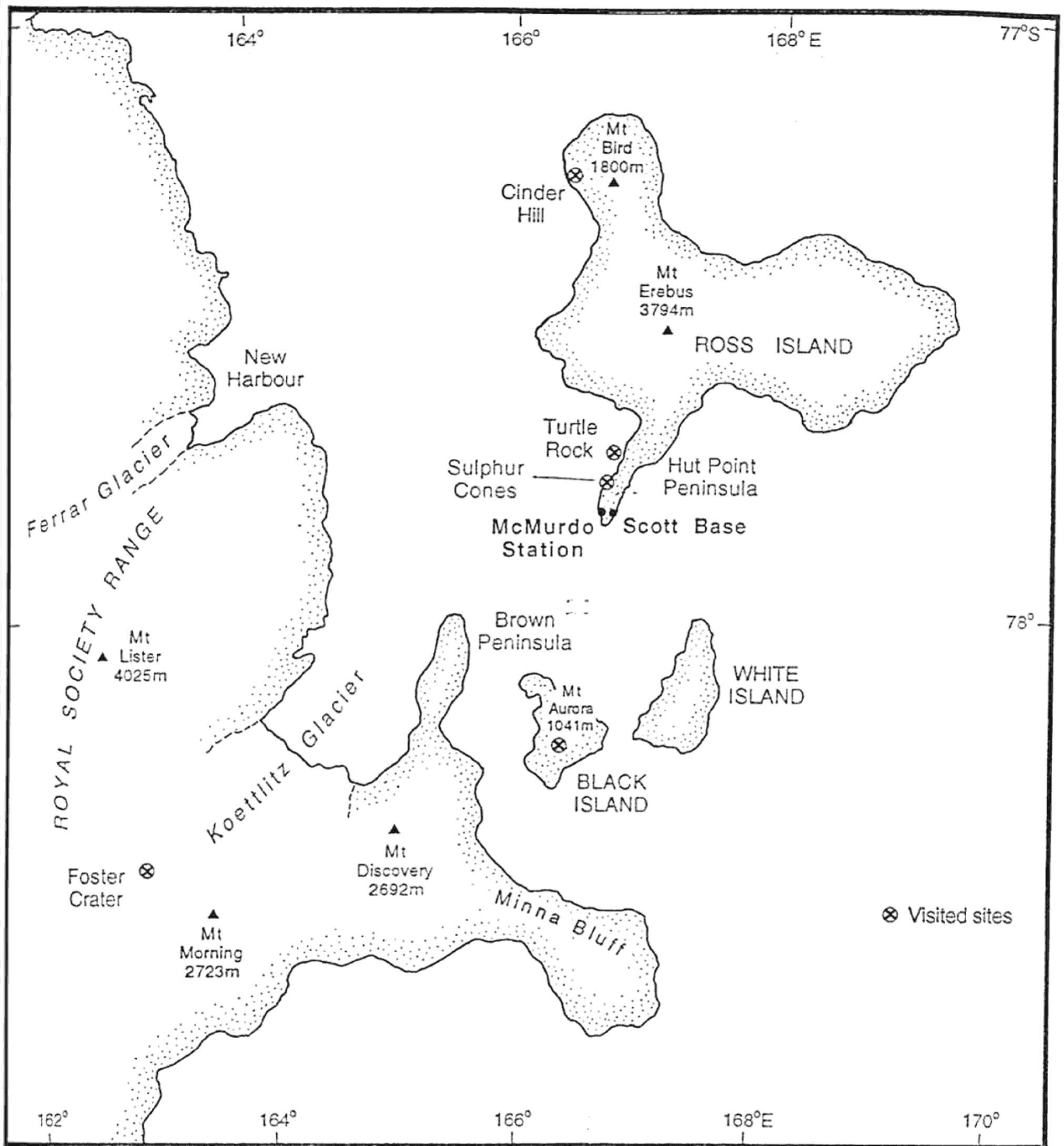
The situation began to develop on the morning of 22nd November when wind speed picked up to permit snow to start blowing. This in itself was not a great problem although it was rather unpleasant to work in. By afternoon the wind had picked up to around 30 knots and snow was clearly visible cascading off the high peaks surrounding the Koettlitz Glacier. By late evening wind had increased to a steady 40+ knots and blowing snow was engulfing the tents. The velocity continued to increase through the early hours of 23rd November so that by the normal radio sked at 08.00, I could barely hear the radio operator at Scott Base and could not stand up outside the tent. I estimated the velocity at 70 - 80 knots, it was remarkably constant. Interestingly, it was not bitingly cold - or was that simply the adrenalin? Between 08.00 and 12.00 the wind showed no signs of abating, and if anything increased, such that we went on to 1/2 hourly reports to Scott Base. One of the Polar Tents had suffered structural damage (bent poles) and I doubted the ability of the camp to withstand a further 24 - 48 hours of these conditions (forecast by Mac Weather to Ops Manager, Scott Base). As a result, a helicopter was dispatched to do a personnel only pick up and the party was returned to Scott Base. Needless to say, the extreme conditions did not persist and we were able to recover the camp the following day, with no difficulty.

Accidents

None to report.

Field Equipment

Our experiences at Foster Crater only serve to reinforce opinions as to the incredible strength of Polar tents. In the 1990/91 WAVE season, a USAP tent suffered bent poles in winds of slightly lesser, but more variable, intensity than those experienced on the Koettlitz Glacier. Our tents at Foster Crater had been dug into a flattened platform of snow. Hollow steel pegs were used to secure all the main guys and the steel reinforcing rod pegs used for the tent valances. Some of the latter were bent. All the heavy snow blocks we had piled on the valances were blown away by the wind which was then able to lift the valance and get underneath, thereby lifting the tent.



Event Map The Ross Sea Embayment area showing details of localities visited by the K-048 (ARSLS) party during the 1992/93 field season.

All our other field gear performed satisfactorily but some comments are in order:

1/ The brown polypo gloves are a success. All of us found them to be excellent. I do not feel that they should replace the blue ploypro gloves - these are finer, make better mitten liners and still allow more feel for jobs such as tying knots.

2/ Better firmer insoles are needed for the "tent slippers" I used the blue insoles provided for the sores - they were excellent.

3/ I recollect Bill Atkinson and myself making a few comments about the prussicks on the Polar Tents in our WAVE 1990/91 report. This is still a problem and we encountered it in the high winds on the Koettlitz Glacier.

4/ The large jackets have problems with the zippers and we all encountered this at one time or other. The problem is that the zip eats up the lining and gets jammed - a real nuisance when it's -20 and blowing snow!

5/ Field Food Boxes We had some boxes of Muesli which were "best before" 1989! Who knows, if cost cutting continues, we may get some boxes out of Scott's Hut!

6/ A weld failed on one of our Primus stoves and it was necessary to replace it with another unit. The failure occurred where the filler sleeve contacts the main reservoir tank of the stove. Failure was reported to field store manager.

Radio Communications

From all of our camp sites we were able to communicate directly with Scott Base via VHF radio; reception was always excellent. On Black Island our position behind Mt Aurora necessitated leaving the tent to establish communications. This was also the case at Cinder Hill on Mt. Bird, where we could receive Scott Base, but could not transmit from the camp site due to its position in a natural hollow. It was a simple task to climb to a suitable vantage point. At Foster Crater radio communications were excellent and we could receive and transmit from within the tent. Using the high gain antenna improved both reception and our ability to transmit. From Mt Bird we used the Erebus Repeater with success. From Black Island and Foster Crater Channel 4.

We encountered a few problems with the battery contacts at Black Island and Foster Crater during extreme cold. This was not a problem at Mt Bird.

At Mt Bird we also set up the HF set and on one occasion communicated with Scott Base (at the put in), otherwise we did not use the Codan set.

Scott Base and Arrival Heights Laboratory Facilities

J. Gamble made us of office space in the Hatherton Lab on several occasions during our stays at Scott Base. I did have an initial problem in gaining access to a Mac computer. Also, as I did not have a personal password, this proved a problem as I only wished to use the Mac on a short term basis and confidentiality was not a concern.

Refuge Huts and NZAP Remote Stations

During our visit to Mt Bird volcano we had occasion to visit the refurbished Cape Bird Hut. We found the hut to be in good condition well supplied and very weather-proof. We did not use the hut apart from having lunch inside. We left the hut as we had found it.

Environmental Impact

See report on the enclosed forms.

Historic Sites

All the K-048 party visited the Hut Point site of the Discovery Hut and both Brooker and Wysoczanski visited the Cape Evans and Cape Royds huts with a Sunday "Fam" trip.

Antarctic Geographic Place Names

Not applicable at this stage.

**K-048
1992/93**

**IMMEDIATE SCIENTIFIC REPORT
K-048: ANTARCTIC ROSS SEA LITHOSPHERE
STUDY (ARSLS)**

NEW ZEALAND ANTARCTIC PROGRAMME 1992/93

**Event Personnel:
J.A. Gamble (Event Leader)
R.J. Wysoczanski
J. Brooker
November 1992 - December 1992**

ABSTRACT

Lithospheric xenoliths were collected from basanitic scoria cones of the Mc Murdo Volcanic Province at a number of localities on and adjacent to Ross Island (Hut Point Peninsula, Turtle Rock), Black Island and in the foothills of the Transantarctic Mountains.

The xenoliths vary from texturally variable, spinel lherzolites and dunites representative of upper mantle assemblages to ultramafic Al-augite \pm kaersutite bearing ultramafic rocks and plagioclase bearing ultramafic to mafic granulites thought to represent the transition zone between upper mantle and lower crust. In some localities (e.g. Foster Crater) supracrustal rocks (sintered granitoids and basement metasediments) occur in significant proportions. Many of the lower crustal mafic granulites are strongly layered mineralogically and, moreover, are notably denser than accepted upper mantle peridotites sampled from the same vent. This observation has an important bearing on the transition zone from lower crust to uppermost mantle and on model parameters for future geophysical modelling of sedimentary basin formation in the region.

The suites of xenoliths collected this season complement and in some cases (Black Island, Cape Bird and Foster Crater) greatly extend our existing xenolith sample sets. They will be used to expand previous models of lithospheric structure for the Ross Sea Embayment region¹ and to make comparisons with similar work being undertaken in West Antarctica as a part of the WAVE research programme, field work for which was undertaken in the 1989/90/91 seasons.

Proposed Programme

Lithospheric xenoliths are a convenient (and relatively cost efficient) means of gaining an insight into the petrology of the deep earth. As such, they provide important information on lithospheric structure and processes and can be used to gauge thermal regime and, possibly, the timing of events. In addition, they provide vital first order information from which to constrain geophysically based models.

Gamble and coworkers^{1,2} have undertaken detailed petrological studies of mantle and lower crustal xenoliths from Foster Crater in the foothills of the Trans Antarctic Mountains. This work has documented a variety of physico-chemical processes influencing the lithosphere and isotopic studies on a subset of these samples (McGibbon, 1991³) have yielded ages ranging from Proterozoic to Phanerozoic.

¹ Gamble J.A., McGibbon F., Kyle P.R., Menzies M.A., and Kirsch I. 1988: Metasomatised xenoliths from Foster Crater, Antarctica: Implications for lithospheric structure and processes beneath the Transantarctic Mountain Front. *J. Petrology, Special Lithosphere Issue*, 109 - 138.

² Gamble J.A. & Kyle P.R. 1987: The Origins of Glass and Amphibole in Spinel Wehrlite Xenoliths from Foster Crater, McMurdo Volcanic Group, Antarctica. *J. Petrology*, 28, 755 - 779.

³ McGibbon F. 1991: Geochemistry and petrology of ultramafic xenoliths of the Erebus Volcanic Province. In: Thomson, Crame and Thomson (eds) "Geological Evolution of Antarctica" Pub: Cambridge Univ. Press pp 317 - 321.

Further, and more rigorous sampling of the localities visited in the 1992/93 season was necessary to complete xenolith collections from the Ross Embayment area so that comparison could be attempted with the comprehensive suites collected in West Antarctica as part of the WAVE research programme.

Scientific Endeavours and Achievements

The Antarctic Ross Sea Lithosphere Study (ARSLS) was planned to visit a number of key volcanic cones in the vicinity of Ross Island and the foothills of the Transantarctic Mountains to collect xenoliths derived from the lower continental crust and lithospheric mantle. Most of the localities visited had been sampled by Gamble on previous occasions, but many of these were helicopter supported visits with little opportunity for detailed sampling. The aim for the 1992/93 season was to establish a field camp and spend several days undertaking exhaustive sampling. At this stage we are pleased to report that our sampling was both rigorous and highly successful as may be judged by the 1000lb + of rocks being returned to New Zealand.

The ARSLS team consisted of John Gamble (Event Leader), Richard Wysoczanski (PhD student) and Jonathan Brooker (BSc Hons student).

The party departed for Antarctica on Monday 10th December 1992 after a delay of 1 day due to bad weather in McMurdo. Between the 11th - 13th November Wysoczanski and Brooker attended Field Training (Gamble day only) and assembled field gear. During this exercise, Wysoczanski and Brooker took the opportunity to sample xenoliths from Half-Moon Crater, adjacent to Castle Rock on Hut Point Peninsula. On Saturday 14th November the party travelled north along the length of Hut Point Peninsula and collected xenoliths from Sulphur Cones (166° 45'E, 77° 48' S) and Turtle Rock (166° 47' E, 77° 44.5' S). A wide range of xenoliths was collected from both localities. On 16th November the party moved by helicopter to Black Island, to a locality immediately south of Mt Aurora (163° 23' E, 78° 14' S) to visit a cone initially sampled by Gamble in the 1984/85 season. Careful collecting and more thorough exploration of the locality resulted in a complete crust-mantle suite being collected, considerably extending that made on the previous visit. The party returned to Scott Base on 18th November 1992.

At Black Island the team experienced persistent 20 - 30 knot winds and this led us to acquire an additional Polar tent (replacing the Olympus) for the next phase to Foster Crater on the Koettlitz Glacier. This decision was to prove timely.

The party left Scott Base for Foster Crater (162° 57.00' E, 78° 23.73' S) on the 20th November, arriving at the crater amidst gathering cloud conditions which actually obscured the previous camp site used by Gamble in 1982/83 and 1984/85. As a result we camped on hard snow on the south of the crater, several hundred feet above the Koettlitz Glacier. The party encountered

4 Wysoczanski R.J. & Gamble J.A., 1992: Xenoliths from the volcanic province of West Antarctica and implications for lithospheric structure and processes. Proceedings 6th International Symposium on Antarctic Earth Sciences. (in press).

extreme winds (>75 - 80 knots) at this locality which eventuated in an early rescue (see logistic report) on 23rd November. However, before the high wind situation had developed, a comprehensive set of xenoliths was recovered. In particular, we added to the number of upper mantle spinel lherzolite samples and the granulite lower crustal suite.

The final destination in our search for xenoliths was Cape Bird and the basalt scoria cone called Cinder Hill (166° 25' E, 77° 16.53' S). On this trip the K-048 party had an extra field assistant in Vivienne Taylor, from the Scott Base staff. The field party departed Scott Base on 27th November, returning 1st December. Fresh granular spinel lherzolite xenoliths were recovered from a new locality to the south of Cinder Hill. These xenoliths were contained in dense black lava, in contrast to most other xenolith occurrences, which are in poorly welded, frequently oxidised, scoria deposits.

In summary, the 1992/93 season proved very successful, a new xenolith locality was located at Cape Bird and previous collections from Turtle Rock, Sulphur Cones, Black Island and Foster Crater were greatly enlarged and expanded. Work on these samples will commence as soon as they are returned from the ice.

Publications

Publication of our results will be by way of scientific journals and meetings. R.J. Wysoczanski will complete his PhD thesis (on West Antarctic xenoliths) in the next few months. J. Brooker will embark on a MSc thesis on rocks collected this season. Gamble and Wysoczanski will present results of this season at the International Association of Volcanology and Chemistry of the Earth's Interior congress in Canberra (September 1993) and the Geological society of New Zealand Annual meeting (November 1993). They will draw comparisons between West Antarctica suites and those of the Ross Sea Embayment and Transantarctic Mountains.

Environmental Impact

A completed environmental impact form is enclosed with this report. All waste products, including solid human wastes, were returned to Scott Base for disposal.

Future Research

Future research will involve detailed geochemical studies of the suites of samples collected this season. This will involve electron microprobe study and careful mineral separation followed by stable and radiogenic isotope analysis. The results will then be integrated into our extensive data-base of xenoliths from West Antarctica.

To some extent, this season marks a conclusion to the field work associated with xenolith studies in the Ross Sea area and West Antarctica. Time will be needed to work through the data and publish our results. A major aim is that this work can be integrated with available and planned geophysical studies of the lithosphere.

Management of Science in the Ross Dependency

An original intention of this year's programme was to have a visiting foreign scientist (Dr M.A. Menzies of the University of London) collaborate on the field aspect of the programme. Much of the radiogenic isotope work in the WAVE programme has been carried out in his laboratories at Royal Holloway and Bedford New College, University of London and it was fitting that we extend this to the field aspect. Unfortunately, due to other commitments, Dr Menzies was forced to withdraw, but is still involved as a collaborating scientist.

Concerning Scott Base, Field equipment and logistics we have no complaints, in fact, to the contrary, I found the Base staff entirely accommodating and helpful during my preparations for the field and on return from the field.

Acknowledgements

We are grateful to VUW Internal Grants Committee for funding and Alex Pyne of the ARC VUW for organisation and advice. Thanks to all the staff at Scott Base for their efforts to make things happen on time and according to plan, to the staff of NZAP for making it possible and to the helicopter crews of VXE-6 and RNZAF who carried us to and from our various work places.