

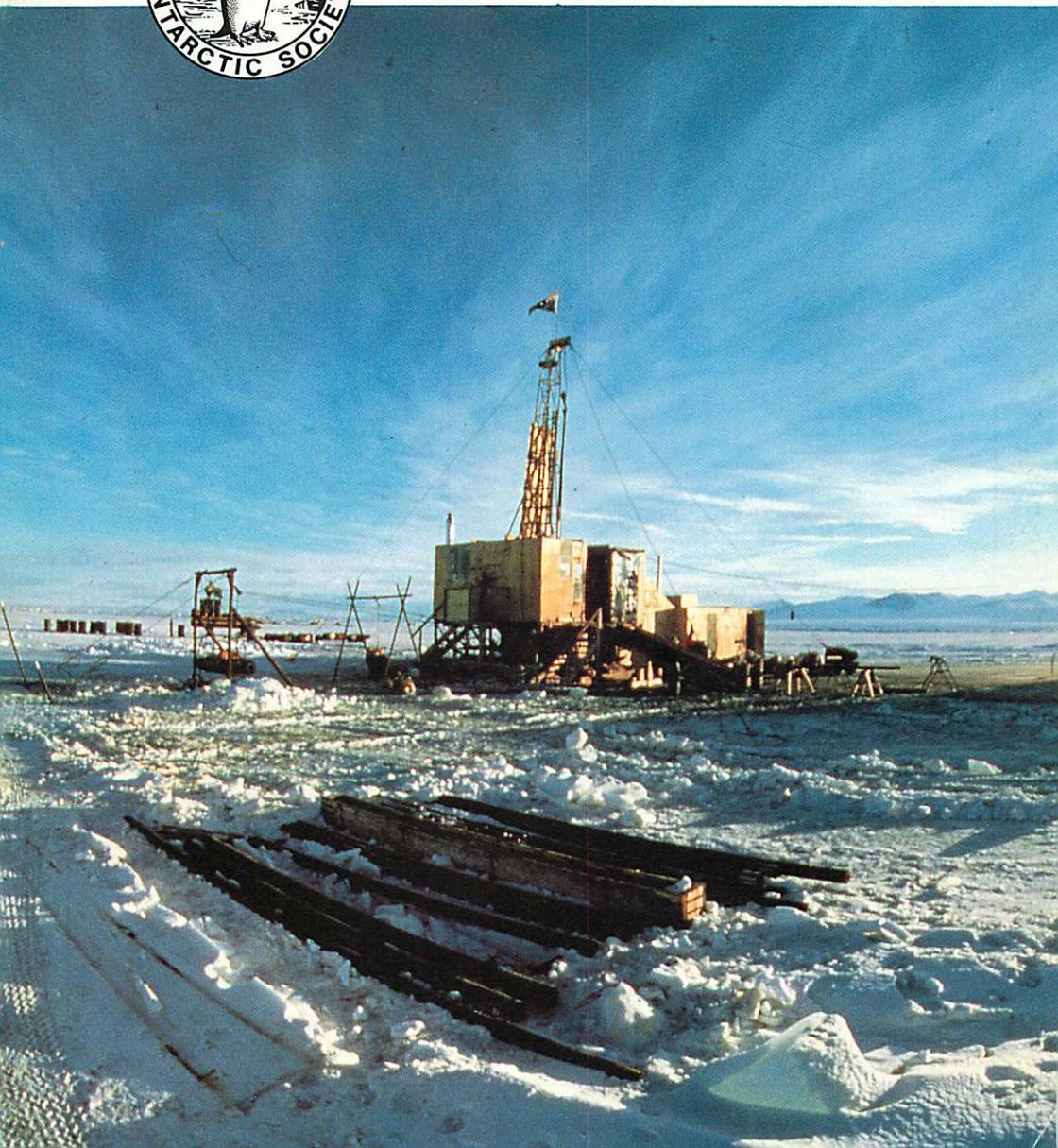
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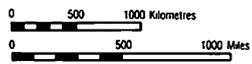
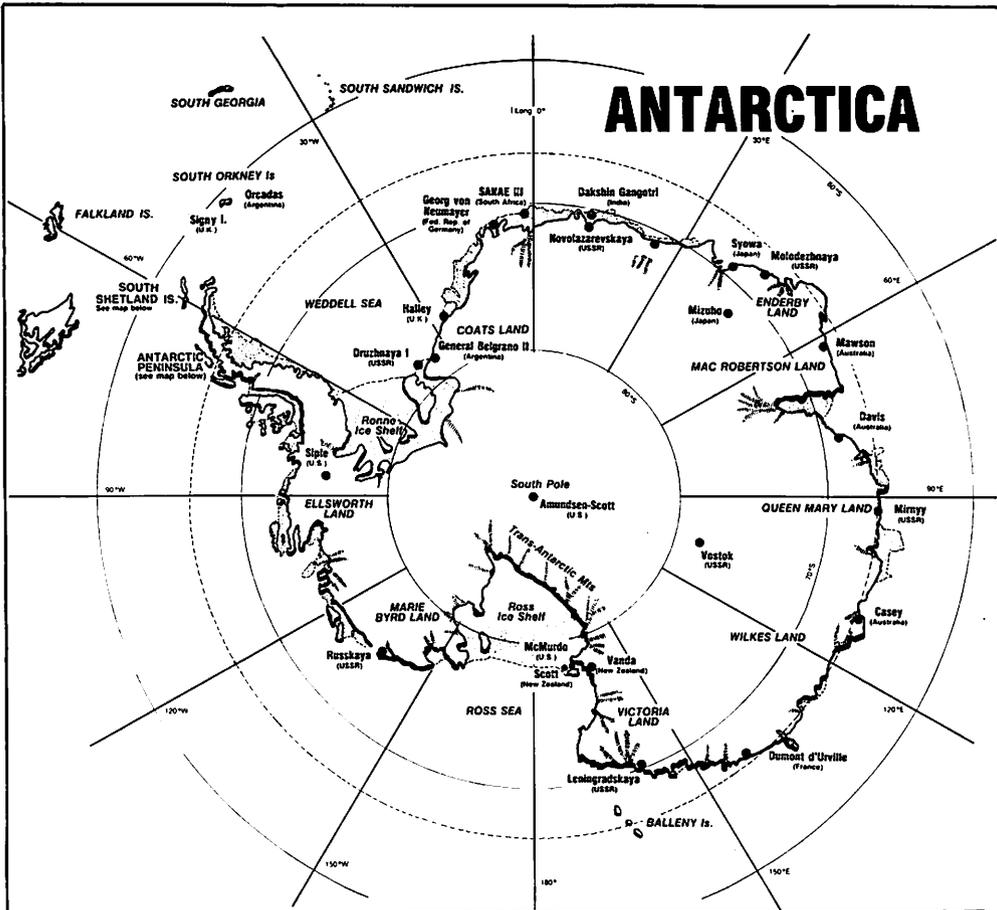
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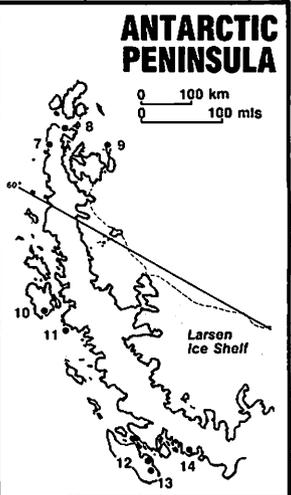
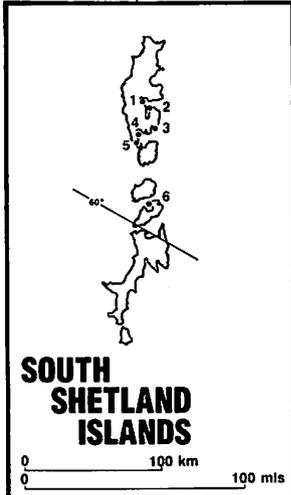


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- 11 Faraday UK
- 12 Rothera UK
- 13 Teniente Carvajal CHILE
- 14 General San Martin ARGENTINA



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Cover: *The CIROS 1 drilling rig in McMurdo Sound. Photo — Carey Mills. Story, page 61.*

NZARP

Forty-four projects in this season's programme

*Drilling of CIROS 1 (the Cenozoic Investigations of the western Ross Sea) the major project in the 1986-87 New Zealand Antarctic Research Programme was completed in late November.**

The forty-four projects which make up the 1986-87 New Zealand Antarctic Research programme include Adelie penguin tracking and work related to breeding success, under ice studies of benthic algae and microbiological analysis of the Mt. Erebus fumerole environment. The physical and optical properties of ice, the chemical constituents of the atmosphere, Ross Sea glaciations and the analysis of some of the geological problems found in the dry valleys are among the projects that will also be undertaken by the 200 scientists, base support and field staff who began flying south in August.

Penguin studies

Previous Biomass studies have assumed that changes in population size of Adelie penguin rookeries correlates to abundance of krill available for feeding but it is not known whether the krill is a limiting factor in the number of penguins that attempt to breed each year or their success in breeding. Further studies needed in this area will be undertaken by scientists from Otago and Auckland Universities and the Ecology Division of DSIR. They will be joined by guest scientists from Australia and the United States. Members of the team will cover thirteen weeks in the field from late October. The purpose will be to isolate factors which influence Adelie penguin breeding with seven different studies.

Dr Richard Sadlier and Kevin Lay of Ecology Division will be attaching radio transmitters to selected penguins to track them at sea and close to shore while foraging after incubation. This follows previous work but this year the team has a more sophisticated tracking system with aerials at Cape Bird and on the lower slopes of Mt. Erebus and they are able to cover a wider area. The team is also working as birds leave the nest to gather food for chicks instead of during incubation. The success and behaviour of the birds will be monitored after tracking is completed.

Dr Brian Greene of CSIRO in Canberra and Dr Lloyd Davis from Otago will be studying the energetic requirements by determining the metabolic rates and therefore the amount of food required by measuring the rates of turnover of body water and salt.

The behavioural patterns of penguins will be examined by Lloyd Davis together with the effect of pair bond duration on co-ordination of nest relief to assess whether the duration of foraging trips are regulated.

Dr John Cockrem and Don Waddington of Ecology Division will be furthering previous work on circadian rhythms. This will involve the collection of regular blood samples for subsequent laboratory analysis of melatonin levels. Last year's work indicated that birds may be able to respond to variations in light intensity which may explain behaviour rhythms in the constant daylight.

Dave Lambert of Auckland University will be seeking to determine the amount of genetic variation between penguin populations in the same and in different colonies. This project will include the collection of blood samples for subsequent analysis by electrophoresis from which it is hoped to identify protein differences which reflect genetic differences.

* Full coverage of this event appears on page 61.

From previous work it is estimated that fifty percent of penguins change their mates from year to year even though the previous mate may be in the colony. Recognition is considered to be determined by vocal cues. Beth Spiers of Otago University will be studying the female response to the old mate compared with the new mate and the similarities and differences in calls.

Guest scientist Dr Gary Miller of the University of New Mexico will study the pattern of nest site selection; this involves observations, early and late in the season, of the movement of birds through idfferent colonies in order to understand more about the choice of site.

The aerial reconnaissance of the coastline of the Ross Sea to determine the locations of colonies and numbers of penguin populations is planned again this year as part of New Zealand's contribution to ISAS, the International Survey of Antarctic Seabirds. The programme continues to provide basic data against which future population levels may be compared in order to monitor natural or man-induced environmental changes.

A ground truth count will be made at the colonies at Cape Royds and the other rookeries on Ross Island will be photographed by helicopter. RNZAF C130 flights to locate and photograph the Ross Sea rookeries will also be carried out. The team involved this year includes Dr Peter Wilson, Bruce Thomas and Tim Fitzgerald from Ecology Division. They will be in Antarctica in late November and early December.

Benthic algae

Few quantitative investigations have been undertaken on the growth of benthic algae in the extreme environment of the Antarctic. Scientists from Otago University will dive to collect samples and subsequently conduct a series of experiments to investigate the rates of photosynthesis and respiration in a number of Antarctic species in a range of light and temperature conditions. Led by Dr Murray Brown the team comprising Jonathon Keogh, Rex Haig and Trevor Dick will also make estimates of growth and biomass of the various species of benthic algae. The diving supervisor this year will be

Edwin Aaron of the Ministry of Agriculture and Fisheries.

Microbiology

A party of biologists from Waikato University will be working on Mt. Erebus. Professor Roy Daniel and Andrew Hudson will be accompanied by Andrew Dailey, an Antarctic Division field assistant. They will acclimatize on the Fang Glacier and hope to spend up to 14 days in the summit area of Erebus conducting wide ranging investigations of the microbiology of the Mt. Erebus fumarole environment which should provide data on the diversity and structure of bacterial morphotypes in thermal conditions.

Ecological survey

Drs Paul Broady and Laurie Breenfield and Andrew Kibblewhite of the University of Canterbury will carry out a general floristic and ecological survey of plants and microbes in the Garwood Valley and Lake Joyce and glacier area. This will include vegetation mapping, collection and microscopic examination of sample material and on site measurements of nitrogen fixation rates.

Physico chemical studies of the pond environment at Cape Royds and floristic and ecological studies of the algae in the ponds will also be carried out by the team during their two months in the field.

Fish studies

The physiological adaptations of Antarctic fishes and marine invertebrates begun in 1974 by scientists from Auckland University will be continued. This season the project is being lead by Professor Rufus Wells who has been joined by Professor Gordon Grigg and Lynette Beard of Sydney University and Graeme Summers of DSIR in Auckland. Working from the fish hut near Scott Base and in the laboratories the team are focussing on aspects of the cardiovascular regulatory processes of fishes and protein thermostability. A party will also visit Cape Royds to continue fish tagging operations to measure length, sample scales and collect data on size and population.

Further studies of fish are being undertaken by Cam Falkner, a biochemist from

Victoria University who specialises in detoxification mechanisms which break down naturally occurring or man made toxins. Because the process is likely to be slower in cold water fish they are particularly suitable for study. In 1983/84 Cam Falkner separated the detoxification enzyme, glutathione-s-transferases, a peroxidase in *Dissotichus mawsoni* and *Pagothenia borchgrevenki*. The role of this enzyme in breaking down peroxide has been questioned in fish and the ability to catalyse the reaction shown only last year; it is still uncertain in Antarctic fish but is currently being studied. Cam Falkner will be testing enzymes with a variety of substrates including cumene hydroperoxide on samples of tissues collected from fish near Scott Base and Cape Armitage.

Pelagic litter

A survey of pelagic litter levels in surface waters of the sector of the Southern Ocean lying south of New Zealand is to be continued by Dr Murray Gregory and Peter Grieve of Auckland University who will be travelling north on the USCGC Polar Sea in February.

The pair hope to continue mapping the shore types of the Ross Dependency with a visit to the Balleny Islands. This project includes a survey of seaborne litter. They will also study the high latitude beach forming processes and conduct further research into the extent, character and significance of the sub-tidal (abrasion) platforms.

Glaciations

Scientists from Waikato University will be undertaking further work on the dating of Ross Sea Glaciations. Led by Dr Chris Hendy, the party comprising Fiona Judd and Tony Sadler will be searching for exposures of radiometrically dateable deposits of algae carbonates and gypsum within the Ross Sea Glacial drifts in the Southern Koettlitz glacier region and in the meltwater streams between Trough Lake and the Miers Valley. It is thought to have been an area of extreme ablation between 17 and 21,000 years ago. Using a light percussion drill soft sediment core samples will be taken from

the Pyramid Trough area to obtain a sedimentary history from late Ross Sea 1 to the present. Water column samples will also be taken from Lake Trough for subsequent chemical and biological analysis. This party will be in the field for three weeks from late December.

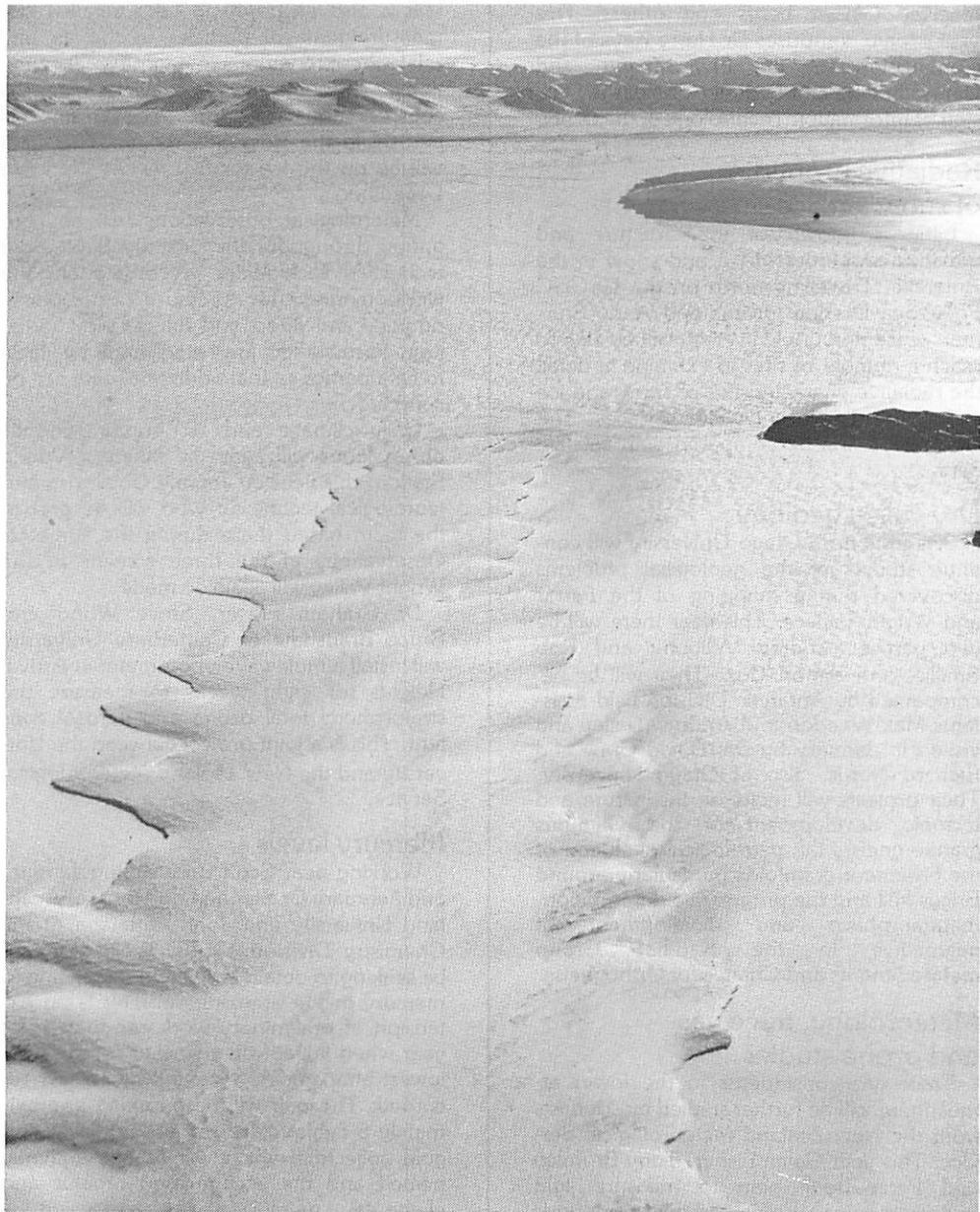
Ice studies

Dr Bob Buckley and Haley Bryan of the Physics and Engineering Laboratory, Dr Joe Trodahl and Marianne Vignaux of Victoria University will continue work begun last year aimed at improving the understanding of the optical and electrical properties of sea ice in order to understand the relationship between scattering and attenuation of light in its transmission through sea ice. From late October to mid-November they will make measurements of the spectral transmission of light in sea ice at several locations near the ice runway and the Erebus Tongue. Core samples will also be taken in order to study the structure of ice at these sites.

In mid-January Drs Bill Robinson of Physics and Engineering Laboratory and Tim Haskell of the Division of Information and Technology, DSIR, are due to fly south to upgrade the control equipment installed during the last two seasons to monitor the movement in the Erebus Ice Tongue.

The seaward end of the tongue calved in March 1911 and again during the 1940s. Since November 1983 two ice strain meters mounted on either side of the Tongue 4 km from the snout, which extends far out into McMurdo Sound, have been providing data on the forward movement and the elastic deformation due to the motion of the sea. Since December 1985 the meters have fed continuous information via Arrival Heights to Scott Base and this season it is proposed to upgrade the equipment to be remotely controlled from Scott Base so that data can be collected during strong northerly storms.

Oblique aerial photographs will again be taken from a Northbound RNZAF C130 of the icebergs in the fast ice along the western coastline of the Ross Sea. The photographs will be compared with those of previous years in order to determine the types, sizes, distribution, residence times and drifts of the



The seaward end of the Erebus ice tongue calved in March 1911 and again during the 1940's. The snout extends far out into McMurdo Sound and data is being collected on the forward movement and elastic deformation due to the motion of the sea. Photo — Antarctic Division, DSIR.

MacKay Glacier bergs and others. This year's team comprises Dr Harry Keys of the Commission for the Environment, and Dennis Fowler and Dr Peter Ellis of the Division of Information Technology of the DSIR.

Radiative properties of snow and ice

Little is known of the structure and radiative properties of ice and snow in the Antarctic. Travelling north on the USCGC Polar Sea Drs Ian Owens and Andy Sturman of Canterbury University will be able to reach a number of sites to examine in detail the radiative characteristics of snow and ice surfaces and adjacent water surfaces. The information will be compared with satellite data.

Dry valley geology

Scientists from Otago University will continue studies of the geological problems discovered during mapping of the Ferrar and Wright Valleys. This year there will be two parties, Andrew Allibone and Rob Smillie, and Simon Cox. They will be accompanied by Antarctic Division field assistants Max Wendon and Andrew Dailey and visited in January by Drs David Craw and Richard Norris, also of Otago University. Their projects will focus on the nature and tectonic development of the Olympus granite gneiss, the petrological evolution of the basement granitoids particularly around Briggs Hill and the progressive deformation, metamorphism and development of migmatites in the Keotlitz Group metasediments and Chancellor Orthogneiss.

Meteorology, trace gas and ozone studies

Trace gas constituents in the lower atmosphere will be further studied by scientists from the New Zealand Meteorological Service. This year Gavin Fisher, Tony Bromley and Peter Isaac plan to measure light hydrocarbons and halo carbon compounds and assess their relation to meteorological conditions. They will compare samples collected at various levels by balloons from Scott Base, Bratina Island, the Ice Shelf and Cape Bird.

It is also proposed to take detailed size measurements of particles in the air and relate these to various meteorological conditions. The objective is to determine the sources and transport mechanisms of aerosol in the Ross Sea region. The team will be on the ice for five weeks from late December.

Meteorological observations will be continued throughout the year by Scott Base technician Nick Miller. Recordings include wind, temperature, pressure, atmospheric turbidity and direct and diffuse solar radiation. Portable kits are being made available to field parties so that additional data can be collected.

Daily climatic and six hourly synoptic observations will again be taken at Vanda Station, this year by Joanne Cowern a meteorological technician who will be part of the team based there during the summer. Observations at the three screens in the Wright Valley will again be made.

Dr Graham Fraser, Steve Wood and Bruce Bradshaw of Canterbury University will install a multiwave photometer at Arrival Heights for eight weeks to measure the stratospheric total ozone and aerosol content. This is a joint project between the University and the New Zealand Meteorological Service.

Mercury levels

Working near Scott Base during January and February Dr Stephen de Mora, of Auckland University and John Patterson of the Chemistry Division, DSIR, Wellington will be seeking to obtain baseline data relating to mercury in the atmosphere. This is an extension of preliminary work conducted last year when initial tests revealed some of the lowest atmospheric mercury levels ever recorded. The pair will be pumping approximately 5 cubic metres of air into silver and gold collectors which will be subsequently heated and the accumulated organic and elemental mercury analysed using a photo-acoustic mercury-detector. Each sample can take between 24 and 48 hours to collect but improvements to equipment should shorten this time. A Scott Base technician will also be trained to continue

collecting samples during the months of winter darkness in order to provide a long term record.

Seismic work

Changes in types of eruptions occurring in the lava lake and active vent of Mt. Erebus will be observed on a television screen at Scott Base this year following the installation of a low powered camera transmitter at the crater rim. The project is part of the IM-EEMS, the International Mt. Erebus Eruption Mechanism Study, and will be led by Dr Ray Dibble of Victoria University accompanied by Drs K. Kaminuma and S. Miura of Japanese National Institute for Polar Research in Tokyo. Previous research has shown that earthquakes could be accompanied by several types of eruption but because of the equipment only one was described.

From this year additional data will also be obtained from infrared sensors, infrasonic microphones and three component wide-band seismometers which will also be installed at the stations around the summit area and linked to Scott Base by phototelemetry to provide continuous recordings of seismic activity. The project is of particular interest at present as the lava lake is recovering from choking by debris from the September 1984 increase in activity. Dr Dibble will also be visiting Windless Bight to upgrade the infrasonic array equipment to improve real time monitoring of Erebus eruptions.

Further seismic work will be undertaken in conjunction with CIROS by Dr Bryan Davey of Geophysics Division, DSIR and Graham Alder of Victoria University. They will be accompanied by Hernan Moreano Andrade, a Commander in the Ecuadorian Navy. The purpose of the project, which is in two parts, is to link the geological stratigraphy determined from the CIROS 1 borehole. A hydrophone will be lowered down the hole at the completion of drilling and in successive steps of 5–20 metres seismic impulses will be produced and recorded to show the travel time to the various layers.

Seismic reflection profiles will also be obtained along two lines 1 to 2 km in length radiating at right angles from the drillhole. The project is also designed to test alternative sound source systems — seismic or marine airgun — to determine which is suitable for a future more extensive survey.

Surveying and mapping

Two Lands and Survey surveyors will again provide assistance to a number of research and works programmes in the McMurdo Sound/Dry Valleys region. This year they are Phil Winters of Gisborne and Brian Anderson of Christchurch. Their work will also include survey control, triangulation measuring and observing between three survey stations and the establishment of a new survey station at Mt. Newall. In addition control measurements will be made for the McMurdo Sound Ice Shelf movement study, the CIROS drilling programme and at Cape Bird for the compilation of a 1:10,000 map of the region.

A co-operative project between the Department of Lands and Survey and the U.S. Geological Survey will involve two teams of New Zealand surveyors working with the Americans to survey a comprehensive network of control sites in the McMurdo Sound area; the network will also provide a basic spatial reference system to support precise positioning for a variety of scientific and mapping projects. The teams include Vince Belgrave of the Lands and Survey (Wellington), Joe Mulder and Bill Wicks of the University of Otago, Ross Paton (Blenheim) and John Oldridge (Hamilton) both of Lands and Survey.

Building and maintenance

Rebuilding of Scott Base is to be continued with the internal finishing of the light workshop complex. This is stage six of the project. It was erected last year and contains the carpenter shop, machine shop, and the electrician and base engineer's workshop.

Stage seven will also begin in October and by the end of the summer it is hoped that a new garage and workshop complex comprising a total area of 1,000 square metres will have been completed. This will be finished during the 1987/88 summer.

The work will again be undertaken by a team of New Zealand Army Engineers under the supervision of the Ministry of Works and Development. Captain Ed Ludbrook of No. Three Field Squad, Burnham Camp will be in charge of the 23 engineers and construction personnel drawn from camps throughout New Zealand.

Historic huts

Further work will be carried out on the historic huts at Hut Point, Capes Evans and Royds. Two members of the New Zealand Historic Places Trust, Dr Neville Ritchie and Alexy Simmons of Cromwell, an American

architect who has specialised in the archaeology of buildings, will be joined by New Zealand Antarctic Society members Ron Garrick of Gore and John Nielsen of Wellington. Five weeks will be spent at the three huts carrying out a work programme organised by the Historic Sites Management Committee, a sub-committee of the Ross Dependency Research Committee.

The annual inspection of the post office equipment will be carried out by Phil Orchard of Christchurch in December. Maintenance will be undertaken in January by Doug Rose, Ross Gargett and Paul Awdry all of Christchurch.

The long term programmes reviewed

Long term programmes continuing again this year include ionospheric monitoring, trace gas measurements, infrasonic detection studies, magnetic recordings, investigation of the normal and disturbed ionospheric D-region, and corrosion in the Antarctic environment.

The ionosphere, a region of the atmosphere with significant numbers of charged particles, is important to world high frequency communications but like the lower atmosphere it is subject to variations in intensity. Fluctuations are recorded on the Scott Base ionosonde which bounces radio waves of varying frequencies off the ionosphere and measures the intensity and frequency of the returned wave. When combined with ionosonde data collected at Scott Base since 1957 the information assists in forecasting radio wave propagation conditions and in research on the formation and behaviour of the ionospheric regions.

Since 1982 trace gas measurements have also been made at Scott Base; the purpose is to measure the amounts of stratospheric nitrogen dioxide and ozone by examining the absorption of scattered light from the zenith sky in the wavelength interval of 435 to 450 nanometres. The programme has recently become more relevant with the discovery of a large depletion of the springtime ozone amount (ozone hole) over

Antarctica. It is thought that the oxides of chlorine, some of which will also be measured, as well as the oxides of nitrogen may be playing a significant role in this depletion. Alan Thomas of PEL, Omakau will be installing a modified moon tracking spectrometer system which will enable measurements to be made throughout the winter.

Infrasonic detection studies involves the detection of solutions, non dispersive waves associated with currents in the low and middle atmosphere by infrasonic detection arrays sited at Windless Bight. The equipment is powered by a radio-isotope thermal generator and the results recorded at the Scott Base Laboratory as part of a joint project of the Physics and Engineering Laboratory and the University of Alaska. It is known that there may be a connection between these waves and volcanic activity. The operation will again be managed by Scott Base staff.

Scott Base staff will also be overseeing the magnetic recordings in the laboratory. This programme has operated since 1957 and provides regular measurement data from two magnetographs and a magnetometer for transmission to recording centres in New Zealand and the United States. Technicians are likely to visit field magnetic stations at Capes Evans and Royds and at Vanda Station to determine rates of magnetic field strength change and declination.

Scientists and technicians from the University of Canterbury will be upgrading equipment used to record measurements in the D region of the ionosphere at Arrival Heights and at Scott Base. This is the sixth year of the programme which will operate from 10 to 15 years. The team travelling south comprises Dr Andre Von Biel, Greg Haslett, Bill Wilson and Brian Lawrence all of Christchurch. The work is part of an international middle atmosphere programme.

A 20 year experiment on the effects of the local atmosphere on specially coated aluminium plates mounted near Scott Base and Arrival Heights will be continued. Each year the plates are returned to New Zealand for corrosion analysis and then remounted for a further year's exposure in Antarctica. The results are compared with similar plates mounted in Christchurch and Papua New Guinea.

The joint US/NZ Dry Valleys real-time telemetry seismic project begun last year is to be completed with the installation of a seismometer in the Wright Valley borehole for the long term monitoring of seismic events. Special tanks will also be installed by the Americans at Mt. Newall and at the bore site.

The equipment at Scott Base is to be overhauled and recalibrated by an officer of the US Geological Survey, University of New Mexico. Helicorders are to be installed in place of the old photographic seismic recorders producing visible records. Eventually data will be transmitted in real time via a synchronous satellite to the US Geological Survey Albuquerque Seismological Laboratory as part of a larger seismic data collection network.

CIROS 1

Drilling phase successfully completed

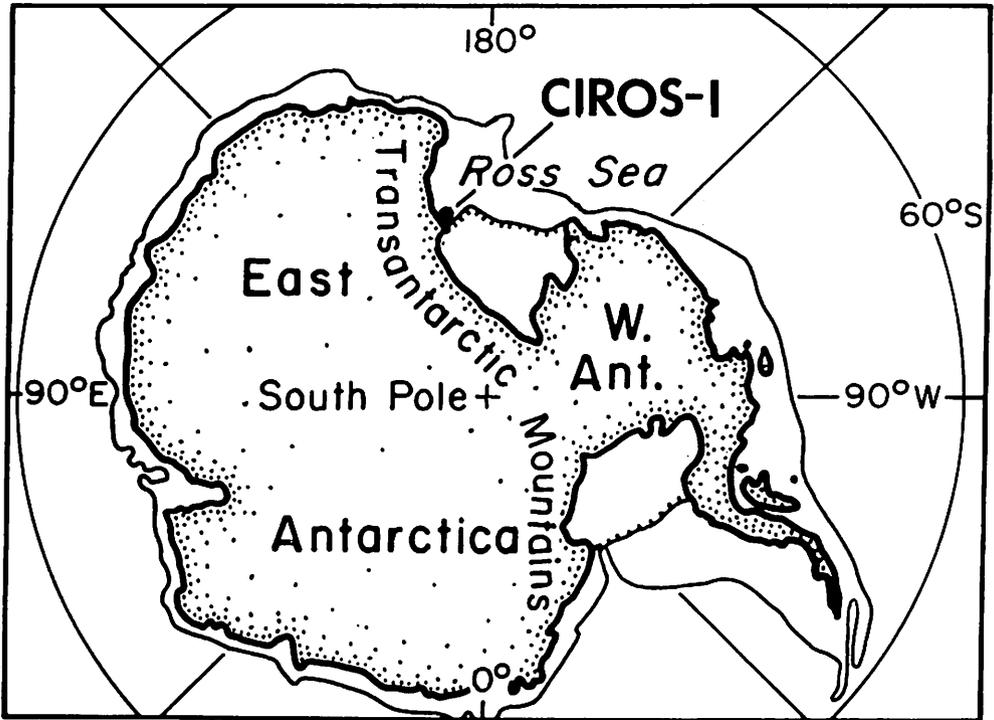
The CIROS (Cenozoic Investigations in the Ross Sea) 1 drill hole, a geological drilling project in western McMurdo Sound, and a major part of the 1986/87 New Zealand Antarctic Research Programme, has been completed. Ninety-eight percent of the core was recovered from the hole, which was believed to be one of the deepest drilled in bedrock in Antarctica, and reached 702.14 metres into the sediment (900 metres below sea level). The core, said by scientists to be in "excellent" condition, dates back to the early Oligocene 30 to 38 million years ago. This is of particular interest because rocks of this age are not exposed on the Antarctic continent.

Previous drilling had shown that Antarctic glaciation went back 30 million years. Further analysis of the core, from CIROS 1 yet to be undertaken, will provide a detailed record of past glacial advances and retreats and also evidence of the uplift history of the Trans-Antarctic Mountains which grew during this period.

The CIROS 1 drill hole was the second of the programme launched during the 1984/85 season and the last in a series begun in 1971. This season's hole is the fourth to be drilled offshore in the western

Ross Sea by New Zealand teams and the most successful having been continuously cored from a depth of 27 metres below the sea floor to the bottom at 702 metres. CIROS II, drilling in 1984 near the snout of the Ferrar Glacier in the Ferrar Fiord, reached basement gneiss after penetrating 167 m of sediments.

CIROS was a joint venture between Victoria University of Wellington and the Geophysics and Antarctic Divisions of DSIR. This season's scientific team co-ordinated by Dr Peter Barrett comprised Alex Pyne,



The location of CIROS I in terms of the continent of Antarctica.

science manager, also of Victoria University; Dr Paul Robinson from the Geological Survey in Lower Hutt, and visiting geologists Drs Michael Hambrey, University of Cambridge, and Kevin Hall, a Briton working at the University of Natal; Drs Hugh Rieck, a paleomagnetist from the U.S. Geological Survey and Flagstaff and Hideki Wada, a geochemist from the Japanese Institute of Polar Research.

Paul White, of the Ministry of Works and Development was the down-hole logger, and Ted Hardy, a technician; Jeff Ashby, Carey Mills and Bruce Morris, all of Victoria University, handled the core processing for the team.

The drillers, co-ordinated by Jack Hoffman and supervised by Kevin Jenkins, both of Wellington, included Pat Cooper, assistant supervisor of Westport; Colin Weaver of Christchurch, Stephen Pilcher of Alexandra, John Marcussen of Auckland and Stephen Brierly from near Waihi. They were

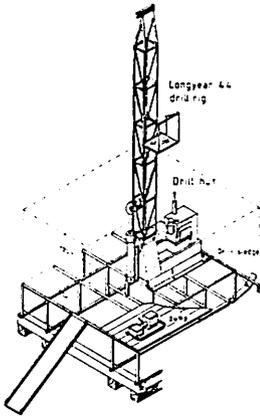
assisted by Mike Wing, (Auckland), Merv McKinnon and Geoff Brown of Invercargill, Gary Brown of Rotorua and Kim Stevenson of Christchurch.

An advance party of 9 drillers and one scientist flew south on August 20 to open up the camp at Butter Point (70 km from Scott Base) on the coast of Victoria Land and establish the drill site on 2 m of annual sea ice 12 kilometres offshore from the camp. The team worked in fine weather but at temperatures as low as minus 43 celsius and limited daylight to complete the preliminary preparations before the main body of scientists and other assistants arrived on October 9.

Throughout the operation all personnel lived at the Butter Point Camp managed by Max Williams of Wellington. Other staff included Ron Topping of Mosgiel, operator; Evan Somerville of Invercargill, mechanic and maintenance officer and Jeff Westworth, chef, of Rotorua. Neville

Steedman, later to become the Scott Base carpenter, was also at the camp which was established in 1984 and can accommodate up to 26 people.

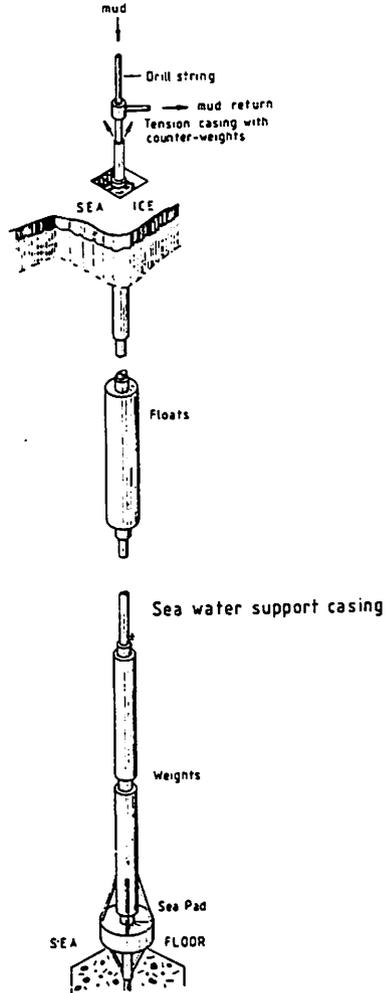
Three clusters of buildings made up the drillsite; the rig, messhut and science building. The rig sat on an elevated sub-frame almost totally enclosed in a heated insulated drill shack with a large opening onto the sloping rod rack. An enclosed stairway led down to the mud hut, a building housing five 200 gal mud tanks with mixing and circulating pumps.



Drilling commenced on October 14 with the installation of a 5" sea casing. A sea pod and heavy collar were lowered to the sea floor 200 m below the ice and bouyed by a series of nine floats and a counterweight system was installed on the ice to prevent shifting by the erratic tide pattern at the site.

Working two twelve hour shifts a day the teams had reached 266 metres by October 27. Operations ceased on November 14 when technical difficulties were encountered because of loss of circulation.

In addition to the mess hut and the surveyors hut from where the sea ice movements were monitored were the science huts housing the equipment for core processing. As the core was brought up, sometimes in lengths as long as 3 m, it was cut into 1 m lengths and split by a diamond saw. Half was boxed for transport to the U.S. National Science Foundation Antarctic Core Facility



at Florida State University and the rest boxed, photographed and logged before samples were taken for paleomagnetic analysis and other studies.

Preliminary analysis of the core reveals the oldest physical record so far of Antarctic glaciation; its strata are mainly shallow marine sandstone and mudstone with scattered stones deposited by floating or grounded ice. Many of the stones are striated which with their features in the core are a positive indication of the continued presence of ice throughout the time period which the core represents.

Variations in stone content and sedimentary features record the advance and retreat of the ice indicating two distinct phases to the glacial history — an early one from about 38 to 32 million years which ice was quite limited in extent and a later phase when ice was at times more extensive than today. Planned studies of the microfossils and magnetic reversal stratigraphy will allow these events to be accurately dated.

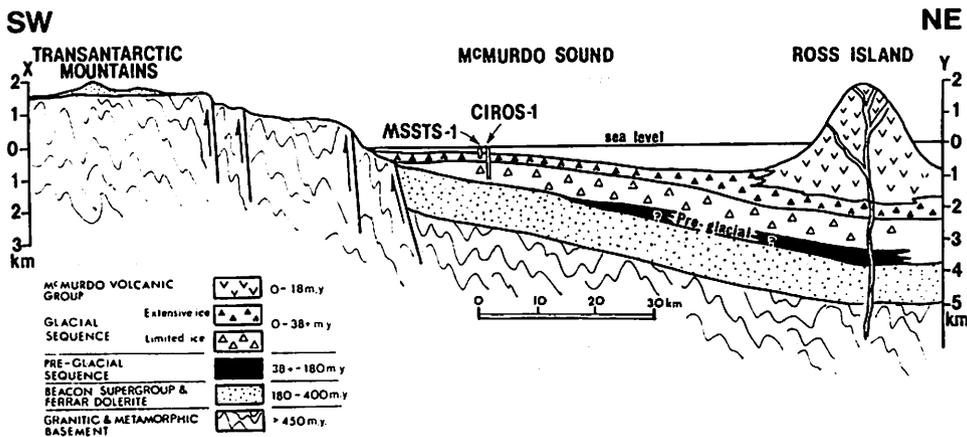
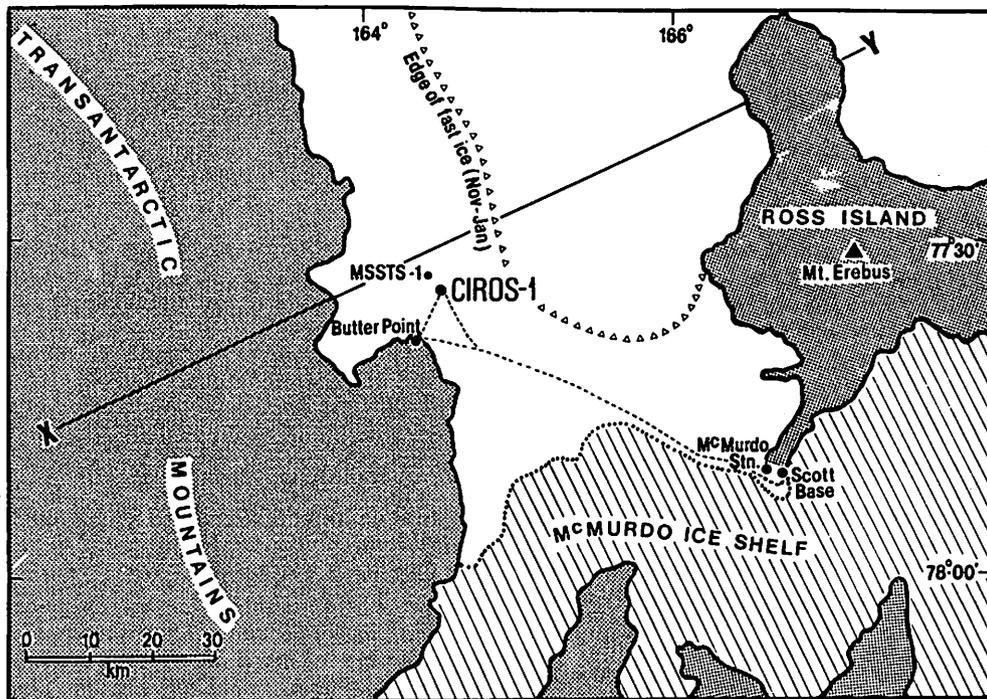
A number of bivalves were found at various levels in the core and shell fragments along with other signs of activity such as burrowing, are common. However the most significant macrofossil in the core is part of a leaf, probably from a beech tree, in mudstone at 215 m between two glacial beds showing that during this period trees were able to re-establish themselves in Antarctica during extensive glaciation. The age at this level is about 30 million years.

An unexpected bonus was the coring of conglomerate with boulders up to 50 cm

long in the lower few metres of the hole, suggesting that the base of the sedimentary section was no more than a few metres away. The boulders are all of dolerite similar to the 180 million year old Jurassic dolerite now found only as sills in the Beacon Sandstone in the adjacent Transantarctic Mountains. This discovery should allow scientists to determine for the first time the vertical displacement across the mountain front over 2 km since the early Oligocene.

The rock types represented by the stones in the core vary widely but show a progressive change reflecting the depth of erosion as the Transantarctic Mountains grew. In the upper part of the core granitic basement rocks are common, but near the base most were basaltic rocks like the Jurassic basalts above the Beacon sandstone. A significant proportion near the base are of coal, *Cracks in the sea ice sometimes made access to the camp and drilling site difficult.*
Photo — Max Williams.





The location of CIROS 1 in McMurdo Sound and a geological cross section.

which could either be from the Permian coal measures high in the nearby mountains to the west or from a younger post-Jurassic coal bearing sequence since eroded off the top of the mountains. Analysis of their composition and rank should indicate conclusively the origin of these fragments.

Methane traces

Traces of methane were found in the upper part of the hole, but none was encountered lower down. Two metres of dark-stained sand were encountered at 630 m. Analysis of the stain by the DSIR suggests that it is caused by an asphaltic residue. The material appears to represent the residue of a petroleum deposit that has escaped naturally. Further tests are planned to identify the substance and determine whether the source is marine or terrestrial.

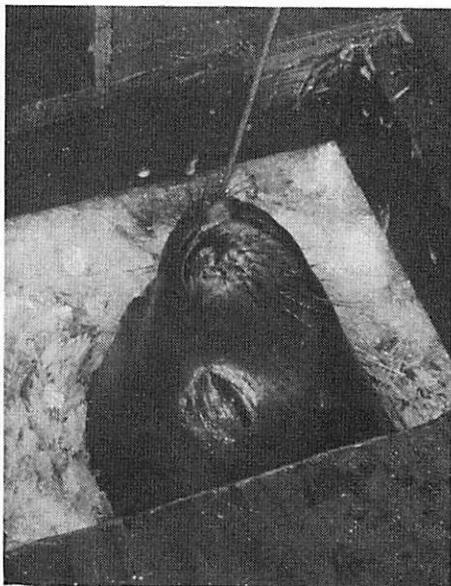
At the conclusion of drilling the hole was logged with several probes recording various properties such as density, natural radioactivity and temperature which at the bottom was 25 deg. C. The hole was then filled with a cement plug and abandoned after the removal of all retrievable casing.

Moved six metres

The surveyor, Vince Belgrave of Wellington, who had been monitoring the site throughout the drilling found the ice had moved six metres northeast during the drilling and the weight of the rig and equipment on the site had depressed the ice by 13 cm. The drill hole itself had been located with an accuracy of less than 1 m. A seismic survey was subsequently carried out to trace different horizons away from the drill hole.

At the conclusion of operations the scientists, the drillers and camp staff returned to Scott Base, leaving the site to be cleared in accordance with pre-planned environmental procedures. All equipment was transported to Scott Base. This stage of the project, supervised by Garth Varcoe of Antarctic Division, was completed early in December, although two huts have been left at Butter Point as a field base.

The core was expected in New Zealand in early December and in the States late in February. Over 1000 pieces will be sent to



K.C.L. K-Seal one of the locals, inspired by the activity, became a regular visitor to the mud hut... named after the mud used for drilling. Photo — Max Williams.

other scientists in New Zealand, the United States, Japan and Australia for detailed analysis.

"Antarctic" would like to thank Dr Peter Barrett and Kevin Jenkins for their assistance with this article.

Midwinter squared

New Zealand was nearly 30 years ahead of Britain in sending a Midwinter to winter in Antarctica. Next winter the British Antarctic Survey will have a new medical officer named Dr Mark Midwinter at one of its bases.

In 1958 a 24-year-old Dunedin student, Graeme Midwinter, wintered at Scott Base. He was completing an M.Sc. degree in chemistry at Otago University and was responsible for the auroral and solar radiation observations at the base. His colleagues allowed him no extra privileges except on Midwinter's Day when he was allowed to go around saying: "This is Midwinter's Day".

Scott Base personnel

Summer staff

Officer in charge, Stewart Guy, Rotorua

A 42-year-old police officer, Mr Stewart Guy is officer in charge at Scott Base for the 1986-87 summer season of the New Zealand Antarctic research programme. He is a senior detective sergeant in Rotorua, and is responsible for the co-ordination of emergency operations in the Bay of Plenty area.

Mr Guy, who was educated at Here-taunga College, Wellington, has served with the New Zealand Police since 1972. He is stationed in the city area of Rotorua and is particularly concerned with administration and planning for land and sea search and rescue operations.

Deputy officer in charge,

A. R. Buckland, Hokitika

A 32-year-old English born forest ranger with the Forest Service which he joined in 1970.

B. L. Brice, Christchurch, storeman.

S. Clark, Ohakea, canteen manager.

G. C. Newman, Christchurch, field leader (snowcraft and survival).

W. G. Herrick, Dunedin, field assistant (snowcraft and survival).

Mary Rose Fowlie, Mt Cook, field assistant (snowcraft and survival).

M. J. Wenoin, Wanaka, field assistant.

A. B. Daly, Christchurch, field assistant.

W. C. King, Christchurch, field assistant.

D. S. Johnston, Waiouru, chef.

C. S. Ross, Nelson, mechanic.

N. O. Steedman, Alexandra, carpenter.

A. R. Gray, Palmerston North, Post Office technician (summer).

Paula Ward, Christchurch, Post Office clerk.

Dorothy Anne Subritzky, Awanui, Post Office clerk.

Paulette Clemence, Christchurch, general duties.

Sally Croawell, Hokitika, general duties.

Vanda Station

C. L. Lynch, Wanganui, leader. He is a 45-year-old employment officer with the Labour Department in Wanganui. Born in Dunfermline, Scotland, he has 24 years' experience as a radio electronics tradesman.

D. R. Stotter, Wellington, assistant maintenance officer/field leader.

Joanne Mary Cowern, New Plymouth, meteorological observer.

Winter team, 1987

K. J. Martin (36), Hastings, base engineer. He is an electronics technician with the Hawkes Bay Electric Power Board and wintered at Scott Base in 1982.

S. R. Orr (23), New Plymouth, assistant base engineer. He is a heating and ventilation engineer with the Ministry of Works and Development.

N. G. Miller (34), Lower Hutt. Senior scientific officer from the Soil Science Bureau, DSIR.

P. N. Denyer (25), Auckland, technician with Plessey Electronics.

D. P. Stevens (25), Lower Hutt, technician. Electronics technician with Physics and Engineering Laboratory, DSIR.

K. R. Paterson (23), Hamilton, chef. Holds similar position in a Hamilton restaurant.

W. J. Ratahi (30), Lower Hutt, mechanic employed by a local motor garage.

B. D. Whitley (24), Auckland, electrician, similar job with MOWD.

G. T. Sanne (29), Tauranga. Postmaster at the Brookfield suburban office.

J. M. O'Donoghue (23), Hamilton, Post Office technician who holds similar position in his home town.

L. G. Gillespie (27), Wanaka, field leader/dog handler. He is an experienced mountain guide.

★ ★ ★

ANARE

Australia plans largest science programme for twenty years

Scientific programmes conducted at nine locations spread as widely as Heard and Macquarie Islands, the new summer station Edgeworth David in the Bunger Hills 712 kilometres west of Casey Station, the Scullin Monolith 150 km east of Mawson, Law Dome and Commonwealth Bay form part of the largest Australian Antarctic field programme for twenty years.

Supported by eight voyages of two chartered ice strengthened vessels Icebird and Nella Dan, staff and scientists from ten nations are expected to participate in the operations which extend from October to March. This is the second year of an expanded scientific programme which, in spite of budget cuts, has been made possible by reducing stocks and deferring expenditure on capital equipment.

Departing Hobart in mid-October Icebird is expected at the Casey ice edge at the end of the month to change winter with summer teams and airlift essential cargo before deposing fuel at Snyder Rocks to support subsequent helicopter operations between Casey and Edgeworth David. It is then expected to rendezvous with the Nella Dan at the Mawson ice edge and eight helicopters from both ships will airlift expeditioners and essential cargo an estimated 60 to 70 kilometres to the station; the distance depending on ice conditions.

Edgeworth David

Before returning to Hobart in early December Icebird is scheduled to relieve Davis and exchange some of the winter party and to proceed to the Shackleton iceshelf with the Edgeworth David team, helicopters, equipment and supplies. The station, completed last year, will be occupied for four months of the summer.

Summer operations will be in two stages with the personnel from the first retrieved by the Nella Dan in early January when the second party will be put in to be collected late in the season by Icebird.

New fibreglass huts will be installed to increase the station size and some of the existing buildings will also be enlarged. One Squirrel and two jet-ranger helicopters will be at the station

throughout the season. This is the first time a Squirrel has been used by Anare.

Major programmes to be carried out include an environmental history of lake catchments in the Bunger Hills, studies of the dynamics of the Denman Glacier/Shackleton Iceshelf system, and of the crustal evolution of the Bunger Hills. Measurements will also be made of ice thickness and variations of the earth's gravity and magnetic field over a 24,000 km area inland from Bunger Hills.

Heard Island

Leaving Fremantle in late October the Nella Dan is expected to deploy a summer party of ten scientists and twelve support staff at Heard Island before assisting with offloading cargo from Icebird at Mawson.

The party, under the leadership of Rod Ledingham, the Antarctic Division's Field officer, includes scientists from five universities and archaeologists from the Tasmanian Museum in Hobart. The main base for the nine week field programme is the former ANARE station at Atlas Cove at the north-eastern end of the Island. Three fibre glass Apple shelters will be added to the huts from a joint Australian-French expedition in 1970-71 which will be used by the party.

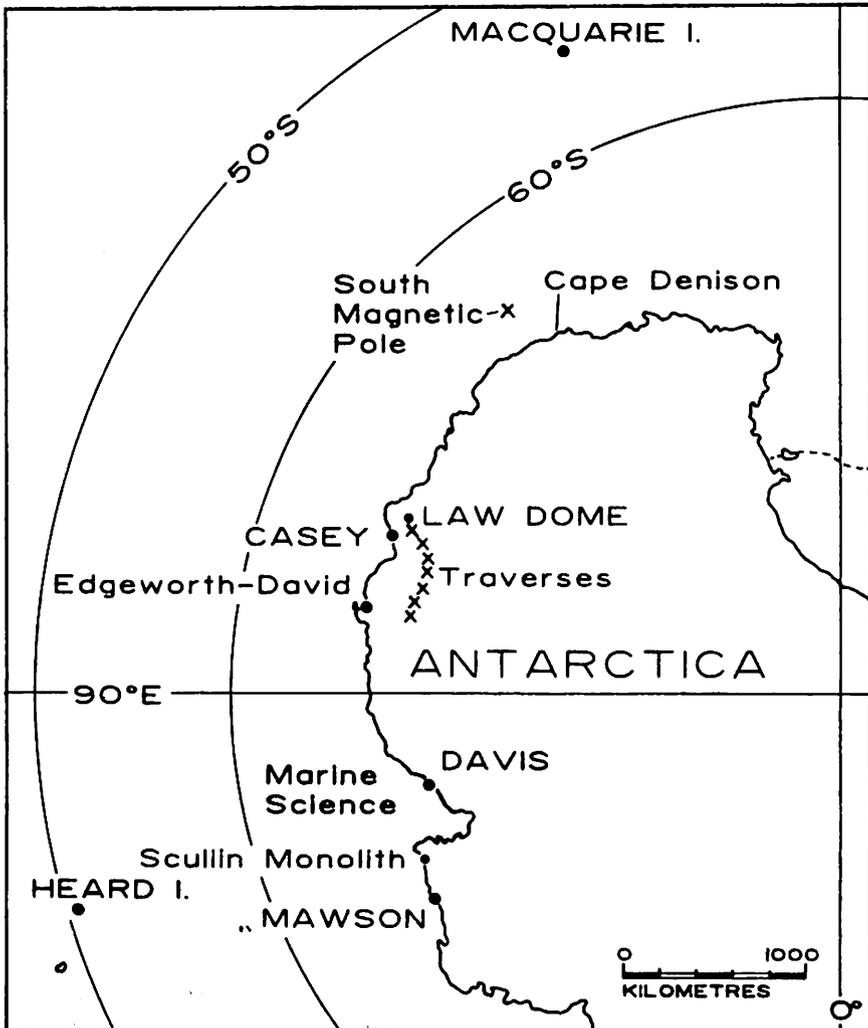
Research programmes comprise detailed geological studies, including the eruptions observed

during the last two summers; and work on aspects of the botany and the glaciology of the island. Other programmes include meteorology, upper atmosphere physics, oceanography, and seismology. It is also proposed to develop a management plan to establish guidelines for human activity on the island and carry out detailed archaeological survey of old sealing sites. This follows the discovery last season of a large number of artifacts dating from sealing operations of 1850 to 1875.

On its homeward journey the Nella Dan will

offload three Hughes 500c helicopters and equipment to support the Heard Island programme which is the largest of its kind conducted by ANARE. Previous Australian parties wintered on the island from 1948-54 and there were summer operations in 1963, 1970-71 and again last year. In 1969 an American team wintered there as part of a satellite observation

Areas of ANARE operation during the 1986-87 summer season. Reproduced from ANARE News September, 1986.



programme and private expeditions made brief visits in the summers of 1965 and 1983.

Macquarie Island

Leaving Hobart in early December the Nella Dan, on its second voyage of the season, is scheduled to resupply Macquarie Island, changeover party members and undertake a preliminary survey of the fish species in the surrounding area.

Twelve programmes will be conducted by fourteen scientists who will spend six weeks on the island and another 11 will be working during the changeover. These include biological work which will focus on bryophytes, soil fauna, the history of quaternary vegetation and the location of dateable deposits around shorelines of selected lakes; on the Light Mantled and Wandering albatross, the Macquarie Island waterfowl and the northern giant petrels, the fur seals and marine invertebrates. Upper atmosphere physics, ionospheric, meteorological, geophysics and seismic programmes are also planned.

Early completion of major station resupply

Because of late season ice conditions it is planned to complete resupply of the major stations by the first week of February. On its second voyage Icebird will complete main resupply of Casey and on her third she is scheduled to complete the main resupply of Davis and Mawson and collect the party from Heard Island. It will also deploy a party of 10 which will spend two weeks late in January studying Antarctic petrels at Scullin Monolith 160km east of Mawson.

Scullin Monolith

Scullin Monolith has a estimated breeding colony of 100,000 to 300,000 breeding pairs of Antarctic petrels. It is the largest in the Prydz Bay region. Working from a small field camp centred around an "Apple" hut on the south western side

of the Monolith the party hope to determine the number of petrels produced in the area, study the diet fed to the chicks by their parents and investigate the dispersal process from the colony at the end of the season. Although the birds have been visited on a number of occasions in the last three years this will be the first extended study.

Commonwealth Bay

During her third voyage Nella Dan is to visit Commonwealth Bay, conduct a brief marine science cruise, take the second party into Edgworth David and collect the Macquarie Island team.

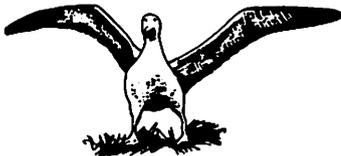
Late in December a field party of ten will be landed at Commonwealth Bay. Under the leadership of Martin Betts of the Antarctic Division they will conduct geological and biological surveys and inspect Sir Douglas Mawsons 1911-14 AAE hut. An automatic weather station may also be established at Cape Denison. While the field party is at work the Nella Dan will carry out a detailed geomagnetic survey of the region around the South Magnetic Pole which is at present located at sea some 160 km north west of Cape Denison.

Marine science cruise

In late January the Nella Dan is due to leave Hobart on its fourth and final voyage of the season during which it will conduct a 45 day marine science cruise in the Mawson/Prydz Bay/Davis region. The objective is a survey of the demersal and pelagic fishes in the area where commercial fishing has been underway for some years. Although some data is available for pelagic fish little information exists on demersal fish. Information will be collected on the distribution, relative abundance, and feeding of species from which it is hoped to establish a data set on which the role of fish in the region can be assessed.

Previous information indicates that some species of bottom living fish feed heavily on krill, and that juveniles of these fish and pelagic fish at all stages also feed on krill. Public attention has centred on possible overfishing of krill but the fish themselves form a significant by-catch of such operations and may be under more immediate threat of exploitation.

Using a three metre beam trawl stations will be made each thirty nautical miles along six north south transects from the continental shelf edge



to the coast between 70 and 80 degrees. E. Sections of the Prydz Bay ocean circulation gyre will also be sampled and stations will be taken between Cape Darnley and Storegg Bank.

Although most of the survey time will be spent studying the demersal fish, midwater, pelagic fish and larvae will also receive attention.

The Nella Dan is due to complete her operations for the season on April 3, a week after the end of the fourth and final voyage of Icebird which leaves Hobart in mid-February to take remaining expeditioners wintering at Davis, Mawson and Casey. She will also collect the last of the summer teams from these stations and from Edgeworth David.

Station programmes

Casey

Biology programmes will include a year round study of the photosynthetic attributes of Antarctic plants which will be studied on the moss beds adjacent to the station, in the laboratory and on Clark Peninsula a biological study of the terrestrial ecosystem and summer work on the comparative ecology of Fulmarine petrels on Ardery Island by a Dutch scientist supported by an Antarctic Division field assistant.

Visits are also planned to Petersen Island to study the number of Elephant Seals there. Over 500 were counted there last season but there has been a significant decrease in the population in the Vestfold Hills near Davis and on Heard Island in recent years. More information is required to determine what and why this is happening. Other studies of Elephant and Weddell seals will try to determine the degree of intermingling between the populations at Macquarie and the Heard/Kerguelen breeding populations. Further tagging will also take place at Davis as part of this programme.

During the summer the glaciology programmes will comprise ice drilling to a depth of about 200 metres to obtain cores for analysis of trace gases (freons, methane and carbon dioxide) in the air trapped when snow is compressed into ice. A 300 mm diameter thermal drill will be tested and preparatory field work will be undertaken for the planned three year Law Dome deep drilling ice core programme.

Law Dome is a small ice cap about 200 km in diameter east of Casey adjoining the main Antarctic ice sheet. It is of interest as a model ice cap, big enough to have the features of a large ice sheet and small enough to be studied in detail. Systematic surveys have been carried out in 1964-68 and in 1970 in conjunction with major ice sheet surveys.

The 1987 programme is aimed at extending survey coverage and completing other long term work previously initiated including drilling and borehole logging. The physical properties of snow and ice will be studied by Jun Li from the People's Republic of China and snow temperature measurements will also be taken at sites installed in 1984. Four traverses, ranging from six to eleven weeks, will be made by teams during 1987.

Other programmes at Casey cover aspects of meteorology and ionsonde, upper atmosphere physics including observatory observations, magnetics geomagnetics and geophysics.

Mawson and

From May to December monthly visits will be made to the Auster — Emperor penguin colony to collect faecal samples and in July and September and October all colonies are to be visited to collect further samples and count incubating adults and subsequently the chicks.

New automatic weather stations will be installed in the Mawson area and sea ice observations will be maintained. A cosmic ray physics programme concentrating on variations in high energy cosmic radiation and low energy intensity variations; an upper atmosphere physics programme will include observatory work and a magnetics, mesospheric temperatures and upper atmosphere dynamics components. The geophysics programme is to be continued and work will done of the propagation of geomagnetic pulsations across the Polar ice. Aerosol studies are also being undertaken and there will be an ionospheric physics programme. The seismograph station is to be upgraded.

Davis

During the summer selected aspects of the feeding ecology of Adelie penguins on Magnetic Island will be studied. These include diet composition, an energetic study and food availability

and will be carried out in addition to the continuation of censusing, banding and weighing programmes. The collection of stomach contents from Emperor penguins Amanda Bay is likely to be continued. Depending on conditions Antarctic petrels and Southern Fulmars will be counted and banded in their various colonies on Hop, Filla and Buchan Islands.

In February or March scientists also hope to visit and band the Southern Giant petrels nesting in the most southern colony known in the northern part of Hawker Island. The Snow petrels and Wilson's storm petrels inhabiting the Vestfold Hills area will also be counted to provide baseline information and diet components will be collected on an opportunity basis.

Antarctic fleas

Some work may be undertaken on the Antarctic flea stages of which have been found in the nests of Southern Fulmars and Snow petrels. Little is known about the flea and the study will focus on life-cycle, distribution and abundance and activity patterns. Filla Island in the Rauer Island group will be the location for most of this work but other sites will also be sampled.

A year long survey of the Elephant seals in the area will be also be made and the annual tagging of Weddell seals is to be continued.

Work is likely to be undertaken on various micro organisms, the neritic eupausiid *Euphausia crystallorophias* and its role in the inshore marine ecosystem, on sea waters and salts and the physiological tolerances of some Antarctic zooplankters. The microbiological contribution of sulphur gases and the distribution an abundance of benthic harpacticoid copepods in saline lakes in the Vestfold Hill will be studied.

Sea ice observations and an upper atmosphere physics programmes will continue throughout the year in addition to work on satellite signal scintillations and work on polar region magnetic pulsations.

Guest scientists

Guest scientists at Mawson this year include Lu Qiang Xu from the People's Republic of China who is involved in various biological programmes and Professor Lundquist of the Department of Quaternary Research at the University of Stockholm who will be studying till and moraine formation in dry areas.

Other guest scientists working with ANARE include two Belgians on the Marine research voyage to Prydz Bay, Chilean and Finnish observers on the Casey resupply, a Japanese geologist and a Spanish ornithologist who will be on Icebirds visits to the Heard Island, the Scullin Monolith, Davis and Mawson. Hans-Martin Braun of West Germany's Paelontology Institute will take part in the Bunger Hills work and researchers from the People's Republic of China are to winter at Casey and Davis as part of a joint Australia — PRC programme which began in 1981.

Communications with the Antarctic stations will be upgraded this year with the installation of satellite communications equipment to be in-

The leaders

A police officer, two farmers and a retired pilot turned farmer will lead the four major Australian bases for 1987.

Paul Butler of East Brunswick in Victoria is officer in charge at Davis. He spent 15 years in the Victorian Police force serving in the Uniform Branch, Search and Rescue, UN Forces in Cyprus and the Special operations group. In 1980 he was in charge of Mawson and in 1981/82 and 1982/83 spent the summer as Diving Officer at Davis where he was also officer in charge in 1985.

In charge of Casey is Russell Rachinger of Ararat in Victoria. A former employee of the Commonwealth Government he now operates a 1600 acre sheep property. Ted Upton of Yeppon on the central Queensland coast and former officer in charge of Macquarie Island in 1982 will be spending his second winter as leader of Mawson. He was last there in 1985.

Leader at Macquarie Island is Ian Jacobsen of Brisbane who entered the Royal Australian Airforce as an engineering tradesman and retired twenty six years later in 1983 as a Wing Commander. Between 1980 and 1983 he was Commanding officer of the VIP air transport squadron in Canberra and was 'royal' pilot for three visits by the Queen and two by Prince Charles in Australia.

stated at Casey, Mawson, Davis and MacQuarie Island. Station environments will also be receiving attention.

The Deputy-Director of Antarctic Division Rex Moncur indicated recently that although support for scientific research was expected to

increase in 1986-87, funding restrictions resulting from the nations' present economic situation would probably result on a slightly reduced programme in 1987-88. Planning for next season's operations has already commenced.

BAS

Rothera to be completed this season

The final stage in the development of the British Antarctic Survey base Rothera is due to be completed this season during which scientists will continue the Off-shore Biological Programme, and conduct a marine geophysics programme. The last major blank on the geological map of Palmer Land should also be filled when a joint British American geological survey party visits the southern Black Coast to complete the work.

BAS will continue to maintain five permanent stations — Faraday and Halley geophysical observatories, Signy and Bird Island biological laboratories and Rothera air base.

Almost doubled

Rothera, which is the centre of BAS earth sciences field programmes, is to be almost doubled in size this year, as required by a greatly increased level of activity. When completed, the new building will provide accommodation and working facilities for 72 men. The station was established on south-eastern Adelaide Island in 1976-76 to replace an earlier Adelaide Island station now occupied by the Chileans and renamed Teniente Carvajal. This is the final stage of Rothera's planned development.

As usual, the three BAS Twin Otter aircraft will be based at Rothera throughout the summer, supplying Fossil Bluff field station overlooking George VI Sound, ferrying passengers from Damoy air facility (about 380 km to the north) to remote southern work sites, supporting them, setting up depots and undertaking geophysical flights. A large-format Zeiss camera and navigational telescope have recently been fitted in one aircraft and will be used to provide

photographs for hydrographic surveys and earth sciences projects. The aircraft were due to arrive at Rothera from the UK in late October.

Bransfield's 17th season

The two ships, RRS John Biscoe and RRS Bransfield, will again undertake the annual relief and the John Biscoe will, as usual, also carry out marine scientific programmes. It will be the John Biscoe's 31st consecutive Antarctic season and a possible replacement is now being considered. It will be the Bransfield's 17th season.

The John Biscoe left the UK in mid-September and sailed south via Montevideo. Bird Island, South Georgia, were relieved before the ship went to Stanley, Falkland Islands, to collect more personnel and cargo. Field parties were then taken to Hope Bay (north-eastern Antarctic Peninsula), Livingston Island (South Shetland Islands) and Damoy air facility (Wiencke Island). Earth scientists going to southern work sites were flown south from Damoy via Rothera. Signy (South Orkney Islands) and Faraday (off the west coast of the Antarctic Peninsula) should also be relieved by the beginning of December.



OBP

The ship is due to arrive at South Georgia in late December and will spend the next month continuing the long-term Offshore Biological Programme (OBP) — (a study of the biology of krill in relation to its environment and predators) and BIOMASS (Biological Investigation of Marine Antarctic Systems and Stocks). After a brief visit to Stanley, work will commence on a six-week marine geophysics programme consisting of magnetic and bathymetric surveys and the investigation of currents in the northern Weddell Sea, hard-rock dredging around the South Sandwich Islands and participation in the international Ocean Drilling Programme.

Bransfield departed from the UK at the end of October and sailed south via Montevideo and Stanley. Her first task was to deliver personnel and stores to Signy before heading for Halley (Brunt Ice Shelf).

RRS John Biscoe photographed off Faraday Station in November 1985 is entering her 31st consecutive season and a replacement is being considered. Photo — B. Thomas, BAS

Weddell Sea ice permitting, the ship should arrive at Halley in mid-December and remain there for ten days. The Livingston Island party will be assisted in mid-January and, after a further five weeks, will be moved to Deception Island.

The ship will be carrying the large quantity of building materials and equipment needed for Rothera and will make three delivery runs to the station in January—March, spending a total of three weeks there to provide extra man-power for the building operations. Faraday will be visited en route. The Hope Bay party will be picked up in mid-January after working on the Trinity Peninsula for three months.

Bransfield will finally leave the Antarctic Peninsula in mid-March, and will pick up the Deception Island party and sail north via Signy and South Georgia. While the ship is at South Georgia, geomagnetic measurements will be repeated and biologists will sample the lakes.

Damien II chartered again

The French yacht *Damien II*, which was chartered very successfully last season for biological work around South Georgia, is to be chartered again. She will first be used by biologists to complete a survey of surface breeding seabirds around South Georgia and, later, by geologists for two months' landings along the west coast of the Antarctic Peninsula.

Field Programmes

The 1986-87 geological programmes cover a wide range of investigations. The Hope Bay party will study occurrences of Late Mesozoic fossil plants on Trinity Peninsula (first reported by members of the Swedish expedition of 1901-03) to gain insight into the palaeoenvironmental conditions of the time. In the South Shetland Islands, two men will investigate the geochemical characteristics of the Late Cenozoic volcanism associated with the opening of Bransfield Strait. They will also set up a programme to monitor the current volcanic activity on Deception Island. Starting from Livingston Island geologists will work southwards along the western coast of the Antarctic Peninsula on the yacht *Damien II*, studying the relationship between the arc magmatism and areas of possible mineralization. The main aim of this work will be to distinguish chemically those plutons which are barren from those which are potentially productive.

Geological mapping to be completed

Long-term plans to map the last major blank on the geological map of Palmer Land will be realized this season when a joint BAS/US Geological Survey party visits the southern Black Coast. Mapping in north-eastern Palmer Land by two BAS geologists

and in south-eastern Palmer Land by two USGS geologists suggests that the unmaped area is one of marked tectonic variation. For part of the season the party will use a BAS Twin Otter aircraft to visit key localities throughout eastern Palmer Land; this will enable them to establish a regional picture for their more detailed studies.

Far to the west, in Alexander Island, another geologist with an assistant will spend a second season unravelling the structural complexities of probably accretionary prism assemblages related to the Mesozoic arc of Palmer Land. Considerable progress was made last year when the importance of major crustal shearing, (probably generated by oblique subduction) to the formation of the structures present was recognized. It is possible that the shearing events may also have controlled the formation of the fore-arc basin in which the fossiliferous marine sediments of the Fossil Bluff Formation were deposited. Two other men will examine the little known northern part of this formation with a view to identifying the oldest part of the basin fill. Detailed studies will be made of slump zones in the sequence, which are undoubtedly some of the most spectacular of their kind anywhere in the world.

Geophysics

The field geophysics programme will include both surface and airborne surveys. A six-man team will undertake a 1500-km traverse over southern Palmer Land and Ellsworth Land, investigating major structural and tectonic trends relating the continental block of the Antarctic Peninsula to the rest of West Antarctica. Gravity, seismic depth-to-bedrock, radio-echo ice thickness and magnetic measurements will be made.

Aeromagnetic reconnaissance was completed last year over the Antarctic Peninsula and the Ronne Ice Shelf—Martin Hills region. This season's project will again be undertaken in collaboration with USARP, which will be providing fuel at Siple and Byrd stations. Flight networks will operate in both areas and also across to Thurston Island, Eights Coast. If time permits, additional tie lines will be flown over southern

Palmer Land and Ellsworth Land to strengthen the aeromagnetic network between the proposed and existing surveys. The aeromagnetic investigations complement those of the oversnow traverse and will provide further understanding of West Antarctica's tectonic framework.

Parties of glaciologists will continue work on the dynamics of the Rutford Ice Stream and Ronne Ice Shelf. Sites established last year will be resurveyed. On the Ronne Ice Shelf, a traverse along a flow line will be extended to the ice front. On the Rutford Ice Stream, further investigations will be made into downstream areas that may be partially grounded.

Chemical analysis

Shallow drilling for chemical analysis will be carried out on the Antarctic Peninsula plateau. The cores will enable the snow chemists to find a site suitable for subsequent deeper drilling. A new technique for dielectric profiling of cores will be further tested at various locations. A pit, 10 m deep, is to be dug in a low-accumulation area of Coats Land. Large blocks from the pit wall will be returned to Cambridge, where they will be analysed for heavy metal concentrations. The pit should provide a record up to a century in length.

Biological programmes will continue at Bird Island and Signy. At Bird Island, a new project involving hormone studies will be initiated into penguin reproductive cycles. For the first time, the Sea Mammal Research Unit (SMRU) of the Natural Environment Research Council, which is housed at BAS's Cambridge headquarters, will be participating in Antarctic work. A BAS/SMRU group will study the bioenergetics of reproduction and lactation in elephant seals at Husvik, South Georgia.

Offshore biological programme

The Offshore Biological Programme (OBP) will concentrate this year on the biology of two key predator groups — fish and squid. Sampling from the John Biscoe off the northern coast of South Georgia is planned for 34 days in December and

January. Its aim is to investigate the horizontal and vertical distribution of fish in relation to distance from the coast, oceanographic conditions, time of day and the distribution of the major components of their diet.

Squid comprise a significant proportion of the diet of many Antarctic seabirds, seals and toothed whales, yet almost nothing is known of their biology. Part of this season's sampling will be devoted to using a mid-water trawl, in an attempt to collect specimens of mature squid. These and other pelagic fish and squid will be investigated by three physiologists from St Andrews University who are working on the ecophysiological adaptations of marine organisms to the polar environment. This project will complement their earlier studies at Signy on demersal fish.

Last season

In spite of a bad beginning to the 1985-86 summer because of poor travelling conditions, storm damage to the aircraft and RRS John Biscoe becoming trapped in pressure ice, it was a remarkably successful season. Excellent progress was made with most field programmes, including detailed geology, geophysics and glaciology on James Ross Island (part of a Cretaceous back-arc basin), investigation of the ice dynamics of the Ronne Ice Shelf and Rutford Ice Stream, airborne geophysics and ice-depth sounding and continuation of the long-term Offshore Biological Programme (OBP).

The OBP work, carried out from the John Biscoe, recommenced at the end of December and continued until early March, with a brief visit to Montevideo at the end of January to pick up spare parts for a defective bow-thruster. This year's OBP covered the area extending 70 nautical miles radially from the Willis Islands and Bird Island north-west of South Georgia. During the first part of the programme a strong upwelling system was found at the shelf break north-west of Bird Island, with enhanced phytoplankton biomass and productivity. The French yacht *Damien* was chartered for six weeks in November-December to assist



in a census of krill predators (fur seals, macaroni penguins and other seabirds). It had earlier been chartered for a six-week census of the elephant seals around South Georgia. HMs *Endurance's* helicopters carried out an aerial survey of the penguin colonies.

The second part of the OBP programme concentrated on a krill patch study, with a brief interval during which cargo was collected from a Royal Fleet Auxiliary at Grytviken and delivered to the Bird Island station. The John Biscoe left the area on March 6 to return home via Rio de Janeiro, and arrived at Grimsby on April 10.

RRS *Bransfield* meanwhile, was responsible for the main relief work. Halley station was reached at the end of December and, after some delay because of strongwinds, unloading on to the Brunt Ice Shelf was comparatively easy this year. (In some years, in the absence of fast ice and a suitable ramp up to the ice shelf, unloading has had to take place up to 64 km from the station.) The ship then placed a weather buoy in drifting ice at lat. 75deg 53min S/32deg 46min W as part of an international (West

The Damoy air facility at Wiencke Island, 66 deg. 49 min. S, 63 deg. 31 min. W. at which field workers can be transferred to and from ships to aircraft for flights via Rothera to southern work sites while sea access to Rothera is blocked. Photo — B. Thomas, BAS.

German-US-UK) Winter Weddell Sea Project investigating atmosphere/ice/ocean interactions. The West German ship *Polarstern* will be taking more buoys to the area during a winter voyage. *Bransfield* also called at Neumayer station.

After assisting biologists at South Georgia and collecting more cargo and passengers from Montevideo the ship headed south to the Antarctic Peninsula via the Falkland Islands. Cargo was delivered to Rothera station in mid-February and geologists were supported in a series of landings extending south into Marguerite Bay. In the north-eastern part of the bay, the Horseshoe Island base hut (first occupied in March 1955) was reopened by a party which spent a week working in the area. Further south, violent katabatic winds made work very difficult.

Proceeding north again, there were further geological landings, including ten on Brabant Island and some on the neighbouring Melchior Islands. Passengers and cargo were transferred from HMS Endurance to the Bransfield at Faraday at the beginning of March and taken to Rothera, and more cargo for Faraday was collected from the Falkland Islands.

En route, geologists were picked up from Livingston Island, South Shetland Islands, where they had been landed a few weeks previously by Endurance after working on James Ross Island.

Endurance then provided support for the geologists in Marguerite Bay and also undertook a hydrographic survey of the northern entrance to George VI Sound. The geologists returned to the Bransfield which made final visits to Rothera and Faraday, called at the American Palmer station to collect BAS specimens, secured the Damoy (Wiencke Island) hut for the winter and returned to the Falklands.

VIP's

The Director of the US National Science Foundation and the US Ambassadors to Argentina and Chile were entertained on the Bransfield at Palmer. They also visited Faraday and delivered a telescope on loan from NASA, to enable the station to undertake observations on the development of the tail of Halley's comet. Bransfield made final calls to Signy and Bird Island in early April and then headed for home via Rio. She arrived at Tilbury on May 6.

As previously reported, the three Twin Otter aircraft were grounded by bad weather and storm damage for several weeks at the beginning of the season, and one was grounded at Fossil Bluff for a further week in January by mechanical trouble. Flights were also severely restricted by bad weather in February. Nevertheless, support was given to field workers in many areas, including Alexander Island, James Ross Island, the Eternity Range (Palmer Land), the east coast of the Antarctic Peninsula, the Larsen Ice Shelf, the Ronne Ice Shelf and Rutford Ice Stream. One aircraft concentrated on

reconnaissance aeromagnetic and radio-echo sounding flights over Ellsworth Land and southern Palmer Land in continuation of a joint BAS-USAP project investigating the structure of West Antarctica and its relationship to East Antarctica. Urgent supplies were flown to Halley and automatic weather stations deployed at Dolleman Island (Black Coast) and Uranus Glacier (Alexander Island) for the University of Wisconsin.

All field parties were airlifted back to Rothera by early March, Fossil Bluff station (George VI Sound) was closed for the winter and the aircraft departed for the UK.

Poor weather, bad ice conditions and fuel shortages

Both the airborne and some oversnow geophysics projects were completed despite poor weather and fuel shortages and both succeeded in gathering new and useful geophysical data.

Aeromagnetic and radio-echo ice thickness measurements were recovered along a 12,500 km flight network. The profiles were mainly in southern Palmer Land, linking previous surveys over the Antarctic Peninsula and Ronne Ice Shelf. Preliminary analysis indicates that whilst some of the major anomalies are an extension of trends seen to the north there are other distinct and separate anomalous zones. These include the magnetic field over Ronne Entrance and another belt through Spatz Island east to the English Coast.

Poor sea ice conditions prevented the proposed oversnow traverses across Prince Gustav Channel off the north-east coast of Graham Land. However, gravity, magnetic and ice thickness values were measured at each of 97 geophysical stations on James Ross Island. Other geological parties in the Antarctic Peninsular area were also able to establish many new gravity stations.

Fifty-nine winterers

There were 59 BAS winterers this year, 18 at Halley, 14 at Rothera, 10 at Faraday, 14 at Signy and 3 at Bird Island. Local journeys from Rothera were resumed in April, much to the delight of the remaining 35 dogs which are still used for sledging.



One of 14 men wintering at Rothera, the British Antarctic Survey station on Adelaide Island, this year is a New Zealander. He is Ash Morton, formerly of Wellington who is the winter base commander.

Mr Morton, who worked for New Zealand television in Wellington, went to England late in 1977. He worked there as a builder and spent two years and a half from 1981 to 1984 as a field assistant at Rothera. After cruising in the Pacific aboard a yacht which he joined in Alaska, he returned to Rothera in October last year on an 18-month contract with BAS.

Two other New Zealanders have worked at Rothera after wintering at Scott Base. Peter Cleary, of Christchurch, who was base commander at Rothera for the 1984 winter, was there from November, 1982 to March, 1985. He was at Scott Base in the 1978-79 and 1980-81 summers and was dog handler for the 1979 winter.

In 1980 Rex Hendry, of Turangi, wintered at Scott Base as a fitter/electrician. He served at Rothera in 1982 and 1983.

BAS geologist working at Trinity Peninsula (northern Antarctic Peninsula). BAS photo — I. Lovegrove

In addition to the other ships and aircraft reported, an American party on board Polar Duke carried out an official inspection of Faraday station in November and March. The ship also visited Rothera in early March. The Polish tug Arctowski called at Faraday in mid-February. The station is also becoming popular with yachts: six called there in February! One of them, Damien, (which had assisted in the OBP programme earlier in the season) also went on to Rothera.

A Borekair Twin Otter, on lease to the US National Science Foundation for glaciological work on the Siple Coast, and two West German Dornier aircraft called at Rothera on their way home in February. The Dorniers also called at Fossil Bluff after flying from Neumayer.

A helicopter from the Brazilian ship Barao de Teffe and another from the US icebreaker Glacier flew over Rothera in mid-February.

New Soviet research ship under construction

A new Antarctic research vessel is now being built for the Soviet Union in a Finnish shipyard. She will be named the Academician Fedorov after a noted Polar scientist, and is expected to leave Leningrad on her maiden voyage south late in October next year.

Specifically designed by Soviet and Finnish experts for Antarctic research expeditions the 7600-tonne Academician Fedorov will operate as an icebreaker, research, supply, and passenger vessel. When completed she will replace the 7714-tonne Mikhail Somov, present flagship of the Soviet Antarctic fleet which made her maiden voyage south in the 1975-76 season.

Rauma-Repola, one of the largest companies in Finland, which has an annual turnover of US\$1.5 billion and employs more than 18,000 people, is responsible for the new vessel. Its shipbuilding group has four shipyards and in the last 40 years has built more than 800 different ships for the Soviet Union.

Last December representatives of Sudoimport and Rauma-Repola signed a contract in Moscow for building the new ship. The keel was laid on August 29 and the launching is planned for March. Delivery is set down for early in the northern autumn of 1987. The Rauma shipyard has built 30 different tankers and services vessels for Arctic conditions and the parent company has done extensive research into ice navigation technology to improve the strength of its ships and their ice-going properties.

Icebreaker Hull

Designed with a reinforced icebreaker hull the new ship will be able to operate in temperatures as low as minus 40deg Celsius and proceed at low speed in level ice one metre thick. Her Soviet-made diesel-electric propulsion system gives her a speed of

16 knots. She is 140m long, 23m wide, and has a draught of 8.5m.

To fulfil her research, supply, and transport roles the ship will carry 90 scientists, crew, and helicopter unit. There is also accommodation for 160 members of the research and support teams at the 10 Soviet coastal and inland stations, seven of which are permanently manned. By comparison, the Mikhail Somov can carry 112 people, including the crew.

Various roles

For marine and climate research the ship will have 10 laboratories equipped for hydrology, hydrochemistry, hydrobiology, aerology, meteorology, and studies of ice properties. Results of this research will be analysed in the ship's computer centre. It is provided with computers which, like the navigation equipment, are Soviet-made. A Rauma deck machinery company has built an oceanographic winch which can lower observation equipment to a depth of 6km and retrieve marine specimens.

As a multi-cargo transport the ship will carry aircraft, helicopters, vehicles and containers as deck cargo and machines and equipment below. She has cargo tanks for lubricating and fuel oils, a special compartment for gases, sulphuric acid and explosives, and a refrigerated hold for foodstuffs.

Gangway crane

For cargo handling the ship will have two 50-tonne cranes amidships and two 10-tonne cranes astern with a range of 25



metres. On the bow is a gangway that doubles as a crane. In its open position it is a gangway for the crew; closed it becomes a two-tonne crane with a range of 20m.

Because all the Soviet coastal stations except Bellingshausen on King George Island, South Shetlands, have no real harbours, relief and supply operations have to be conducted either off the ice edge, using helicopter or aircraft support, or by mooring ships alongside the ice shelf. For this reason the new vessel which has a fixed propeller with a diameter of 5m, will also be fitted with bow and stern steering propellers to hold the stern in position during loading and off-loading operations.

In addition the vessel will carry tractors for transport operations across fast ice and two heavy landing craft for moving supplies to shore. If conditions allow material can be unloaded directly from the hold either onto the fast ice or the shore. The vessel's helicopters and landing deck can also be used for supply operations.

North Pole Drift

Yevgeniy Konstantinovich Fedorov whose name has been given to the new ship was one of four men who set up the first

A Finnish artist's impression of the new Soviet icebreaker Akademian Federov expected to leave on her maiden voyage in October 1987. She will replace the present flagship of the Antarctic fleet Mikhail Somov.

scientific drifting station on Arctic ice at the North Pole in 1937. He began his polar career in 1932 as a meteorologist and geophysicist at Scientific stations in the Soviet Arctic and when he died at the end of 1981 after a fall on an expedition to the Caucasus he had reached high levels in Soviet science administration.

Fedorov was one of the two scientists in the North Pole expedition led by I.D. Papanin which was landed by an aircraft on May 21, 1937, and drifted on a diminishing ice floe for nine months to 70deg 54min S midway between Scoresbysund on the Greenland coast and Jan Mayen Island. The party was picked up by Soviet icebreakers on February 19, 1938.

Soon after his return Fedorov was appointed director of the Arctic Research Institute for one year (1938-39) and then at the age of 29 head of the Hydrometeorological Service of the USSR, holding the position for two terms — 1939-47 and 1963-74. In 1956 he set up the Institute of Applied Geophysics attached to

the Hydrometeorological Service, became its director, and held the position, except in 1968-74, until his death.

A vice-president of the World Meteorological Organisation from 1963 to 1971

Fedorov was awarded its gold medal in 1977. His many scientific interests included the impact of human action on the environment and ways of minimising this.

Soviet jet transport on Antarctic route

With the introduction of a four-engined jet transport aircraft on the Antarctic route between Leningrad and Molodezhnaya the Soviet Union plans to provide faster and more efficient air support for its research expeditions each season. For the first time winter staff for the 31st Soviet Antarctic Expedition (SAE-31) were flown south last season by an Aeroflot Ilyushin-76TD which covered 16,000km on the Leningrad-Djibouti-Maputo (Mozambique) - Molodezhnaya route to begin the new airlift. In February and March the IL-76 made three flights to Molodezhnaya and Novolazarevskaya.

Construction of more permanent compacted snow/ice airstrips and the use of the IL-76 which has been redesigned to carry 90-100 passengers as well as five tonnes of cargo are expected to reduce the number of ships needed to transport scientists, support staff, supplies and equipment to maintain seven permanent stations - Molodezhnaya, Mirny, Novolazarevskaya, Vostok, Bellingshausen, Russkaya, Leningradskaya, and three summer stations, Druzhnaya I and II and Soyuz. Last season SAE-31 used three research ships, three cargo ships, and a passenger liner to transport winter and summer parties and resupply the stations.

Two attempts were made in the 1960s to establish a reliable air route to Antarctica by way of South-east Asia, Australia, and New Zealand. But the flights by Antonov 12 and Ilyushin-18 aircraft took more than 10 days and the last leg to Mirny was dangerous because there were no navigation aids for 2855km across East Antarctica. These trials showed that permanent specially-prepared airstrips were needed to take heavy wheeled transport aircraft.

Experimental work on the development of snow/ice airstrips with a strong bearing surface began in 1965. New methods were devised to produce a snow/ice surface with

Antarctic air crashes

A Soviet twin-engined Ilyushin-14 transport which had been supporting seasonal operations at Druzhnaya I and II on the Weddell Sea coast last season crashed on the Philippi Glacier, 135 nautical miles from Mirny, in

February, killing all six of its crew. Its remains were found by searching aircraft five days later.

On the 1087nm leg between Molodezhnaya and Mirny the IL-14 which was on its way to take part in an airlift of supplies to Vostok Station, was caught in a whiteout over the West Ice Shelf. With fuel running out because of strong head winds and icing of the wings the aircraft attempted to land in zero visibility but crashed.

Philippi Glacier (66deg 45min S/88deg 20min E) is a coastal glacier 24km long flowing north to the east end of the West Ice Shelf. It is 24km west of Gaussberg.

Footnote: In our December, 1985 issue we reported the deaths of eight United States tourists and two Chileans on December 31 when a Cessna Titan 404 crashed off the coast of King George Island, South Shetlands. Later information confirms that the aircraft crashed on Nelson Island which is about 18nm south-west of King George Island.

a strength similar to concrete on the ice-cap about 20km east of the main Soviet station, Molodezhnaya, which is on the Prince Olav Coast of Enderby Land. Construction of a permanent airstrip for use in the summer months by heavy wheeled aircraft began in the 1978-79 season.

An IL-18D medium-range turbo-transport made the first proving flight to Molodezhnaya in February, 1980. Since the 1980-81 season it has maintained airlift operations between the Soviet Union and Antarctica on the Moscow-Maputo-Molodezhnaya route, making three shuttle flights each summer with 40 to 45 passengers.

But its maximum payload of 13.5 tonnes has had to be reduced because its cruising range is 3700km at 375 to 400 km.p.h. and the last leg of the flight over the Indian Ocean from Mozambique is about 4,900 km.

Thick crust

In six years of operation the Molodezhnaya airstrip has grown in thickness by nearly one third. Now its multi-layer snow/ice cover, mechanically compacted each season, forms a "crust" one metre thick. The bearing strength is sufficient to take heavy wheeled aircraft like the IL-76.

Sites were determined for similar snow/ice strips at Novolazarevskaya, 1500 km from Molodezhnaya and Druzhnaya in the 1984-85 season. Experimental work began in the same season at Vostock, the station on the Polar Plateau 3300m above sea level which is supplied by tractor train from Mirny on the coast 15410km away. Novolazarevskaya's strip was approved as an alternate for IL-76TF flights last summer. It is built on an ice dome which gives it the required bearing strength.

Used by Aeroflot in Siberia and the north of the Soviet Union on commercial services, the IL-76 has been adapted for Antarctic conditions. It has a payload up to 40 tonnes and part of the cargo section has been re-equipped to carry 100 passengers with five tonnes of cargo as well. The aircraft's four

turbo-fan jet engines enable it to cruise at 750-800 km.p.h.

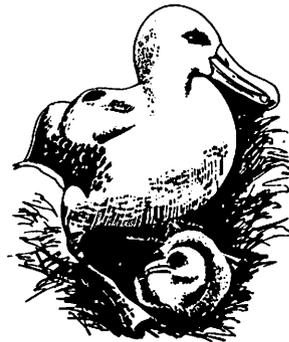
Cargo handling

For Antarctic operations the IL-76TD has several advantages. Because of its independently operating inertial navigation systems it can fly without communication with ground control services. Its airframe and engines have been designed for operation away from ground maintenance for up to 90 days.

Cargo handling at remote Antarctic stations is made easier with four overhead cranes each with a capacity of 2.5 tonnes on monorails. Two electrically-driven winches move cargo along a ramp to the opening end of the fuselage.

Before the IL-76TD made its first flight to Molodezhnaya last season the crew practised takeoffs and landings on a specially-compact snow airstrip in the Soviet Union. Practice was needed because it was the first time such a heavy aircraft with a takeoff weight of 175 tonnes had used the Molodezhnaya airstrip.

Introduction of the IL-76TD to Antarctica does not mean that the IL-18D will be retired. Eventually it will be used all summer more extensively for research in regions of difficult access and will also continue to fly cargo from Molodezhnaya to other stations. Since the 1980-81 season the aircraft has returned to the Soviet Union after completing shuttle flights earlier in the summer.



USARP

Seventy projects to be undertaken in 1986/87 season

Exploiting the unique advantages of the South Pole, researchers this summer will seek an answer to a fundamental question so far eluding scientists: How did matter in the universe form into structures such as galaxies and clusters of galaxies?

The scientists will try to detect fluctuations in the microwave background radiation that permeates the universe. So far, measurements of this radiation show it to be uniform in all directions but theorists claim that it must contain fluctuations which scientists call anisotropy and which describe the initial clumping of matter during the early formation of structure in the universe.

With newly developed instrumentation capable of observing fluctuations down to a few millionths of a degree, more than 10 times smaller than before — and well below the limit of theoretical prediction, the team, headed by Dr Martin Pomerantz of the Franklin Institute's Barton Research Foundation in Newark, Delaware, is optimistic of success. If not, a new theory will be needed to account for the formation of galaxies and clusters of galaxies, the spawning ground for stars.

Microwave background radiation is a relic of the early universe according to Dr Pomerantz; the remnant cooled by expansion to a current temperature of 2.75 degrees centigrade above absolute zero from about one thousand billion billion billion degrees at the earliest epoch imagined by current physics. This all-pervasive radiation is an imprint of the structures that started to form about a million years after the Big Bang.

In 1965 one of the members of this year's team studying the radiation Dr Wilson of Bell Laboratories, New Jersey, was one of two scientists who discovered that a background radiation permeated all regions of the sky; solid evidence that the universe started with a tremendous explosion of an extremely dense, hot and compact object. They were awarded the Nobel prize for this work.

The best measurements so far of cosmic background radiation show it to be remarkably uniform in all directions with temperature fluctuations of less than 50 millionths of a degree

centigrade, just above the minimum predicted by theories describing the initial clumping of matter after its production following the big bang. The equipment being used at the Pole this year was developed by Dr Wilson's group and overcomes an earlier problem which arose when radiation from the earth's atmosphere overrode the microwave background radiation.

Two years ago a French team led by Dr Pomerantz made infrared optical observations at the Pole up to the millimeter region where the intensity of background radiation peaks and the new radiometer operates. The one meter radio telescope can receive signals at wavelengths of about 3 mm. To attain the required sensitivity the telescope's receiver will be cooled by liquid helium to three tenths of a degree centigrade above absolute zero, minus 273.15 c.

Scientists plan to work on this project in November and December. It is one of seventy projects covering a variety of disciplines involving 255 investigators and technicians that make up the 1986-87 United States Antarctic Programme. Work will be carried out around the Antarctic Peninsula, at Palmer, Siple and Amundsen-Scott South Pole and McMurdo Stations and surrounding areas, in remote field camps, from ice breakers and at facilities of other countries.

The scientific programmes, logistic support and the coastal and inland stations are coordinated by the National Science Foundation. Logic support is provided by Hercules aircraft and helicopters flown by the United States

Navy VXE-6 squadron, US Airforce Starlifters and the United States Coast Guard's icebreakers Polar Sea and Glacier.

The Polar Sea is to resupply Palmer Station shortly before Christmas and then proceed to McMurdo Sound where it is due at the ice edge in early January. Because last year's ice never left the Sound thicker than usual ice is anticipated for some 30 nm before the channel breaking begins.

The Paul Buck, a tank ship, and the stores vessel Green Wave, will be assisted in and out of McMurdo by the Polar Sea which will also undertake three short science cruises in the area before heading north in late February.

USCGC Glacier is scheduled to cruise for five weeks in the Northern Peninsula area from mid-December before heading for McMurdo where she is due in early February to support science work planned for completion towards the end of the month.

Ice shelf sediments

Modern antarctic shelf sediments have unusual sources and transport paths unique to the present glacial setting. Previous studies along the antarctic continental margin have shown that biological and physical processes affect sediment transport and deposition. Sedimentary processes have been characterised by a series of surface sediment experiments that estimate the sinking flux of particulate matter and reveal different depositional styles at various points.

As part of an integrated study to measure primary production in surface waters, particle fluxes at depth, and sediment accumulation rates on the sea floor scientists from Rice University will sample particulate matter at 11 sites on and below the sea ice and, working with marine geologists, will conduct a high frequency seismic survey of several regions in the McMurdo Sound from the icebreaker Glacier. The results will provide data for paleo-oceanographic studies and for investigations of geochemical cycles of nutrient elements in the southern ocean.

Mass balance

Melting of ice shelves by above freezing seawater is a factor in ice shelf mass balance, which, in turn, may relate to the mass balance of the west Antarctic ice sheet and sea level.

Since 1983 Dr Dale Pilsbury of Oregon State University and Stanley Jacobs of Columbia University have furthered their understanding of ocean circulation on the antarctic continental shelf and the interaction among the ocean, sea and glacial ice. They are studying heat transport into the sub-ice shelf cavity via a relatively warm current "jet" that crosses the continental shelf at intermediate depths.

Ice shelf melting and winter formation of sea ice strongly influence shelf-water thermohaline and geochemical characteristics and consequently contribute significantly to the formation of Antarctic bottom water. From investigations on board the Polar Sea the scientists this year hope to learn more about the variability of Ross Sea circulation and ocean-glacial ice interactions.

Transantarctic Mountain studies

The Transantarctic Mountains extend over 4,000 kilometres between the Weddell and Ross Seas and form the western boundary of the east Antarctic craton. Within the Mountain chain and in the Ellsworth Mountains in West Antarctica Upper Proterozoic and Lower Paleozoic rocks crop out in isolated areas. From regional mapping and some detailed study geologists have shown these areas to have in general, similar histories but differences in stratigraphy and structure.

Dr Margaret Rees of University of Nevada and her team will focus on two sequences of conglomerate and sandstone, one in the central Transantarctic Mountains and the other in Northern Victoria Land where stratigraphic similarities of the clastic sequences suggest a genetic relationship in the two geographically widespread areas. They will analyse facies for depositional settings, evaluate sediment composition to ascertain lithologies and ages of source areas, determine ages of interbedded rocks, collect fossils and examine relationships between coarse clastic sequences and the underlying formations. The data should help them

determine if the tectonic setting which controlled the origin and distribution of the sequences later deformed them. If there is a genetic relationship scientific understanding of the lower Paleozoic development of the western continental margin of Antarctica and perhaps of Gondwana will be greatly modified.

Between the Nimrod and Beardmore Glaciers in the central Antarctic mountains, an exposed segment of bedrock appears to straddle the boundary between the old Precambrian craton and later Precambrian geosynclinal sediments and the Paleozoic batholith overlaps the edge of Precambrian basement. In 1985-86 Dr Donald DePaolo of the University of California completed reconnaissance mapping and sampling of granites between the Nimrod and Ramsey Glaciers.

This summer the objectives are to understand the petrogenesis of the granitic rocks, investigate the age and origin of the precambrian basement rocks, and develop tectonic-magmatic models of early Paleozoic evolution of the continental margin.

In the Miller Range they will map and sample Paleozoic granites and investigate in detail the structural geology and metamorphic petrology of the Precambrian metamorphic rocks.

In the Gabbro Hills south of the mouth of the Shackleton Glacier sampling will be extended to an area geologists believe was the furthest edge of the continental margin during the late Precambrian and early Paleozoic. The results of their detailed analytical studies will help explain the petrologic evolution of the Transantarctic Mountains.

Cenozoic geology

Working with New Zealand Antarctic Research Programme scientists from Ohio State University under the leadership of Peter-Noel Webb will provide on-site bio-stratigraphic control at a hole to be drilled near Butter point as part of New Zealand's CIROS programme unravelling Cenozoic geology.

Samples will also be collected from Royal Society Range and some sites in the Dry Valleys in an effort to determine, as geologists have suggested, that the fossiliferous Late Cenozoic terrestrial Sirius Formation which crops out

along the Transantarctic Mountains, may have originated in the Wilkes-Pensacola Basins inland from the mountains. Believing that some of the Sirius-Formation marine sediments contain fossils which may have come from a geologic setting similar to the McMurdo Iceshelf they hope also to collect samples to determine if the shelf contains marine material with ages similar to the Palogene, Neogene and Pleistocene sediments of the Sirius Formation. Their long term objective is to develop a Cenozoic biostratigraphy based on microfossil groups and apply paleoecological data to solving problems of basin, evolution, mountain building and climate fluctuation.

Mt. Erebus

Seeking a better understanding of the nature, behaviour and evolution of the Mt. Erebus magma chamber Dr Philip Kyle of the New Mexico Institute of Mining and Technology will continue observations of the volcano this summer. The team will document the nature and changes in activity, collect samples of material ejected at various times for subsequent detailed petrologic/geochemical/isotopic analysis to evaluate the petrogenesis of the magma. Temperature measurements of the lava lake will be made, the emission rate of chemicals and particulate matter and changes in the composition of the magma will also be part of the study made by the scientists who believe that the volcano has begun a new eruptive cycle that is characterised by strombolian eruptions.

This is based on observations made in December 1984 a few weeks after a series of large magmatic eruptions rocked the volcano. In December 1985 the lava lake, 15 metres in diameter, was observed to be in a site similar to that of the former lake. It represents the top of the volcano's magma chamber and can be viewed as a window through which the processes operating within the chamber system can be observed.

Mapping

In a joint US/NZ programme two cartographers from the US Geological Survey and two New Zealand surveyors will connect loose scientific surveys to create a single geodetic network in Southern Victoria Land and Ross Island

to support 1:50,000 scale mapping by the two programmes. The controls will later be used to support a Shuttle Imaging Radar Project. The US Cartographers will also locate the true geographic south pole and check the control network near the Amundsen-Scott South Pole station.

Meteorites

Meteorites are useful in investigating possible changes through time in the meteoroid flux at earth, measuring the cosmic-ray flux of past eras, searching events in which asteroid parent bodies were disrupted and defining the abundances and characteristics of pre-solar-system organic molecules.

This summer Dr William Cassidy from the University of Pittsburgh and his team will conduct search systematically for meteorites in an area from near the Beardmore field camp to the Lewis Cliff Ice Tongue, some 30 miles south and also in the Dominion Range. Meteorite finds will be mapped, ice samples taken for isotopic and age analysis and potential stranding surfaces explored.

Marine biology

Drs Anna Palmisano and Cornelius Sullivan of the University of Southern California will examine physiological changes in ice algae from the beginning of the bloom in November through its decay in January in both bottom congelation and platelet ice communities to determine the primary factors affecting ageing.

Scientists have reported that microalgae remain trapped in the bottom of the annual sea ice in McMurdo Sound during the entire spring bloom; crops can represent high chlorophyll levels. Ice microalgae may also provide a model for studying physiological changes during an algal bloom and because vertical mixing and horizontal movement are absent and losses from grazing and sinking are reduced scientists are able to follow a single community through bloom development and decay.

In a changing environment phytoplankton typically adapt by altering a metabolic pattern of nutrient use enabling the cell to operate efficiently for a short time. In the southern ocean and under annual sea ice they are exposed to discontinuous light and nutrients because of the

turbulent motion, seasonal variations in light, varying cloud cover, wave action and the localized and periodic regeneration of nutrients.

In 1980 biologists reported that southern ocean phytoplankton can incorporate 70 to 80 percent of recent products of photosynthesis into lipids (organic compounds) and smaller amounts into proteins, a finding which contrasts with traditional interpretations of primary production measurements.

Laboratory results suggest that patterns of uptake vary significantly with species and geographic location. From late August until mid November Dr Richard B. Rivkin of the Horn Point Environment Laboratory, University of Maryland will lead a team collecting samples, measuring growth rates and temporal changes beneath the ice and in the open water of McMurdo Sound. Their objective is to examine how fluctuating light cycles are related to carbon metabolism, photosynthesis and the growth of individual species and phytoplankton assemblages.

Although benthic foraminifera are abundant in many marine communities, their trophic (nutritional) positions and significance in energy transfer and community dynamics are unknown. Dr William Stockton of the University of California and four others will focus their work this season on rhizopods, one type of benthic foraminifera, which appear to be important in the energy transfer in benthic food webs. Capable of rapid growth on various foods, rhizopods may represent a large benthic biomass that preys on microbial life forms and serves as a food source to higher trophic levels, especially small species and the developmental stages of larger ones.

McMurdo has diverse types of habitats with distinctive foraminiferal assemblages ranging from shallow water to deep ocean species and because it is within a polar environment with pronounced seasonal fluctuations in benthic populations ecological relationships can be sorted out more easily. Working mainly at New Harbour, where they will dive under the ice to collect samples, the team will analyze the energy flow into rhizopods populations, evaluate the standing stocks, biomasses, chemical and calorific compositions of rhizopods and determine what is the most likely to prey on them.

Observations will also be made on the eastern and western side of McMurdo Sound.

Trace metals

As the largest volume closed lake in the dry valleys of the southern Victoria Land Lake Vanda provides an excellent ecosystem for investigating metal dynamics and phase specific removal systems. In addition to being fed by a single river the Onyx the lake has a well characterised chemistry and biology, a permanent ice cover which excludes airborne inputs of metals and it is remote from human influences.

Dr William Green of the University of Hawaii and two other researchers will study the solid phase speciation of chromium, magnesium, iron, cobalt, nickel, copper, zinc, cadmium, lead and aluminium, determine the phases controlling the transport of each in the river and lake, trace the associations from sediments, obtain residence times and compare trends in metal reactivity in this system with those in the ocean. Other studies relating to mobilization, residence times, equilibria and solubilization will also be conducted. By combining the data with that obtained in 1980 knowledge of the processes regulating metal transport and concentrations will be better understood.

Winter oxygen levels

Antarctic lakes are enriched perennially with high levels of oxygen which in other environments would be lethal to many organisms. However here biota flourish; biological activity and effects caused by large shifts in the freeze thaw cycle of the ice over an associated inputs from glacial meltwater apparently influence the oxygen budget in these lakes. Without winter data scientific understanding of this ecosystem is incomplete.

Continuing work at Lake Hoare in the Taylor Valley George Simmons of the Virginia Polytechnic Institute and State University and Christopher McKay from National Aeronautics and Space Administration will instal remote sensing equipment to acquire winter data and construct a model for the oxygen cycle from these and other data.

Data collected during the 1985-86 season suggests that Lake Hoare is undergoing an unanticipated dynamic change. The ice cover is

now only 10 feet thick instead of the previously measured 15 to 18; the sediment layer appears further down in the ice cover and the supersaturated oxygen zone is now about 2 to 3 feet lower in the water column.

Sediment traps placed last year will be retrieved and reset; water from meltstreams, a moat, the lake and lake ice will be analysed for seasonal changes of oxygen and nitrogen and the seasonal fluctuation of chlorophyll and oxygen concentrates will be further evaluated. Data is to be collected from temperature and oxygen electrodes; the algal mats in experimental growth plots established over three seasons since 1980 will be sampled and new plots set up. A reconnaissance trip to Lake Joyce is planned for collection of comparative data. From the combined information of this and previous seasons a better understanding is sought of how growth and production in microbial communities are related to changes in the oxygen budget and how shifts in the freeze thaw cycle affect the oxygen level.

Thyroid experiments

In mammals many factors regulate the basal metabolic rate to satisfy energy and heat requirements. Dr John T. O'Brian, Department of Internal Medicine, Naval Hospital, Bethesda will study thyroid hormone kinetics in cold exposed man at McMurdo Station using six volunteers in a year long experiment. Thyroid hormones are important for maintaining basal metabolic rates and, along with other endocrine factors, are related to non-shivering thermogenesis. However adaptation to the environment can alter the serum concentrations of these hormones. Changes in hormone activity may be related directly to cold exposures unique in Antarctica.

The dynamics of thyroid turnover will be calculated during cold exposure by using radio labelled thyroid administered intravenously. To obtain turnover rates two hormones will be separated chromatographically from serial plasma samples and counted. The study will be conducted before cold exposures, after 24 weeks and after 40 weeks in Antarctica. The results will help to define a theoretical model of cold adaptation and clarify the contribution of thyroid hormones to this process.

Seals

From early October Dr Donald B. Siniff of the University of Minnesota will continue his work on the behaviour and ecology of the Weddell seals from a camp set up near Hutton Cliffs on Ross Island. The project focusses on male territorial and reproductive behaviour, age specific survival of pups born in the colonies and the activities of and interactions between mothers and pups.

By using physical and electronic markers over the last two summers the peak of breeding activity under water has been identified and the first proof of the degree of polygyny in the species obtained.

Males appearing on the site are tagged with proximity transmitters and small radio transmitters to record their activity in and out of the water. Females are also equipped with proximity recorders to document approaches and copulatory activity by males. Females are weighed before the pups are born and afterbirth mothers and pups are weighed weekly throughout the lactation period to determine time mothers invest in pups.

In November and December a base camp is to be established near Cape Royds to census the seal population near the ice edge. From these observations it is hoped to document the number of immature seals to improve estimates of survival rates for younger age groups.

Fish studies

Living organisms adjust protein synthesis rates in response to environmental factors as a fundamental strategy for survival. Most Antarctic fish living in ice-laden shallow water possess either glycopeptide or peptide compounds with anti-freeze properties.

Dr Arthur DeVries of the University of Illinois leads a team planning to catch various species of fish from the sea ice near McMurdo Station, the shallow waters near Cape Royds and the Dailey Islands for study in the McMurdo aquarium to determine the distribution and role of glycopeptides in various body fluids and tissues.

Previous results have shown that are eight different sized glycopeptides which lower the freezing point of body fluids below the temperature of the seawater.

The team will also study the part glycopeptides play in freezing avoidance of the intestinal fluid, what mechanisms cause them to move from blood to bile and why are not digested as they move through the digestive tract. Biochemical studies will be made of the noncolligative lowering of the freezing point of water by examining the interaction between antifreezes and ice. They will also look at the role of the epithelial tissues in preventing ice propagation into undercooled fluids by determining at what sub-freezing temperatures these tissues act as a barrier, with or without the presence of glycoproteins.

Penguins

Brooding and forging energetics of emperor penguins are to be studied at a colony near Cape Washington in northern Victoria Land. This is part of a study begun in 1985-86 on the king penguins; the two species differ in size, breeding habits and distribution but have similar life styles. Both depend entirely on fish and squid for food, can dive deeper than other penguins and remain near their breeding areas year round and are major predators in the southern ocean food web.

Using a newly designed submersible microprocessor a team led by Gerald L. Kooyman of the Scripps Institution of Oceanography will record for the first time swimming velocity, time/depth profiles and dive patterns of the emperor penguin. The data will help understanding of the physiological response to diving. Energetics will be measured with special isotopes to determine water turnover rates and carbon dioxide production. The average metabolic rates of the birds at the colony will also be measured.

From the combined data from both studies models will be developed showing the impact penguins have on the southern ocean ecosystem. The efficiency of energy transfer from the environment to growing chicks will be calculated to understand better how these species exploit their environment.

Endolithic life Southern Victoria Land

The presence of endolithic micro-organisms in southern Victoria Land's ice free valleys was first reported in 1976. These highly adapted

communities restricted by arid conditions and katabatic winds to life in a narrow zone under the surface or in the fissures, cracks or structural cavities of porous rocks will be studied by Dr E. Imrie Freedman from Florida State University.

Working at Linnaeus Terrace in the Asgard Range and other sites in the ice free valleys of Southern Victoria Land, including Battleship Promontory, Mt. Lister, Mt Fleming and University Valley this year's research will include micrometeorological measurements. Respiration and net photosynthetic rates for microbial communities will be estimated, calculations made of total yearly productivity and the taxonomy of certain lichens and algae studied. Interactions of organisms and the rocks inhabited, colonization, and the yearly accretion of nitrogen in rocks will be examined as part of this project which is designed to provide a more comprehensive understanding of cryptoendolithic microbial ecosystems and their implications for earth sciences.

Dry Valley Ice dynamics

Dr George Denton of the University of Maine and his field team will continue work on the late Cenozoic glacial history and soil development. The history of antarctic ice dynamics relates to causes of global ice ages and provides insights into the behaviour of past northern hemisphere ice sheets. During the Quaternary eustatic sea level and precipitation controlled ice sheet fluctuations, as ground ice repeatedly covered peripheral continental shelves. By combining geological and soil studies a model has been developed for late Cenozoic ice sheet fluctuations and soil development enabling them to infer multiple earlier glaciations with ice-volume maximums greater than those during the Quaternary.

Work this summer will be in southern Victoria Land. Rocks will be collected from near the Rhone Platform and Taylor Glacier for radiometric dating to determine the overriding of the Transantarctic mountains by the East Antarctic ice sheet. Mapping of moraines and drift sheets in the Wright Valley will help tie together the valley floor moraines with basal till deposited by the ice sheet.

Mapping of the moraines and drifts in the Quatermain Range and Arena Valley will be finished and the data when combined with that from the Beardmore Glacier region, the Ellsworth Mountains and northern Victoria Land will help them to reconstruct the East Antarctic ice sheet during the time it overrode the Transantarctic Mountains. Mapping of the moraines and drift sheets in the Beacon Valley near Mt. Feather will also be completed.

Ozone, Aerosols and Katabatic winds

Lower atmosphere studies conducted in the McMurdo Sound region this year will include meteorological and ozone studies aimed at determining the atmospheric layers through which the various materials are transported to Antarctica and how they are transformed en route. The information is vital for climate modelling that includes aerosols as a component of the radiation budget and to an understanding of aerosol transport processes related to glacial and climatic history.

Long term measurements of trace atmospheric constituents that may influence climate will be continued. Part of the data collected in this programme will be used to determine how the rate of change in aerosol concentrations affect climate.

Further work on katabatic winds to be undertaken near Terra Nova Bay will clarify knowledge of forcing mechanisms and the relationship between coastal katabatic winds and interior conditions on the continent which are not well understood.

Accommodation, workshop and water plant planned this season.

Two dormitory buildings, a vehicle maintenance and repair shop will be built at McMurdo Station during the summer when a water distillation plant which has taken three years to construct will come into service.

Built in steel frame and fire resistant materials the two three storey dormitory buildings each accommodating 138 people will replace temporary structures some of which have been in use since IGY in 1957.

A 21,000 square foot one storey repair shop will replace the vehicle maintenance facility destroyed by fire in 1981.

The water distillation plant, which draws sea water from McMurdo Sound through a 2,500 foot heated and insulated pipe will supply about 80,000 gallons of fresh water per day. This is

about double the capacity of the previous plant which will remain for emergency use.

With extreme conservation measures McMurdo uses about 38,000 gallons of water per day for all purposes during the summer season which some 1,000 people live there for varying lengths of time.

Fresh eggs and pemmican for winter residents

Slightly more than 40 tonnes of mail, fresh food, and supplies were dropped to 161 men and women at the Amundsen-Scott South Pole Station, McMurdo Station, and Scott Base by a United States Air Force Starlifter which made two mid-winter flights from Christchurch on June 21 and 23. That to the Pole was the sixth mail and supply drop by the USAF — the first was on June 22, 1981 — and the eighth to Ross Island since the first on July 14, 1979.

On the round trip between Christchurch and the Pole on June 21 the Starlifter covered 5326 nautical miles and was in the air for 14hrs 50mins. It was refuelled in mid-air three times by a KC10 tanker which also refuelled the aircraft on the second flight to Ross Island on June 23.

With a winter population of 126 men and six women McMurdo Station received the first 13.25-tonne drop of mail, fresh fruit and vegetables and supplies. The cargo dropped in containers from a height of 304.8m to 457m included 400 litres of fresh milk for the Americans, and mail and "freshies" for 11 New Zealanders and one Canadian at Scott Base.

Eleven men and six women at Pole Station welcomed in their drop of 5.31 tonnes a special request — 1440 eggs — instead of the water melons asked for last winter. To ensure that the eggs were not scrambled on arrival they were individually packed in plastic bags which were then inserted in holes cut in foam rubber mattresses. All the eggs arrived unbroken.

This was not the first time the USAF had dropped eggs at the South Pole. On October 27, 1957, the first 18 Americans to winter there received a carefully packaged

crate of eggs in a drop by a USAF Globemaster. When the men opened the crate they found one egg was cracked. But the Air Force had not let them down. Written on the shell was a message: "This egg was cracked before it was dropped."

A larger drop of 21.81 tonnes was made on June 23 for the 132 men and women at McMurdo Station, 12 men at Scott Base, and three members of the Footsteps of Scott Expedition, Gareth Wood, Steve Broni, and Tim Lovejoy, who were wintering at Cape Evans. This drop marked the completion of a joint operation by the USAF, US Navy and Army, Royal New Zealand Air Force, and Royal New Zealand Army Corps of Transport.

Change in U.S. command

Commander Al Jones, commander of the Christchurch detachment of the United States Naval Support Force, Antarctica, since 1981, has been replaced by Commander Robert Harler, of the Navy's VXE-6 Squadron, who has been air operations officer at McMurdo Station for the last three seasons. Commander Jones handed over his command on June 30 and at the same time retired from the Navy after nearly 27 years' service.

Among guests at the change of command ceremony were the United States Ambassador (Mr Paul Cleveland), the Mayor of Christchurch (Sir Hamish Hay) and representatives of the Antarctic Division, D.S.I.R., the Royal New Zealand Navy, Army, and Air Force. A guard was provided by Marines from the U.S. Embassy in Wellington and the Royal New Zealand Navy.

In the containers for the South Pole and Ross Island were such items as a personal computer for data recording, a large consignment of material for shower cabinet walls, newspapers, pemmican for the 16 New Zealand huskies, and a special request — two litres of hormone solution for the Scott Base hydroponic gardening project. Ross McDonald, assistant base engineer, had tomato plants in flower and needed the hormone solution to make sure the fruit sets.

Friends and relations in Britain, Canada, Australia, New Zealand, and South Africa did not forget Wood, Broni, and Lovejoy at their Jack Hayward Base. They received

letters and parcels in the drops to the Ross Island residents, and representatives of the expedition in Christchurch packed two 10kg parcels which contained items the men missed most — 10 eggs, apples and oranges, sweets, paperbacks, one bottle of whisky, and one of port.

When the Starlifter headed home to Christchurch on June 23 it left behind floating in the Ross Sea three buoys. They were dropped north of Ross Island on the way south for a University of Washington study of ice floes. Their battery-operated transmitters will send information by satellite to the United States.

Plans to salvage Hercules after 15 years

Since 1977 the United States National Science Foundation and the Navy have planned to recover a ski-equipped Hercules aircraft which has been buried in East Antarctica for 15 years. The aircraft, which is in Wilkes Land, was badly damaged on December 4, 1971 when it took off after supplying a geological traverse party at 68deg 20min S/137deg 31min E about 225 kilometres southwest of the French station Dumont d'Urville.

This summer a team of experts from the Navy and the manufacturers will inspect the Hercules and decide whether it can be recovered and repaired or has to be written off after the removal of as many parts as possible. Inspection by a similar team in the 1977-78 season confirmed that the aircraft could be repaired and returned to service.

Plans for the first stage of the recovery operation in the 1985-86 season had to be deferred because of snow conditions. This season a French team has prepared a landing area (skiway, taxiway and camp) at D21 (6deg 44min 30sec S/139deg 39min E) and 20 km from Dumont d'Urville for two Hercules which flew in from McMurdo Station early in November.

A traverse of about 247 km will be made to D59 (68deg 20min 36sec S/137deg 21min 13sec E) where a skiway will be prepared for a Hercules which will fly direct from McMurdo Station with the US recovery team. D59 which is near the buried Hercules will be manned from November 20 until this season's operations, which include the removal of the engines and if possible the placement of the aircraft in a snow berm, are completed.

Almost completely buried in the ice of East Antarctica, Hercules No. 321 can now be identified only by its tail. In the summer of 1971 it was one of the VXE-6 Squadron aircraft which provided air support for the first stage — 1000km — of the French traverse across Wilkes Land towards the Soviet Vostok Station. The traverse, planned to cover 2000km in two seasons, was part of the co-operative International Antarctic Glaciological Project organised by France, the United States, the Soviet Union, and Australia.

A small advance base, Carrefour, about 40km from Dumont d'Urville, at a height of 530m, was established by the French in the previous season as the starting point of the

traverse. A Hercules flew 1207km from McMurdo Station and landed the traverse party and its supplies near the base on November 1. Later the team of 10 began its 1000km journey.

On December 2 when the party was 200 km south of Carrefour No. 321 flew over its vehicles but could not land. The second attempt on December 4 was successful, and fuel, fresh food, and mail were unloaded on the ice-cap.

But on take-off two JATO (jet-assisted takeoff) bottles broke loose on firing and struck the inside left engine of the Hercules. This broke away, causing damage to the outer engine, and the propeller blades went through the fuselage. The aircraft, which had lightly left the ice, dropped back and in its fall the left wing dropped deep in the snow and it and the radar were damaged.

Eight members of the crew and two passengers, who were safe and sound, evacuated the Hercules and set up a temporary camp in survival tents on the ice near the French party. Insulation, litters, other materials, and snow blocks were used to fashion a windbreak. A relief aircraft landed on December 7 and took the 10 men back to McMurdo Station. The French party continued its journey.

Because of the loss of the Hercules the three remaining supply flights were carried out by air drops of fuel, supplies, and mail.

Almost completely buried in the ice of East Antarctica since it was damaged on December 4, 1971, Hercules No. 321 can now only be identified by its tail. It was badly damaged on December 4, 1971, while providing air support for the first stage of a French traverse across Wilkes Land towards the Soviet Vostok Station.



The last was made when the French party reached the 800km mark and decided to end the traverse because of bad weather, difficult terrain, and the need to repair equipment.

In 1975 two Hercules aircraft were damaged during attempted take-offs on January 15 at Dome C, an ice dome in Wilkes Land 3500m above sea level, and 1150km from McMurdo Station. A third aircraft on a servicing flight from McMurdo Station to Dome C was also damaged when taking off on November 4 for the return flight.

A salvage camp had been set up early in November to recover one of the two aircraft stranded near Dome C on January 15. With

three aircraft down on the ice recovery plans were revised and a decision was made to repair the aircraft damaged on November 4 (No. 320) and then, if time and weather permitted, the less damaged of the two stranded on January 15 (Nos. 319 and 129).

Between December 7 and January 14 Nos. 320 and 129 were repaired, flown from Dome C to McMurdo Station and then to Christchurch. The recovery team left behind at Dome C a skiway and a camp of seven buildings. Repair crews, building materials and equipment had all been flown in from McMurdo Station by the only two Hercules aircraft still operational.

No. 319, the most severely damaged of

Two men killed in crevasse accident

Two American carpenters were killed about 4 p.m. (local time) on November 23 when they fell into a crevasse about 21m deep while on a 3.2km Sunday hike from McMurdo Station towards Castle Rock (415m). The men who died were:

John Emmett Smith, 43, married, Portland Oregon

Matthew Kaz, 25, single, San Carlos, California

With another carpenter, Tom Powell, the two men strayed from a marked track to take a short cut to their destination. Mr Powell could not see or hear his companions after they fell into the crevasse which was half a metre wide at the top. He returned to McMurdo Station for assistance and a United States Navy helicopter and a combined America/New Zealand rescue team were on the scene soon after the alarm was raised.

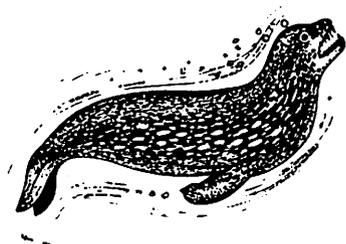
Because of the depth and narrowness of the crevasse the rescue workers took 10 hours to bring out Mr Smith who was trapped at a point where the crevasse was only 25cm wide. Another nine hours' work was needed to free Mr Kaz.

After the bodies of the two men were recovered in the early hours of November 24 they were flown back to Christchurch on the morning of November 25 by a Royal New

Zealand Air Force Hercules aircraft. In the evening a memorial service was held at McMurdo Station for the two men. On November 27 the bodies were flown back to the United States.

All three men were employed by ITT Antarctic Services, contractors to the United States National Science Foundation, and were working with the contractors' construction team at McMurdo Station. Messrs Smith and Kaz had arrived in Antarctica for the first time early in October.

The search for the men was launched when their empty truck was found outside Scott Base. Apparently they had left McMurdo Station to go ski-ing, and after using the small ski tow some distance from Scott Base began their attempt to climb Erebus.



the three aircraft, was recovered the next season after nearly two years' exposure. The camp was occupied on November 11 by a recovery team of Navy and civilian technicians. They completed their task 30 days ahead of schedule, and No. 319 returned to McMurdo Station five minutes before Christmas Day ended. It reached Christchurch on December 30.

In the 1976-77 season plans were made to recover No. 321. A reconnaissance of the area revealed that the abandoned Hercules was still visible but almost buried under snow. The next season a Hercules flew 1500km from McMurdo Station to Dumont d'Urville for the first time so that a Navy and civilian team could inspect No. 321.

First the winter team at Dumont d'Urville built a skiway about 19km inland so a French support team could be flown in from McMurdo Station. It made a traverse from

Carrefour to D59 near the damaged Hercules and built a skiway there. Next the team of experts flew in from McMurdo Station and a temporary camp was established.

United States aerial and French surface observations over the last seven years, knowledge of actual damage to No. 321, and the experience gained in the recovery of the other aircraft at Dome C have indicated that the damaged aircraft can be prepared and returned to service although the operation is likely to extend over two seasons. The approximate cost of recovery and the return of the aircraft to the States is US \$3 million. Once in the United States a further US \$8 or 9 million will be needed to return the aircraft to full operational service. A new Hercules is approximately US \$30 million.

USARP Pole operations

Summer operations at Amundsen-South Pole station are scheduled to begin on November 1 and continue until mid-February. In addition to the various science programmes the complex housing the clean air facility completed in 1970 is to be lifted about 12 feet above the snow surface. Originally it stood some 15 feet up but snow has since packed in underneath. The station fuel lines are to be raised and preliminary work undertaken for the emergency standby electric plant. Approximately 90 LC-130 flights will be made to the station during the summer to support the various activities including winter supply.

Programmes being undertaken at the station this year include long period seismic and gravity observations. Because the station is a seismically quiet platform which lies on the earth's rotational axis the site can be used to measure long-period oscillations of the Earth. Its location on the Great Circle paths, which coincide with portions of the Mid-Atlantic ridge and the East Pacific Rise makes it advantageous for studying middle-phase velocities sensitive to the middle-mantle structure under an oceanic ridge.

Scientists hope to observe motions of the

earth's inner core as part of a programme to attain a better understanding of the deep and lateral structures of the earth. Two technicians will operate electronic doppler satellite tracking equipment to track overflights of navigational satellites throughout the year. The data will be used in studies of polar motion and ice movement. The South Pole seismometer is operated as part of the Worldwide Standardized Seismology Network.

USARP Peninsula programmes

Fifty one investigators will work on ten projects at or near Palmer station or from the 219 ft research vessel R/V Polar Duke operating in the Peninsula area. The Polar Duke is to support scientists from Rice University conducting a piston coring programme in October and put a party into the Polish Arctowski Station before its first cruise departing from Punta Arenas in early November when it will carry a relief crew for Palmer Station and science parties. Two further cruises in the Peninsula area will follow.

Each is to be of about seven weeks.

Three teams of scientists will try to determine what makes the coastal ice shelf ecosystem of the Antarctic Peninsula more rich biologically than the surrounding waters. The Peninsula region is particularly important because it is the principal breeding, feeding and spawning ground for Antarctic krill. These projects will be undertaken as part of a multidisciplinary study RACER (Research on Antarctic Coastal Ecosystem Rates and Processes) which is designed to increase understanding of the paths and rates of energy flow within the Antarctic coastal ecosystem.

Phytoplankton

Working on board the R/V Polar Duke Dr Osmund Holm Hansen from the Scripps Institution of Oceanography in California and his team will focus on the hypothesis that physical mixing processes in coastal waters favour increased water column stability, greater residence times of phytoplankton in shallow mixed layers and allows higher rates of photosynthesis. Because evidence supports the idea that Antarctic phytoplankton are light-limited they will study phytoplankton and biomass distribution, rate processes and photoadaptation in relation to available light to determine conditions for maximum energy input to the ecosystem. They will survey coastal shelf and deep ocean waters to determine temporal interactions between the physical dynamics and plankton populations. Productivity will be determined by radiocarbon techniques and photoactivity by measurements of photosynthetic, optical and biochemical parameters.

Krill

A second project, to be conducted by Mark Huntley also of the Scripps Institution, will focus on aspects of feeding growth and early development of krill. By observing surface and vertical distributions of krill the scientists in this project hope to resolve whether growth rates of larval krill depend on food availability and are therefore greater in the waters of the coastal ecosystem than in deep water areas; whether the development is more rapid in coastal areas and whether juvenile and adult krill supplement their

feeding by carnivorous intake of other zooplankton concentrations are too low to provide adequate food for metabolism. The question of residence times in coastal waters and offshore regions will also be examined.

Food Web

Knowledge of the carbon pathway and energy flow through the lower trophic levels of the oceanic food web is at present incomplete. On board the R/V Polar Duke seven researchers led by Dr David Karl of the University of Hawaii will measure biomass and metabolic activity of microbial populations, relationships between primary and secondary production, the downward flux of carbon, nitrogen and phosphorous with sediment traps and dissolved nutrients, gases and macromolecules in water samples. Data from these experiments will add to the overall understanding of the rates of primary and second production and may be useful in formulating a general model of carbon and energy flow in Antarctic marine ecosystems.

Cold adaptation

As part of their adaptation to the cold most Antarctic fish produce biological antifreeze compounds; however biologists have also found that fish living in the cold waters of the Peninsula and McMurdo Station accumulate substantial quantities of corporeal lipids. Although some biologists have suggested that lipids are a primary fuel for energy metabolism this has not yet been demonstrated. These fish, comprising 65 percent of about 120 species identified in the southern ocean have evolved from others which live in waters with an average temperature of approximately -1.9°C near McMurdo Station and -1.1° to 0.3°C in the Antarctic Peninsula region.

Trawling from R/V Polar Duke to collect samples from the south shore of Low Island off the Antarctic Peninsula and in the laboratory at Palmer Station Dr Bruce Sidell of the University of Maine and his team will use a cellular/biochemical approach to describe more completely energy metabolism of antarctic fish. Their results should help resolve conflicting hypothesis on whether the metabolic rates are cold adapted or whether fats are primary fuels for energy metabolism.

Chitin is a primary component of the exoskeletons of marine invertebrates. In the southern oceans high primary production causes correspondingly high concentrations of herbivorous consumers, particularly krill whose dry weight is about eight percent chitin. Over time the antarctic marine environment would lose an enormous quantity of nitrogen and carbon if chitin were not degraded and remineralized.

To determine the importance of chitin in the carbon and nitrogen cycles of Antarctic coastal waters Dr James Stanley of the University of Washington will lead a team planning to study animals that feed primarily on krill and determine if chitin is being degraded during passage through the digestive tract.

Tissue samples and gastrointestinal contents from a limited number of Adelie penguins and crabeater seals will be tested for chitinase. Samples from the sediments of small boats and the water column near Palmer Station and the water column and sediment traps along the Antarctic Peninsula will be surveyed and the microbiology and degradation of chitin in soils in penguin rookeries investigated. Areas with large populations of crabeater seals near Palmer will also be examined and the chitinases from the various animals, from bacteria residing in the water column and from sediments will be isolated, purified and characterized.

Krill stocks

Exploited by antarctic marine carnivores and the focus of a growing fishing industry aspects of the replenishment of krill stocks are little known. Four factors affect how much food is available for reproduction; ingestion, efficiency of assimilation, metabolic costs of swimming and maintenance and how energy is partitioned for growth and reproduction.

Working aboard the Polar Duke in two regions west of the Antarctic Peninsula Drs Langdon Quetin and Robin Ross of the University of California will search for and collect live krill for laboratory experiments three or four times between November 1986 and January 1987.

Under laboratory conditions the team will measure assimilation efficiency, rates of ingestion, instantaneous growth and egg production.

At Palmer station they will continue investigation of oxygen consumption and ammonia excretion at various swimming speeds for adult krill by driving them to swim at different speeds in an annular respirometer. The aim of the project is to increase understanding of little known or poorly understood aspects of krill biology.

Penguins

Working in rookeries near Palmer Station Mark Chappell of the University of California and Lizbeth Langston will investigate aspects of thermo-regulation of Adelie penguins. Their objective is to produce a description of temperature relations and energetics during incubation and nestling growth by measuring the microclimate and observing behaviour to establish a range of thermal conditions for adult birds and chicks. Data from additional physiological studies, including carbon dioxide consumption, water loss, and ventilation rates will be combined with field measurements and observations. The study should provide insights into the significance of heat and cold stress, the energetic costs of maintaining normal body temperature, daily energy expenditures and the role of thermal and climatic factors in penguin breeding biology.

Predation

As major predators of krill penguins are a significant component of the antarctic marine food web and therefore information on population dynamics including factors that regulate numbers are important for the understanding of the ecosystem. The three pygoscelid penguins — Adelie, Chinstrap and Gentoo nest sympatrically at Point Thomas on King George Island near the Polish Arctowski Base. The Gentoo population is stable but the other two are increasing.

From October to February Dr Wayne Trivel-piece from the Point Reyes Bird Observatory in California and four other researchers will continue banding and studying feeding ecology of birds in two rookeries on the Island. Data from the project will contribute to the scientific understanding of the structure and function of the Antarctic marine ecosystem and add to present knowledge of population dynamics of marine birds.

Geology

The Antarctic Peninsula and Eastern Ellsworth Land belong to a Mesozoic-Cenozoic magmatic arc complex that appears to superimpose on one of at least four small lithospheric plates of the continental crust in West Antarctica. The Antarctic Peninsula-eastern Ellsworth land plate is the largest and best exposed and has the greatest potential of any area in Antarctica for containing economic metallic mineral deposits. Of particular interest is the 12,000 square kilometre long central Black coast, the axis of the southern Antarctic peninsula and some coastal areas near the southern end of that plate.

Being south of the regions studied by British Geologists and north of those worked by American geologists the area, is unexplored. In one of two joint projects in this area scientists from the two nations will use a British Antarctic Survey twin otter for four weeks to assist them with mapping, a number of topical studies and describing and interpreting the geology of the region which will be compared with previously studied southern Black Coast, Lassiter, Orville and English coasts and Eastern Ellsworth Land.

East and West

For several years scientists have sought further understanding of the relationship between East and West Antarctica through geologic time. The investigations carried out, in part, by Dr Ian Dalziel of the University of Texas-Austin have previously focused on the Scotia Arc and the region at the base of the Antarctic Peninsula extending to the Ellsworth, Thiel and Whitmore Mountains.

During the 1983-84 summer U.S. and British geologists began an extensive investigation in Ellsworth Mountains, Martin Hill, and Mt Smart near Siple Station. Field work includes geology, paleomagnetism, geochronology and geophysics with radio-echo sounding and aeromagnetic surveys conducted by British geophysicists.

This summer American scientists will again work with British Antarctic Survey personnel who will conduct an airborne geophysical investigation in the Ellsworth Mountain region in an attempt to define the limits of the blocks and

determine the tectonic nature of the ice covered area between them.

Because the structural history and geometry of the rocks forming the West Antarctica Andean Cordillera in the Scotia Arc are now fairly well defined scientists are interested in understanding the processes that formed the Arc. Accompanied by three other American investigators Dr Dalziel also plans to study the structure and metamorphics of the complex along the Pacific margin of the Antarctic Peninsula in the South Shetland Islands from which they to understand better the processes that placed the complex in its present continental margin setting. Tierra del Fuego and South Georgia Island on the northern Scotia Ridge will also be studied in order to understand the evolution of the southern most Andean Cordillera.

Fossil finds

In March 1982 the discovery of small mammal fossils confirmed theories predicting the past presence of land mammals, particularly marsupials, in Antarctica. The fossils related to an extinct South American marsupial family known there in rocks about 35 to 60 million years old. Dr Michael Woodbourne of the University of California estimates that Antarctic fossils are about 40 million years old and believe this indicates that marsupials dispersed from south America by that time. This discovery as well as others in the summer of 1984 has encouraged scientists to continue the search for fossil remains on Seymour Island and for additional cetacean, bird and plant fossils. The investigations should improve understanding of the geological relationships and stratigraphic controls of that portion of the sequence containing the Cretaceous/Tertiary boundary.

Sequence investigation

Further work on the boundary of the James Ross Island region is intended to enhance understanding of the evolution and faunal content of the late Mesozoic-early tertiary structures in the Island basin. This work will be undertaken by three scientists from the Purdue University in Indiana under the leadership of Dr William Zinsmeister. They plan to complete a geologic and paleontologic survey of the uppermost Cretaceous and lower Tertiary sequence on Seymour

Island, document the stratigraphic relationships of the boundary of these sequences and the occurrences of fossils and to determine if the iridium anomaly associated in other areas of the world with this boundary occurs in the Antarctic Peninsula region. This research should help to define the evolutionary relationship between this area and the Antarctic Cordillera, the tectonic setting of the peninsula region, the evolution of the southern hemisphere shallow water biota, and the changing patterns of land and sea connections.

Also concerned with the James Ross Island basin is Dr Rosemary Askin of the Colorado School of Mines who with two others will try and establish a biostratigraphic zonation for the

marine and nonmarine palynomorph succession of Seymour, Snow Hill and James Ross Islands. Examples previously collected on Seymour Island have yielded rich palynomorph assemblages including new species, some of which have been found in cores from the Ross Sea while others are peculiar to the James Ross Island basin. Additional samples will be collected for age and environmental correlation with other paleontologic and sedimentologic studies. From the resulting Cretaceous early Tertiary palynostratigraphic reference sequence they hope to be able to better define ages in other parts of Antarctica and also to determine the depositional environmental changes in the James Ross Island basin.

Sub-antarctic

Fifth expedition to Snares

A fifth University of Canterbury expedition to the sub-Antarctic Snares Islands 181 nautical miles south-west of Bluff, supported by the Lands and Survey Department with a grant of \$10,000, began biological and entomological research on the islands late in October. Six scientists from the university, Otago University, and the University of Oklahoma, will spend nearly four months studying crested penguins, seabirds, and their impact on the islands' vegetation.

As in previous years the primary purpose of the Government grant to the zoology department, which has organised four previous expeditions, is to have temporary rangers on the islands when they are likely to be visited by fishermen. Surveillance of the main island — North East Island — will be continued this summer to check that no rats or mice reach it from fishing boats. So far there has been no evidence of rats or mice ever having come ashore.

Co-ordinator of this summer's research programme is Dr Ian McLean, a senior lecturer in zoology. He replaces Mr Peter Johns, who has made five previous visits to the Snares but will be overseas next year. Leader of the group is Mr Colin Miskelly, who is completing a Ph.D. on the biology and breeding behaviour of the New Zealand

snipe which is confined to only a few sub-Antarctic islands. He is making his fifth visit to the Snares.

Research projects in 1986-87 include monitoring the Snares crested penguins' population, size, and reproductive success, a study of breeding in prions by Alan Tenynson, of Otago University, and Paul Sagar's study of Antarctic terns and Cape pigeons. Mr Sagar, of the Fisheries Research Division, Ministry of Agriculture and Fisheries, was with the first of the expedition's two parties and left the Snares on November 16 after a stay of three weeks and a half.

One project initiated this year is a detailed analysis of the factors leading to brood reduction in crested penguins. This will be carried out by Dr McLean, and Tim and Cammie Lamey, a husband and wife team from the University of Oklahoma who have been on the Snares since October 22. The expedition will also make a more detailed study of penguin chick mortality rates, the mechanisms of parent-chick recognition in crested penguins, and the time budgets and feeding behaviour in relation to the breeding status of the Snares Islands tomtits and fernbirds.

A series of permanent vegetation plots will be established in January and a complete

floristic description made of each plot. The aim of this study is to monitor the long-term impact of penguins and other birds on the vegetation. There are seven major vegetation types on the main island and several plots will be established in each type.

General monitoring of breeding by Buller's mollyhawk and several other seabird species will continue, depending on the time available. Buller's mollyhawk nests on North East Island and two smaller islands, Broughton Island and Alert Stack.

To reach the remote Snares group the expedition sailed from Bluff in the former research vessel *Acheron*, now the Stewart Island ferry. Colin Miskelly, Paul Sagar, and the Lameys travelled first in late October. They were followed by Alan Tennyson, and Grant Harper and Everit Kampert (University of Canterbury). Arrangements have been made for the party to be picked up by the

Antarctic cruise ship *World Discoverer* on February 20.

Last season's expedition which was on the Snares between mid-September and early March observed egg-laying by crested penguins for the first time; 41.2 per cent of eggs laid fledged successfully from one small colony. Breeding success of crested penguins on the main island declined 19.5 per cent relative to the 1984-85 season; 15,589 chicks were counted just before fledging.

Ten snipe nests were found, and litter samples of invertebrates were collected during 18 consecutive weeks as part of attempts to assess the territory quality of snipe. Five new fish specimens and two new brittlestars were identified in marine and inter-tidal studies, and eight marked sealions from the Auckland Islands were noted in January.

Where have all the rockhoppers gone

This summer officers from the New Zealand Wildlife Service will be continuing their search for reasons for the decline of the rockhopper penguins at Campbell Island. Forty years ago this population was the largest in the Australasian sub-Antarctic, but since then numbers have been declining drastically.

Rockhoppers breed at most islands near the Antarctic convergence. Substantial populations exist at Macquarie, Auckland and the Antipodes Islands in the Australasian sub-Antarctic.

First evidence of a possible decline on Campbell Island came from observations made by the late J. H. Sorensen, a war-time coast watcher stationed there from April 1942 to February 1944 and from February 1945 to November 1947. An enthusiastic and meticulous observer of the island's natural history, his diaries and photographs provide an exceptional basis for comparison with the present situation of the rockhoppers.

On November 17, 1945 Sorensen noted that the colonies at Limestone Point and

Rocky Bay seemed to have far fewer birds than in previous years. Photographs taken in the late 1950's and mid-1970's show that the trend has continued; none of the colonies has maintained its numbers over the past 40 years and many have disappeared entirely.

Reasons for the decline are unknown. Intensive investigations were started in the 1985-86 breeding season by Dr Phil Moors and Duncan Cunningham of the Wildlife Service, and their work will be continued this summer with assistance from Graeme Taylor.

Last summer many chicks in the colonies studied were found to have died from predation by rats or disease. Norway rats, introduced to Campbell Island more than a century ago and now abundant were able to kill penguin chicks for the first few days after hatching, even though the chicks were brooded continuously by the male parent. Older chicks were susceptible to disease and the bacterium *Pasteurella multocida* was isolated from eight carcasses brought back to New Zealand. Deaths from predation and

disease seemed to occur in the same colonies.

This year the team is concentrating on the breeding performance of the penguins, their diet, the growth and survival of chicks and the survival of adults between breeding seasons.

Part of the investigations will also focus on the effects of predation and disease, the role of which is unclear at present. Rats in some colonies will be poisoned to see how the breeding success of the penguins improves and tissue samples and swabs will be collected for subsequent analysis by pathologists from the Ministry of Agriculture and Fisheries. Other possible reasons for the decline include changes in marine conditions, especially the distribution or abundance of food.

Footnote:

The severity of the decline of the rockhoppers would not have been so obvious without photographs of the colonies taken by visitors to Campbell Island. Phil Moors is seeking temporary loan and permission to copy dated black and white photographs or colour slides of rockhopper penguins, the colonies and coastal scenes which might have distant views of the colonies, together with field notes and diaries. Material from before 1940 and between 1955 and 1975 is especially important, but



The Rockhopper penguins at Campbell Island — Photo: G. Harper

more recent photographs and notes would also be useful. The status of rockhoppers on Auckland and Antipodes Islands is unknown and similar photographs and notes from those areas would be useful. If you can help please write to Dr Phil Moors, Wildlife Service, Department of Internal Affairs, Private Bag, Wellington.

Campbell Island team for 1986/87

Maintaining the meteorological and scientific programmes on Campbell Island this year are: Andrew Fyfe, officer in charge, from Christchurch; Wendy Strid, cook, Auckland; Roger Moffat, mechanic, Christchurch; Bruce Shaw, DSIR technician, Auckland; Ian Boyd, senior meteorological technician, Auckland; meteorological technicians Ross Carroll, previously working in Kataia, Antony Wardle, Christchurch and Tuporo Marsters, Wellington; Tony Blandford, station technician, Auckland.

The new team arrived aboard the commercial fishing vessel the Daniel Solander on October 17, the old team returning to Wellington on Tuesday October 23.

Riquita's voyage

Private expedition in Ross Sea

A modest but useful scientific programme was carried out in the Southern Ocean early this year with minimum publicity by a small private Australian expedition which took the 14.3m steel-hulled yawl *Riquita* into the Ross Sea. The expedition spent a month in the Antarctic Treaty area, went ashore at Cape Adare, sailed the yacht as far south as Cape Hallett (72deg 19min S/170deg 16min E) and returned to Sydney on March 23 without incident or being caught in pack ice.

Led by Barry Lewis, who runs a sailing and navigation school in Sydney, the five-man expedition received advice and co-operation from the New Zealand and Australian Antarctic Divisions when planning the voyage south. As a result it was able to bring back information on icebergs and the state of the pack ice along part of the Northern Victoria Land coast from 63deg S, and daily weather and water temperature records for the Australian Bureau of Meteorology in Sydney.

*In addition Barry Lewis and his four companions, Peter Gill (principal observer), Ian Smith (*Riquita's* owner), Phil Kelly, and Steve Dick, recorded sightings of whales, seals, and dolphins. Estimates were made also of the numbers of Adelie penguins at Capes Adare and Hallett, and seabird observations for the ISAS project (International Survey of Antarctic Seabirds), and a log of seabird sightings throughout the voyage. This material has been sent to the two Antarctic Divisions which advised the expedition.*

This account of the expedition's activities between February 4 and 24, 1986 has been provided specially for "Antarctic" by Barry Lewis and his companions particularly Peter Gill.

We sailed from Sydney on January and on January 29 entered the Antarctic Treaty area, also crossing the Antarctic Convergence. The first icebergs were sighted in about 63deg S/178deg E. Three days later we crossed the Antarctic Circle at about 175deg E.

After sighting the first bergs we passed through a belt of them extending south to about 67deg S. During our passage as many as 13 bergs were visible at any one time. Fields of brash ice were encountered two days before we sighted Cape Adare but only occasional bergs after leaving the belt behind.

Cape Adare was sighted on February 9. There was abundant loose pack ice around the cape and in Robertson Bay so we used the opportunity to take soundings and plan a route in between the grounded bergs in the bay. Then we returned to the open sea for the night.

On February 10 the Cape Adare area was free of pack which was visible as a line several kilometres to the north-west, and thus we were able to proceed to Ridley Beach, but a strong current sweeping north along the beach at four to five knots made anchoring impracticable. As a result our two landings on the historic beach were made in groups of three and two while *Riquita* motored around well offshore.

Hut condition

We spent four hours altogether on Ridley Beach. Borchgrevink's hut appeared to be in very good condition with only a small amount of drift just inside the main door. All the external timbers were sound and in place. Flash-light photographs of the interior were taken but nothing was disturbed and the door was properly sealed before we left.

For safety reasons our time ashore was too short to obtain accurate counts of birds. Although the penguin breeding season was obviously well past there were still several hundred birds ashore, mainly chicks in varying degrees of down. They were scattered along the beach in a few isolated groups. The total estimate of 400 to 500 birds was based on a reasonably accurate count within one such group. Numerous birds were also seen swimming in Robertson Bay.

Several potential predators of Adelies were observed. About 30 killer whales were active in the bay about 1609m or so off the beach. They appeared to be hunting in groups of one to six. About 40 to 50 McCormick's skuas were also present in flight round the bay and in small groups on the beach. Numerous freshly-picked Adelie carcasses were seen on the beach but no estimates of mortality were attempted.

Cape Hallett

After spending the night at sea we headed for Cape Hallett, entering the Ross Sea on February 11. We motored to a position about 17 nautical miles north-east of the Possession Islands, and from there we got in touch with Scott Base to inform them of our presence in the area.

We entered Moubray Bay on February 12. When we were between Cape Adare and the Possession Islands ice blink was visible at times to the east, and we encountered pack ice in Moubray Bay. Some large table bergs were aground near Cape Hallett, the largest measured by radar being 6.4km long.

As we entered Edisto Inlet and drew close to the old station we were surprised to see people ashore. Before Riquita left Sydney Peter Gill had corresponded with a New Zealand scientist, Graham Wilson, of

Lincoln College, who had told him that he would be at Cape Hallett until February 5.

[Graham Wilson and Rowley Taylor were to have conducted a ground survey at Cape Hallett to record any changes to the penguin population which might have occurred since the 1982/83 aerial survey of rookeries in the area. For logistic reasons the survey had to be done from the air.]

Station visit

Because our visit was a week later we didn't expect to see anyone. Three of us went ashore in the afternoon and met the New Zealand work party there. [John Alexander (leader), of Whakatane, Norman Hill (Wellington), Richard Garlick (Christchurch), and Allan Weal (Waihi) had been engaged since late January in clearing waste materials and discarded equipment at the site of Hallett Station. They were waiting to be picked up by the United States Coast Guard icebreaker Polar Star when Riquita arrived.]

During our short visit the New Zealanders offered to send a message to our people in Sydney. This was most appreciated as we had lost radio contact with Australia some time previously and had even had difficulty in receiving Scott Base during a radio conversation on February 12. The New Zealanders also provided 40 litres of fresh water for Riquita as the vessel's supply in the ballast tanks had frozen.

Very few Adelie penguins were seen in the vicinity of the station. They were mainly young birds — 50 to 60 — apparently at an earlier stage of development (i.e. more down) than most birds seen ashore at Cape Adare. Some birds were observed sitting on floes near the cape. Snow petrels and Wilson's storm petrels were abundant in the area where there was a reasonable amount of pack ice.

In the afternoon the party left Cape Hallett and hove to in the late evening 11.2 nautical miles off Cape Downshire. We had no difficulty in negotiating moderate amounts of decaying pack ice during our approach to Cape Hallett across Moubray Bay on our way in. But on our way out the density of

the pack was increasing because of a west-flowing current past the cape. However, again we had no difficulty finding a way through it. We were fortunate with the weather during this day; it was calm, cloudless, and exceptionally warm (7 deg Celsius).

We spent February 13 lying ahull preparing Riquita for her voyage north and the next day we left the Ross Sea on our way to the Balleny Islands. We approached from the north-east to avoid possible pack ice. The islands were in radar range on February 18 and we sighted isolated bergs and bergy bits but did not encounter any pack.

Two days in fog

Hopes of attempting a close look at the islands and possibly making a landing were dashed by persistent fog. We stayed in the vicinity for two days but were unable to sight the islands although we approached to within 3.5nm of Young Island. A rising southerly gale forced us to depart on February 21.

Once we left the continent behind gales and fog became more common and we had a fairly stormy exit from the Antarctic Treaty area on February 24. On our way south the weather had been generally settled and calm while we were in the vicinity of the Borchgrevink Coast; in fact we rarely had enough wind to sail. Sunny periods were frequently interspersed with isolated drifting snow clouds. Temperatures averaged about zero C, the lowest being minus 2.5deg and the highest 7deg at Cape Hallett.

Riquita arrived at Macquarie Island on February 28 and at Hobart on March 3. Our cruise ended when we returned to Sydney on March 23.

Our scientific programme was restricted mainly to observations of vertebrate fauna. Peter Gill hoped to record sounds of humpback whales to extend a study he is working on with the Australian Museum as well as keep records of all cetacean and seal sightings throughout the voyage. Unfortunately, no sightings of large baleen whales were made nor were sounds heard.

Sightings of whales and dolphins were made from January 21 to March 4. The positions ranged from 48deg 02min S/

160deg E to 67deg 30min S/176 deg 40min E. One minke whale was seen among the pack and bergs at Cape Adare and seven were sighted east of Cape Adare, the Possession Islands, and Cape Downshire. Seven more were sighted when Riquita was approaching and leaving the Balleny Islands area — two when the vessel was in a southerly gale 78nm north of the group.

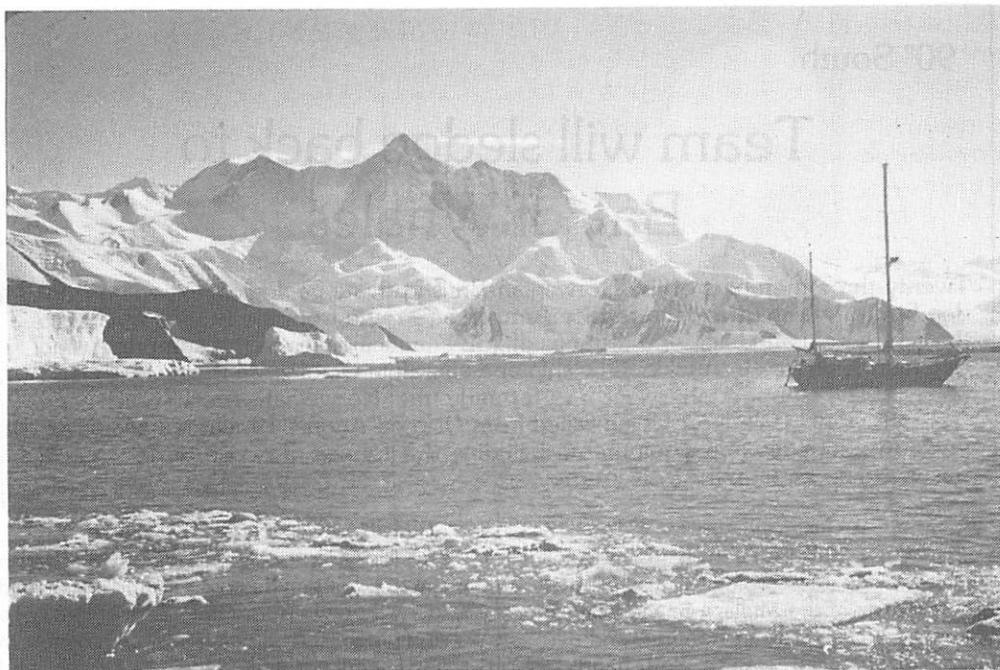
Dolphins sighted

More than 20 southern right whale dolphins were sighted in a calm sea at 48deg 02min S/160deg E. They were moving north and three passed directly under the boat. Four days later three hour-glass dolphins swam around the boat for 20 minutes when she was at 55deg S/165deg 10min E. Five or six repeated the performance on February 19 when the boat was in the fog 12nm east of Buckle Island, one of the Ballenys.

Soon after we crossed the Antarctic Circle two sperm whales were observed blowing quietly on the surface at 66deg 45min S/176deg 50min E. One killer whale was seen cruising among the ice at Cape Adare on February 9 and on the next day there were as many as 30 active in Robertson Bay. Three more appeared briefly in rough weather when we were at 51deg S/161deg E. A solitary orca which could have been a minke or small sei whale was sighted on February 18 slightly more than 17nm east of Buckle Island.

Only six seals were sighted during the voyage. The first was possibly a fur seal which swam briefly round the boat in darkness at 48deg 02min S/160deg E. A seal resting on a floe at Cape Adare might have been a Crabeater; it was not a Weddell or Leopard seal. Another Leopard seal was observed cruising outside the line of surf off Ridley Beach, and a second swam briefly round Riquita when she was in the fog 16.5nm east of Buckle Island, and then headed off towards the Ballenys.

Two Weddell seals were sighted in the Cape Hallett area. One was resting on a floe grounded just off the beach at Seabee Hook, the other was also resting on a floe 8.6nm north-east of Cape Hallett.



Riquita in Moubray Bay, Cape Hallett. Mt. Herschel is in the background. This picture was taken on February 12, the day Riquita reached 72deg 19min S.

Although the expedition's scientific programme was mainly restricted to observations of vertebrate fauna measurements of water temperatures were taken daily and weather records kept to be forwarded to the Bureau of Meteorology, Sydney. Ten-minute seabird cards were kept to be forwarded to Graham Wilson for the ISAS project (International Survey of Antarctic Seabirds) and also a log of seabirds sighted throughout the voyage.

Reports on the expedition's itinerary and activities in the Antarctic Treaty area have been sent to the New Zealand and Australian Antarctic Divisions. These include summaries of sightings of seabirds, cetaceans and seals within the treaty area, and estimates of numbers of Adelie penguins and other species of birds observed at Cape Adare and Cape Hallett.

Because of the size of our crew the notes on bird observations are not comprehensive. A continuous watch was not possible as only Peter Gill and eventually one other member of the party were able to identify birds with any confidence. The Riquita is

only a small vessel and the observer's height above water level was only 3m at sea level. This meant that birds were often obscured by waves (and sails) making identification and estimates of numbers difficult.

But in spite of these difficulties and rough weather plus poor visibility many species of seabirds were observed and recorded. Prions, Antarctic petrels, Wilson's storm petrels, snow petrels, McCormick's skuas, and sooty shearwaters were the most numerous beyond 60deg S to Cape Hallett but the sightings were not comprehensive. More than 200 prions were observed on February 16 when Riquita was at 68deg 30min S/169deg E and nearly 35nm east of Buckle Island. Two days later more than 150 sooty shearwaters were logged.

90° South

Team will sledge back to Bay of Whales

Twenty-three members of the Norwegian-British private geological expedition, 90 deg South, which intends to retrace Amundsen's route from the Bay of Whales to the South Pole and back — a distance of 1324 nautical miles — this summer, using dog teams, arrived in Auckland by ship and aircraft in October on their way to Antarctica. The support ship *Aurora*, formerly the Norwegian Arctic sealer and research vessel *Polaris V*, which sailed from Oslo on August 19, carried all the expedition's supplies and equipment, including 3.5 tonnes of dog food for the 22 huskies to be used on the Pole journey.

Dr Monica Kristensen, leader of the US \$2,517,500,000 expedition, who works for the Norwegian Meteorological Institute, Dr Neil McIntyre of the Mullard Space Science Laboratory, University of London, and two highly experienced Danish dog handlers and sledgers, Jacob Meisner Larsen and Jan Almqvist, arrived by air on October 17 to join the other 19 members of the expedition, including the crew of nine, aboard the *Aurora*. Their aircraft, chartered from British Airways, carried 22 huskies and the Pole team's personal gear, and scientific equipment. The dogs were transferred to the ship which left from Auckland on Wednesday October 22, making a brief call at Lyttelton on October 27 to take on fuel before going to Invercargill from where it sailed south.

In October last year 90 deg South, which had been planned since 1980, was postponed until this season because the organisers could not arrange air transport from Christchurch to McMurdo Station and then to the Bay of Whales or provide for the laying by air of five supply depots on the route to the pole. Arrangements were made, however, with British Airways to fly the Pole team and the huskies as far as Auckland.

After the expedition was postponed for 12 months two of the original members, Dr Bjorn Wold, head of the glaciology section

of the Norwegian Water Resources Board, and Nick Cox, who served with the British Antarctic Survey team 1978 and 1981, had to withdraw from the Pole team. To strengthen the expedition's experience in dog handling and sledging, Larsen and Jesper Andersen were engaged.

Larsen and Andersen, with service in the Danish Navy and Army respectively, gained their sledging experience when selected for duty with the famous Sirius Patrol in Greenland. Patrol members, who operate in pairs, sledge 10,000km during their two-year term of duty in the north and north-east of Greenland. Larsen served a third year and did 15,000km of sledging.

Members of the patrol build all their own equipment, train their own dog teams, and spend eight months in the field. They travel extensively over a variety of Arctic terrain, often in winter darkness, and for long periods in temperatures of minus 30 to minus 50 deg Celsius.

When Nick Cox left the expedition, the Danes took over the care and training of the huskies at Vangen, where a farmhouse serves as the expedition's base for storage of equipment and supplies. In May, Jean Almqvist, who lives in Sweden, replaced Andersen who had decided to leave the expedition for personal reasons.

Twenty-seven year old Almqvist joined



the Sirius patrol from the Danish Navy in 1982 and spent the next 24 months sledging in northern and eastern Greenland. Since then he has trained as a diver and gained experience in many parts of the world.

Earlier this year the organisers made two important changes in their plans. They bought the *Polaris V* to solve the transport problem and decided to rely on their huskies instead of aircraft to bring them back from the Pole. Arrangements were made also for a chartered *Twin Otter* to meet *Aurora* at the bay of Whales and lay the required supply depots. The *Twin Otter* chartered from Greenland Air was freighted from Sweden on board a Danish ship and was flown first from Auckland to Christchurch where it arrived on October 24. Later they flew to Invercargill from where it will leave on its flight south.

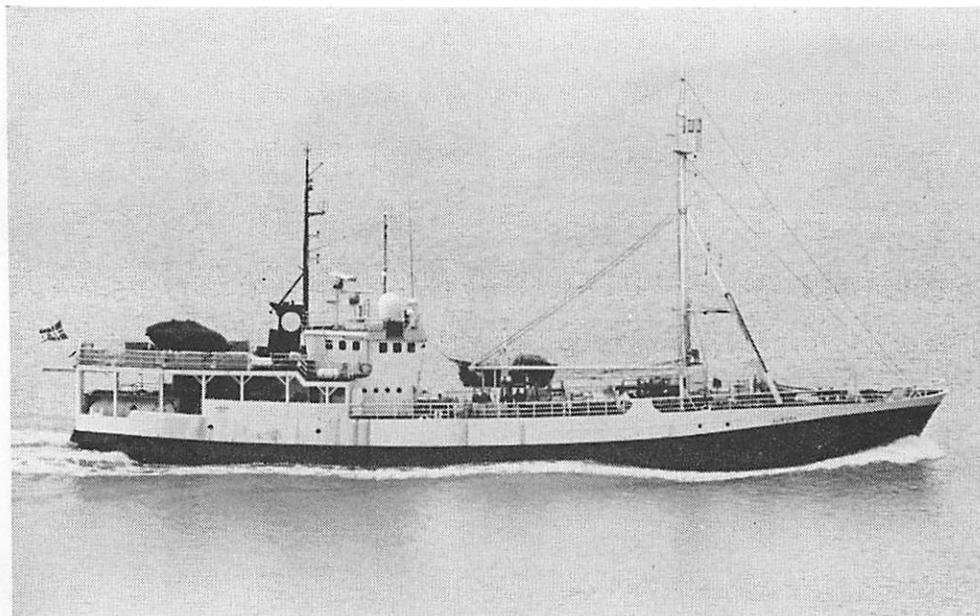
Built in 1951 for the polar ship charter firm G. C. Rieber and Co., of Bergen, the 585 tonne *Polaris V* was an ice-strengthened vessel 53m long and 8m wide, with a draught of 4.5m. Originally she was used for Arctic sealing. In 1977 she was completely rebuilt for research in polar regions. She is

In Amundsen's footsteps: A Greenland husky aboard the Aurora reflects on the journey to come with the team of the 90 Degrees South Expedition which plans to retrace Amundsen's route to the South Pole this summer. From left are the expedition's leader, Dr Monica Kristensen, a Norwegian glaciologist, Jacob Larsen, a Danish dog driver, Dr Neil McIntyre, an English glaciologist, and the second Danish dog driver, Jan Almqvist.

now graded as a Class 1A ice-strengthened vessel by Veritas of Norway and has a helicopter deck.

Before being bought by 90 deg South and renamed *Aurora*, the *Polaris V* was operated under the Canadian flag by the Carino Company Ltd., an affiliate of G. C. Rieber, and registered in St. John's, Newfoundland. When she arrived in Oslo on May 12 she was registered there and transferred to the Norwegian flag.

In preparation for her voyage south the newly named *Aurora* was refurbished and some of her equipment upgraded. Improvements were made also to the



helicopter deck and the satellite communications system.

During the latter part of July and early August preparations for the Aurora's departure were considerably intensified. The expedition's supply depot containers were packed with food, spare equipment and clothing for the Pole journey, and stored in the forward holds with the 3.5 tonnes of dog food specially prepared for 90 deg South. Supplies for the ship's eight month voyage were also loaded and modifications to her infrastructure continued up to the last minute.

Finally at 9.15pm on August 19 the Aurora headed down Oslo Fjord in gathering darkness and torrential rain. Calls were made at Copenhagen to pick up more supplies and fuel, and at Dover for additional equipment. Then the ship headed for Panama, Tahiti and New Zealand.

When the expedition reaches the Bay of Whales (78deg 38min S/164deg 20min W) the chartered Twin Otter is expected to be there to meet the Aurora. The first priority after a summer camp has been set up will be to unload everything needed for the five

Following the Fram: With the Norwegian flag flying at her stern the 585-tonne former Arctic sealer Aurora sails from Lyttelton on her way to the Bay of Whales with the 90 Degrees South Expedition which will retrace the route Amundsen took to the South Pole 75 years ago.

supply depots which the Twin Otter will have to lay for the journey of 1324nm to the Pole and back.

Originally the programme provided for two supply depots on the Ross Ice Shelf between 80 deg S, one at the foot of the Axel Heiberg Glacier, another at the head of the glacier, and the last at Titan Dome, an ice dome on the Polar Plateau at 88deg S/165 deg E. To date 90 deg South has not given any details of the Twin Otter's route, arrangements for refuelling on the flight from Punata Arenas by way of the Antarctic Peninsula and Ellsworth Land or the flight crew.

As the expedition will now use the aircraft for all the depot-laying, the Pole team will be able to move faster. Dr McIntyre has said that the first stage should take 82 days and

Dr Kristensen expects the party to be picked up by the Aurora in late February or early March. If the team is able to start late in October the return journey with lighter loads and a known route could be like Amundsen's and take between 40 and 45 days.

There will be a period this summer when the Aurora will not be used directly by 90 deg South. She is being run commercially and therefore will be available for charter.

Last summer before plans were changed,

arrangements were made for 3.45 tonnes of spare clothing and a small quantity of fuel for the supply depots to be sent south for winter storage on Ross Island in preparation for this summer's programme. The cargo was air freighted to Hobart and loaded on the Footsteps of Scott Expedition support ship Southern Quest. It was still on board the ship when she was caught in the pack ice north-east of Beaufort Island and sank on January 13.

Second Austrian attempt to climb Mount Minto

A first ascent of Mt Minto (4165m) in the Admiralty Mountains, Victoria Land, is planned by an Austrian mountaineering and scientific expedition which is expected to leave Lyttelton in late December or early in January. Arrangements have been made for a party of five led by Dr Bruno Klausbruckner to be taken south by the 90 Degrees South Expedition's support ship Aurora on her second voyage from New Zealand and to return in the New Year.

This will be the second attempt to climb Mt Minto by an expedition under the auspices of the Austrian Himalayan Society (OHG). Last summer Dr Klausbruckner and his deputy, Leopold Krenn, headed an OHG party of five Austrians and a Dutch radio operator which was taken south by the Footsteps of Scott Expedition's support ship Southern Quest but could not be landed at Cape Hallett because of ice conditions. When the Southern Quest sank the mountaineers lost all their supplies and equipment. They were flown back to Christchurch with 23 members of the British expedition on January 15.

Mount Minto (71deg 47min S/168deg 45min E) is a lofty, mostly ice-free peak in the central portion of the Admiralty Mountains about 80km from Cape Hallett. A New Zealand Alpine Club scientific and mountaineering expedition intended to climb the peak in the 1969-70 season but the project was abandoned because it was not approved as part of the New Zealand research programme.

Dr Klausbruckner's team arrived in Christchurch on November 22 expecting to join the Aurora in the first week of December. Because the ship was delayed by heavy ice on her way to the Bay of Whales the Austrians will not have even half the time they hoped to spend in the Admiralty Mountains. Originally they expected to leave Cape Hallett on March 5. Now they intend to stay in Antarctica as long as possible, depending on the Aurora and the state of the ice.

If the ice prevents the team from landing at Cape Hallett it will be flown there by the Aurora's chartered helicopter. From Cape Hallett the five men will haul their sledges across Football Saddle, follow the Tucker Glacier to Man-o'-War Glacier and then continue towards Mt Minto.

Two members of the expedition will do scientific work covering microbiology and lichenology. Dr Fritz Seewald, a 45-year-old biologist, has worked in the Sahara, on Spitzbergen, and in Greenland, and has done difficult ascents in the European Alps. Wolfgang Petz (25), is a lichenologist and biologist, and is completing a Ph.D. degree, specialising in the biology of soil.

Dr Klausbruckner, who is 41, has been on nine mountaineering expeditions, five as leader. He made the third ascent of Lhotse (8511m) in the Himalayas, the first ascent of Mt Ghent (7342m) and first ascents of peaks above 5000m and 6000m. A member of the Austrian Mountain Rescue Association, he has made most of the difficult climbs in the

European Alps.

In the 1982-83 season Dr Klausbruckner and Leopold Krenn took part in an Australian expedition of scientists, mountaineers, and ham radio operators to sub-Antarctic Heard Island aboard the converted whale-chaser Cheyenne II. With an Australian climber they made an unsuccessful attempt to reach the summit of the island's active volcano Big Ben (2743m).

Leopold Krenn, who is 32, is responsible for navigation and telecommunications in the present expedition. He was a member of the OHG expedition to Greenland in 1982,

and has made most of the difficult climbs in the European Alps. A 54-year-old carpenter, Friede Pummer, is the fifth member of the team. He is concerned with Austrian wildlife preservation.

Dr Klausbruckner and his companions decided on January 2 to abandon their expedition because the Aurora, which was to have put them ashore at Cape Hallett, would arrive in the area too late in the season, and ice conditions would be unsuitable. The five men left New Zealand on January 7 by air for Austria.

Cape Evans men may return on Aurora

Two offers of free transport from Ross Island to Christchurch made to three members of the Footsteps of Scott Expedition who have been at Cape Evans since January 15 have been rejected by the expedition's leaders in London. The first offer was made some months ago; the second was made to the three men on October 5 by Dr Peter Wilkniss, director of the United States National Science Foundation's Division of Polar Programmes, after he had made a journey to their base in a Scott Base vehicle.

This offer, which provides for the three men, Gareth Wood, Steve Broni, and Tim Lovejoy to be picked up by helicopter and flown out any time before February 20, was made jointly with the New Zealand Antarctic authorities and announced at a press conference in Christchurch on October 9. Dr Wilkniss made the offer, which still stands, because he was concerned on humanitarian grounds that the men should not spend another winter in Antarctica although he found they were fit and in amazingly good spirits considering the time they had been on the ice.

Gareth Wood, leader of the party at Cape Evans, has been in Antarctica since February 22 last year. He wintered at the expedition's Jack Hahward Base with four other members of the expedition. On October 26 he left the base with Robert Swan and Roger Mear, leaders of the expedition to follow Scott's 1911-12 route to the South Pole

which they reached late on the evening of January 11, only 70 days after departing from Williams Field on the Ross Ice Shelf on November 3.

After the sinking of the expedition's support ship Southern Quest and the rescue of all those aboard, Swan, Mear, and Wood returned to McMurdo Station on January 13 in a U.S. National Science Foundation Hercules aircraft. Wood, and two members of the support team from the ship, Broni and Lovejoy, volunteered to remain at Cape Evans when the rest of the expedition was flown back to Christchurch on January 15.

Swan said on his return that a ship would be sent this summer to bring out the men, the Cessna 185 aircraft brought to pick up the Pole party, and all stores and equipment, including the hut. Later this year he was reported to have said that a ship would sail from Cape Town on December 17 and would reach Ross Island about February 7. This would be less than two weeks before the departure of all aircraft and ships engaged in this season's U.S. research programme. February 20 is the date set for the last flight back to New Zealand.

No information about the expedition's plans was received by the New Zealand and United States authorities from the leaders. But early this October the New Zealand Antarctic Division received advice from South Africa that the expedition would be sending a vessel to Antarctica from Cape Town on November 30.



This information came from the South African Antarctic authorities. Parties to the Antarctic Treaty are required to advise other members of any commercial or private expeditions departing from their countries for Antarctica.

According to the South African information the completion of the Footsteps of Scott Expedition would be undertaken by a vessel called Leadership South which would leave Cape Town on November 30. It was expected to return there by the end of May, 1987.

When Gareth Wood had discussed the offer of free transport with the expedition's leaders by radio-telephone from Scott Base, Swan and the expedition co-ordinator, Richard Down, explained to a press conference in London on October 15 their reasons for refusing the offer. Swan said it was appreciated but as such an offer had been open for months the expedition leaders saw no need to accept it.

Down said the expedition was not prepared to take up the offer because it extended only to the three men and their

The Jack Hayward Base at Cape Evans was the "Antarctic" home of members of the Footsteps of Scott team for two winters.

hand luggage. It was always the expedition's intention to remove the aircraft, hut, and all equipment from Cape Evans.

Once again Down made it clear that the expedition still planned to pick up the men and remove the equipment in February. He said it had two options open, one being its own ship sailing from Britain, and the second being an arrangement with the Norwegian expedition (90 Degrees South) to the Antarctic this summer. There was also an emergency plan in conjunction with the Norwegian expedition to fly the men out if necessary.

Statements made at the London press conference prompted Mr R. B. Thomson, director of the Antarctic Division, to express the hope that the expedition would plan its removal of the three men "very safely". He said also that the New Zealand and United States Antarctic authorities would clean up the Cape Evans area if the men took up the offer.

When the Pole team of 90 Degrees South arrived by air in Auckland on October 17 to join the other members of the expedition aboard the support ship Aurora, Dr Neil McIntyre, the British representative, said a check would be made next week with the Footsteps of Scott Expedition about the ship picking up the party at Cape Evans. If the project went ahead the Aurora would pick up Wood, Broni and Lovejoy after her first voyage to the Bay of Whales.

Early in September Dr Monica Kristensen, leader of 90 Degrees South, confirmed reports that the Aurora had been offered for the Cape Evans operations.

During the winter the team at Cape Evans has continued scientific and equipment experiments begun by the expedition in the 1985 winter. Steve Broni is a Scottish marine ornithologist who gained his B.Sc. in Glasgow and then studied penguins for his M.Sc. at the University of Capetown. Tim Lovejoy is an English geographer who was a school teacher in London after gaining his degree. They were members of the support party aboard the expedition's ship Southern Quest.

One task completed before the winter began in earnest was to remove the Cessna 185 left parked on the sea ice to a safe position on the beach. There it was tied down securely and covered for protection against high winds and blowing snow.

Before the three men settled in Wood, who made a journey to Cape Crozier last year with Mear and the expedition medical officer, Dr Michael Stroud, took his companions over the same route by way of Cape Royds late in April. Early on the journey Wood was bitten on the leg by a leopard seal. His leg was lacerated but he was able to complete the journey. When the party returned to base early in May a precautionary check about lacerations was made with the medical officer at McMurdo Station.

More cheerful news about the expedition has come from London. Every private expedition has returned from Antarctica with

Aurora is available for charter during part of the summer as she is not due to return to the Bay of Whales until late February. Dr Kristensen has said that her expedition is running the ship commercially and therefore the Footsteps of Scott Expedition will be charged slightly more than US\$64,000.

If all goes well the British expedition will be completed in late December/early January. The Aurora would then sail for Hobart to land the Cape Evans team, and unload the hut, Cessna 185, and the stores and equipment.

Swan has confirmed that the account of \$US21,000 from the NSF for the transport of the 20 members of the expedition and the Austrian mountaineers from McMurdo Station to Christchurch has been paid in full. The expedition's depleted finances received a boost four days after the sinking of the Southern Quest; the London Institute of Underwriters paid £93,000 in insurance for what was described as "an Act of God".

Swan and other members of the expedition are expected in New Zealand some time in February to make a lecture tour and screen a film of the expedition. The lecturers and film screenings will help to raise funds and publicise the book about the expedition, now being finished by Mear, which will be published in London in the New Year.

Footnote:

One of the leaders of the Footsteps of Scott expedition, Robert Swan, flew from Chile to Ross Island in a chartered Twin Otter piloted by Captain Giles Kershaw to collect Gareth Wood, Steve Broni and Tim Lovejoy on December 15. The men left behind the dismantled base hut and radio equipment, stores and the Cessna 185 all ready to be shipped out by the Aurora on her final voyage to New Zealand. Antarctic will carry the full story in the 1986/87 summer issue.

Paddington Bear journeys to South Pole

When Robert Swan and Roger Mear, co-leaders of the Footsteps of Scott Expedition, returned to New Zealand after ski-ing to the South Pole in 70 days with Gareth Wood they said rather less than expected about their notable achievement. They had good reasons; the expedition's support ship Southern Quest had been caught in pack ice and sunk, and there were pressing problems arising from its loss.

Not much about the hazards of the journey which followed Scott's 1911-12 route to the Pole emerged when Swan, Mear, and other members of the expedition faced a news conference in Christchurch. Most of the questions from the media were about the sinking of the Southern Quest, the rescue of those aboard her, the reason why the Pole team was not flown back by the Cessna 185, and the United States National Science Foundation's charge to fly the expedition from McMurdo Station to Christchurch.

Full story

As the full story of the expedition, now being written by Mear, will not be known until early next year, the two men could not be criticised for not saying more about what happened on the way to the Pole. They were restricted by contracts with their London publisher and other organisations, and the time available to answer all the questions posed by the media.

Because Swan, Mear, and Wood had no advance depots, air support or radio communication there was virtually no news of their progress to the Pole but any amount of speculation as the days passed. Radio communication difficulties at the expedition's Cape Evans base also delayed news before the start of the journey, and changes in plans because of bad weather and other factors did not become widely known.

Anniversary

Everyone expected the Pole party to begin its journey on November 1, the 74th

anniversary of Scott's departure from Cape Evans. But the five men who had wintered at Jack Hayward Base left Cape Evans on October 26. The Pole party actually left on the main journey at noon (local time) on November 3 from Williams Field, the US air-field complex on the McMurdo Sound sea ice about 26 nautical miles from Cape Evans.

Daily distances

When the three men reached the Pole on the evening of January 11 they were credited in many quarters with having covered the distance from Cape Evans in 70 days. But details of average daily distances given at the New Zealand news conference indicated that the party skied about 767nm from Williams Field to the Pole between November 3 and January 11, and the Cape Evans-Pole total was about 793nm. Skis were not used on the ascent of the Beardmore Glacier.

Using cross-country skis and hauling 165kg of food and equipment on each of three sledges the three men crossed the Ross Ice Shelf in 38 days averaging 9nm a day. The ascent of the Beardmore took seven days and the average daily distance was 14.76nm. From the bottom of the Beardmore to the Pole, the last 434nm, the party averaged 13.80nm daily. On the Polar Plateau the temperature was minus 30deg Celsius, and rose to minus 20deg in the evenings.

Routine

Each day the men set themselves a routine of nine hours ski-ing in three stages with 30-minute rests in between. Their days began usually at 6 a.m., but at times they took up to three hours to dress, melt snow for their breakfast of biscuits, oatmeal block, butter, and hot chocolate, fill four vacuum flasks with the day's soup supply, break camp, and repack their sledges. One morning they did everything in a record 70 minutes.

Bad weather held up the trio for four days. They spent them in their tents, snug in their sleeping bags, and drinking a lot of hot chocolate. On the whole journey they had one other stop — nearly three days at an American scientific field camp.

First news

This stop produced the first news of the team's progress since November 3. It came from a geological field party working near the mouth of the Beardmore. The party, led by Dr Scott Berg, of the Department of Earth and Space Sciences, University of California, Los Angeles, was camped at 83deg 31min 30sec S/170deg 58min 58sec E near the middle of The Gateway, a small low pass between Cape Allen and Mt Hope.

Other members of the field party were Dr Donald DePaolo and John Goodge, also from UCLA, and James Mattinson, of the Department of Geology, UC, Santa Barbara. With them was a Soviet exchange scientist, Dr Eugene Mikhalsky. The party had been in the field since late October.

A brief report which said that the Pole party had been sighted and was halfway to its goal, quickly reached "penguin radio", and there were all kinds of exaggerated reports about the encounter near The Gateway, one suggesting that the three had eaten all of the field party's rations down to its last 250g of butter. But when they arrived they had food for 50 days, and reached the Pole with 18 days' food to spare.

What actually occurred is told here but not from "penguin radio" reports. And the anecdote of a near disaster at the camp is also true.

Dinner party

First of the Americans to sight Swan, Mear, and Wood, was James Mattinson, who was out on a short walk from the camp. The geologists had decided earlier that should they see the expedition, Swan, Mear, and Wood should be invited to tea and possibly dinner. But the Americans planned to explain their complete understanding if the three refused because of their desire to go on unaided.

An invitation for coffee and dinner was accepted, and in the late afternoon of December 10 (about 4 p.m. local time) the Pole party arrived at the American camp and pitched its tents. All were in good spirits, and aside from sunburned faces, chapped lips, and some blisters on their feet, were apparently in good health and condition.

Eight men crowded into the Footsteps of Scott Expedition cook tent for dinner. With representatives of four nations together (Britain, United States, Canada, Soviet Union) the occasion was, in the words of one American scientist, "quite a feast."

Swan, Mear, and Wood, expressed and interest in staying the next day but as they had not planned for such a contingency they asked if they could eat from the party's stores during their stay at the camp. This request was approved as well as all subsequent requests for the use of camp resources.

During their respite at the American camp the three men took time for filming around The Gateway, washing clothes, and making repairs to their sledges. They used the camp's facilities, including tools and minor expendible supplies in making these repairs.

Paddington Bear

After a stay just short of three days Swan, Mear, and Wood departed from The Gateway camp at 12.30 p.m. (local time) on December 13 to start the journey up the Beardmore Glacier. They left with the Americans rubbish to be brought back with the camp refuse. Later some of their film and sound recordings as well as a broken camera were carried back to McMurdo Station by Donald DePaolo and James Mattinson. John Goodge and Donald Borg took film footage and still photographs of the three men with their equipment before and during their departure from the camp.

And what about the near disaster? It goes like this. Before Swan left New Zealand he was given a small Paddington Bear as a good luck charm for the journey. His bear vanished somehow while the Pole party were at The Gateway camp, and naturally

Swan was upset. Fortunately, the adventurous Paddington had not vanished for good. A search disclosed that he had only

fallen into the camp head. None the worse for his adventure Paddington was able to resume his journey to the Pole.

Record North Pole journeys

Five men and one woman reached the North Pole at 6.50pm GMT on May 2 in 56 days using dog teams but no air support or special navigation equipment. A 30-year-old American, Ann Bancroft, became the first woman to reach the Pole by surface transport.

With 49 huskies, five sledges and 3.125 tonnes of food and equipment the United States/Canadian expedition, which included one New Zealander, left Ward Hunt Island (83deg 10min N/74deg 30min W) the northernmost point of the Canadian Arctic, on March 8. Although the direct route was about 434 nautical miles the eight members of the expedition had to cover more than 650 nm over rough pack ice and past large pressure ridges in temperatures ranging from minus 56 to 71 degrees Celsius, the coldest for 20 years.

Injured

Only six members of the expedition and 21 huskies reached the Pole. The New Zealand mountaineer and electronics technician, Bob McKerrow, now director of the New Zealand Outward Bound School, who wintered at Vanda Station in 1970, had to be flown out late in March after a sledge rolled on him and broke two of his ribs.

All the expedition suffered severe frostbite. McKerrow was flown out on April 2 and an Alaskan member of the team, Robert Mantell, followed him some time later with badly frostbitten feet. Both men were picked up by an aircraft which made two flights to bring back 28 huskies which had become exhausted by the rigours of the journey. The only other air support was by a Hawker-Siddeley 748 which flew the expedition from Frobisher Bay to Eureka, a Canadian weather and research station on Ellesmere Island at 79deg 51min N/85deg 57min W.

Despite his broken ribs and frostbitten

fingers and toes, Bob McKerrow kept going with the expedition for 10 more days after his accident before he was flown to Resolute Bay, another Canadian research station on Cornwallis Island. Before he left he gave Ann Bancroft a New Zealand flag, the Outward Bound flag, and his Bible to be taken to the Pole. The only casualty of the expedition was his husky Critter which apparently died of a broken heart. A post mortem examination revealed nothing wrong with the dog.

Broken ice

Although the expedition was averaging 21.5 nm a day when still 107 nm from the Pole, it made slow progress during the last stage of the journey. Usually the sea ice around the pole is smooth. This year the ice had broken, leaving open water which froze again and created a metre-high pressure ridge.

Late on April 29 the expedition was spotted from a Canadian Air Force aircraft when within 27 nm of the Pole. On April 30 and May 1 cloudy weather prevented members of the expedition from obtaining accurate sun sights to determine their position with the sextant and chronometer used for navigation.

A radio beacon carried for emergencies and satellite communication was used with the SARSAT satellite to confirm the accuracy of the expedition's traditional methods. An official announcement of the expedition's success was made when it was sure it had reached 90deg N.

As soon as the news was received four aircraft, newspaper, radio and TV teams arrived from Resolute Bay. The team, Will Steger and Paul Schurke (co-leaders), Ann Bancroft and Geoff Carroll (U.S.A.) and Brent Boddy and Richard Weber (Canada) were met, interviewed, photographed and

then flown out with the 21 huskies to Winnipeg and then Minneapolis, the expedition's base.

Lone Walker

Eight days after the Americans and Canadians reached the Pole a 39-year-old Paris doctor, Jean-Louis Etienne, arrived there alone on foot, having skied and pulled a small sledge across the ice for 66 days.

Dr Etienne left Ward Hunt Island on March 6 and reached the Pole at 2am GMT on May 10. He received supplies by air drop every 10 days on the journey and was in daily radio communication with his base at Resolute Bay. He calculated his position from flares he lit, and it was confirmed by satellite.

Although the Japanese adventurer and explorer, Naomi Uemura, reached the Pole alone with dog teams in 1978 he was resupplied by air and replacement huskies were flown in during his journey. Dr Etienne was

supplied by air and used radio; he is still the first man to reach the Pole alone on foot. An aircraft brought him back to Resolute Bay.

More than a month before Dr Etienne's trek two Englishmen travelled on foot towards the Pole without the aid of modern equipment, aircraft re-supply or huskies. Sir Ranulph Fiennes, who crossed Antarctica by way of the South Pole in 1980-81 and reached the North Pole in 1982, and Dr Michael Stroud, medical officer with the Footsteps of Scott Expedition at Cape Evans last season, travelled 102 nm in two weeks from Ward Hunt Island to set a new record for unaided travel on foot towards the Pole.

Hauling sledges weighing 160 kg each Fiennes and Stroud set out on April 2 to break the two-week record which had stood at just under 86 nm since 1968. They travelled in temperatures below minus 40deg C and had to cope with open water when the sea ice cracked, and melting ice sludge with the consistency of porridge.

Antarctic climbers scale Soviet peak

Two New Zealanders, both with Antarctic field experience, who joined climbers from 20 other countries in an international expedition to the mountains of the Soviet Pamirs in Central Asia reached the summit of Pik Kommunisma (7483m), the highest peak in the USSR on August 1. Gary Ball (32), of Twizel, and Colin Monteath (37), of Christchurch, became the first New Zealanders to conquer a Soviet mountain.

High altitude sickness forced Bill King (32), of Christchurch, leader of the expedition, to abandon the climb when the party had reached 7010m. The three men were caught in a snowstorm on July 26 and spent the night in the open. They had to drop down to 6096m the next morning because King's fingertips were frostbitten and both he and Ball were suffering from high altitude sickness.

After camping in an igloo which they had built on their way up the mountain Ball recovered and he and Monteath resumed their ascent. By July 29 King had also recovered and was able to make his way down to a field camp at a lower level. From

there he was flown by helicopter to the main base camp.

Between July 28 and 30 Ball and Monteath had to interrupt their climb twice. First they assisted in the recovery of the body of an American, S. Monfredo, who developed serious high altitude sickness at 7000m, managed to make his own way down to 6000m and then died. Stretcher parties carried his body down to the low-level camp.

Another American climber, Maggie Urdall, broke her leg when she slipped on a rock. She was carried by stretcher parties, including the two New Zealanders, to the lower camp, brought to the main camp by helicopter and then flown to hospital.

By July 30 Ball and Monteath were able to resume their climb. They reached the summit of Pik Kommunisma at 11a.m. and remained there two hours. There were no checks on the descent which took 24 hours, and the two men reached their plateau base on August 2.

New Zealand's first expedition to the Pamirs really began on July 12 when King,

Ball, and Monteath reached the international expedition's main base at 400m by Soviet helicopter. The three, whose joint climbing experience included India, Nepal, Tibet, and Antarctica, made their first Soviet climb on Peak of Four (6400m) to acclimatise themselves.

They started on July 17 and had reached 6000m when they were called on to help a

Soviet party bring down one of its members who had collapsed from severe high altitude sickness. Like the American woman climber the man had to be carried back by stretcher to the low-level camp and taken by helicopter to the main camp. As a result the New Zealanders did not begin their ascent of Pik Kommunisma until July 19.

Polar history

The Voyage of the Scotia 1902 — 04

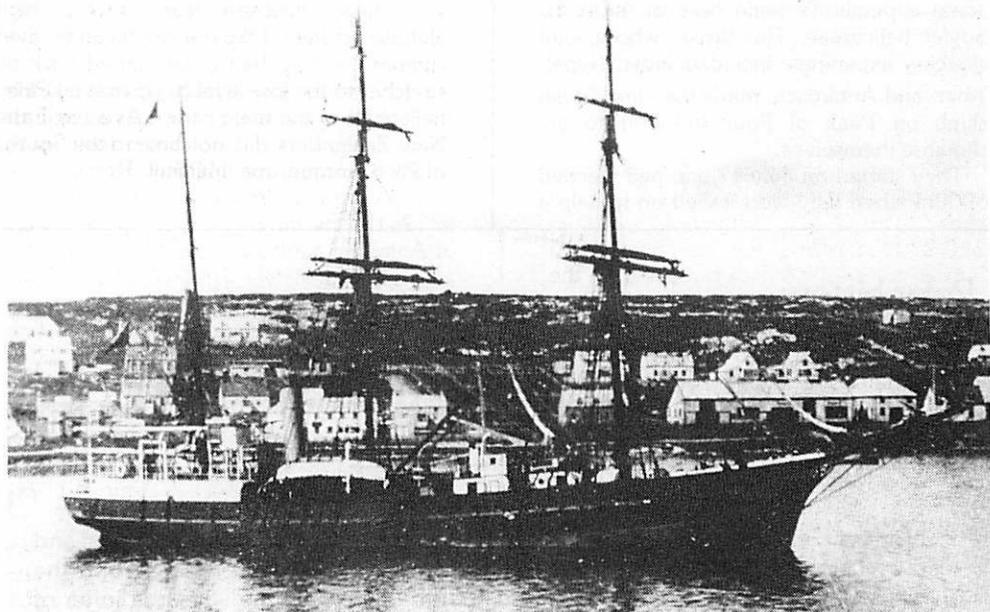
Just over eighty-two years ago, on 12 November 1904, William Bruce and fellow scientists of the "Scotia" and Robert Scott with his team from the "Discovery" were guests of honour in Edinburgh at the 20th anniversary dinner of the Royal Scottish Geographical Society. Both Bruce and Scott responded to the toast "Antarctic Expeditions" proposed by President Geikie. The menu included consomme a la "Discovery" and poillettes a la "Scotia". The "Discovery" had returned to England on 9 September 1904.¹ The "Scotia", with the Scottish National Antarctic Expedition, had sailed up the Clyde on 21 July 1904 to a rousing reception. The Expedition had left 20 months earlier on a voyage of over 30,000 km. They had penetrated twice into the Weddell Sea to discover a 270 km stretch of Antarctic coastline (named Coats Land for their major supporters) and had overwintered on Laurie Island, the easternmost of the South Orkneys group,² in the sub-Antarctic.

Professor Ralph Bernstein of Johannesburg, South Africa, writes of the little known 1902-4 Scottish National Antarctic expedition which not only discovered part of the continent but also collected valuable scientific data and established a base still used today.

The "Scotia" put into Port Stanley, East Falklands, on January 6, 1903. The team had already commenced their scientific observations (leader Bruce with Wilton and Brown on marine and terrestrial fauna and flora; Mossman, meteorology; and Dr Pirie, their medical officer, on geology and benthology).

The "Scotia" sailed from the Falklands for South Orkneys on January 26,³ but then encountered heavy pack ice and turned east to South Thule (South Sandwichs) to skirt this. Sea floor soundings revealed a rise in the ocean bed (later named the Scotia Ridge). Proceeding south, the "Scotia" sailed and steamed along the pack ice until February 22, when the ship became beset in 70deg 25min S/17deg 12min W in deep water (2543 fathoms), and far short of Weddell's furthest south 80 years earlier.

Bruce retreated to the South Orkneys. Known harbours on its several islands were inspected but considered unsuitable, and on



March 25, 1903, a landing was made on an unknown bay (named Scotia Bay) on the south shore of Laurie Island. The "Scotia" remained ice-in from March 30 to November 23; it was to prove a particularly severe and bitter winter.

Winter and spring on Laurie Island

The expedition and crew members built, on the beach, a hut fifteen feet square (Omond House), and this was "home" for 8 months for some and 11 months for most. In latitude 61deg S, the climate was polar, with -40 degrees C temperatures, virtually no sun whatsoever and continuous severe winds. Penguin meat, and fish caught through holes in the Scotia Bay ice, provided fresh food — and scurvy, in contrast to the "Discovery" expedition,⁴ was never a problem. Apart from snowblindness, few medical conditions occurred.⁴ As spring approached, the collecting of marine fauna and flora was extended from Scotia Bay to the offshore islets and the Laurie Island shoreline. Sledge and boat journeys were

The Scotia lies anchored in the harbour at Port Stanley in the Falkland Islands. Photo: Museum of Johannesburg.

undertaken to chart the island and collect nature specimens. A map of the island was published,⁵ and a survey by the BAS 30 years later indicated that it was substantially correct.

Seals, penguins and flying birds were a striking feature on Laurie and adjacent islands. Some of the penguin rookeries were immense, with estimates up to several million. Skins, eggs and embryos were assembled and later presented to various Scottish Museums and the South African Museum, Cape Town. Forty-eight species of Antarctic fish, ten new to science at the time, were collected. The meticulous meteorological observations introduced by Mossman at Cape Pembroke, Port Stanley and at the Copeland Observatory, Laurie Island were of inestimable value to shipping in those treacherous waters.

Late in November 1903, the "Scotia" left for Montevideo to fetch stores and coal, and returned on 14 February 1904 with 3

Argentinian scientists, who were to take over the base. As the Orcadas Meteorological Station, it has been in continuous operation ever since, even during the 75-day Falklands War.

Second voyage

The "Scotia" left on February 22, 1904, heading south into the Weddell Sea. The depth soundings continued between 2300-2700 fathoms for the next 1200 nautical miles in more open seas than the previous year. On March 3, with a deep sea reading of 1131 fathoms, a 25-40 meter ice barrier was sighted, and followed for the next 10 days southwest for 150 nautical miles to a furthest south of 74deg S/22deg W and a deep sea sounding of 161 fathoms. Bruce named this coast, forming the eastern landarm of the Weddell Sea, Coats Land, after the major supporters of the Expedition. All the members commented on the very prolific seal and bird life in this area.

Breaking free of the ice, the "Scotia" turned north, and found that the Ross Deep — "4000 fathoms no bottom"⁶ did not exist in the position claimed (soundings of 2620, 2487, 2660 and 2715 fathoms made). Gough Island (40deg 19min S/9deg 57min W) was reached April 21, 1904, and the "Scotia" naturalists were able to compare its physical and biological features with those of Laurie and East Falkland Islands. The "Scotia" returned to Scotland via Cape Town (May 5-21), St. Helena (June 2) and Ascension Island (June 10).

Scientific achievements

The objectives of the SNAE in the Weddell Sea were scientific; the extensive works were reported in appropriate journals. Finally, a comprehensive publication of their findings appeared in 10 volumes,⁷ profusely illustrated with drawings and photographs. This was, at the time, the most complete compilation of Antarctic fauna, geology, bathymetry of the Weddell Sea and highly detailed weather observations. Over 30 years were to elapse before any further detailed scientific studies of this Antarctic zone were forthcoming. As a voyage of scientific investigation into the physical features and

biology of the Antarctic, the Scottish National Antarctic Expedition ranks in the forefront of the heroic era of Antarctic Exploration.⁸

On his return to Scotland, Dr Harvey Pirie specialised in pathology; he served in East Africa in World War I and came to the South African Institute for Medical Research in 1919 as deputy director until his retirement in 1941. Pirie published a complete survey of Antarctic posts in 1948.⁹ He pursued his interests in philately, photography and the preservation of Africana until his death on 27 September 1965 (aged 86 years). Two photo albums belonging to Pirie and illustrating the voyage of the "Scotia", form part of the present Pirie Collection in the Africana Museum, Johannesburg. Many of the photographs of the Expedition's activities published^{2,7} were taken by Pirie.

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Polar Medal awards to six New Zealanders

Six New Zealanders have been awarded the Polar Medal by the Queen for their services with New Zealand research programmes in the field or at Scott Base and Vanda Station. One is a geologist, Dr Barrie McKelvey, who began his Antarctic research in the 1957-58 summer; Mr Leo Slattery has wintered three times at Scott Base, twice as officer-in-charge. Messrs C. A. Roper and E. J. Saxby have wintered at the base as officers-in-charge, and Mr P. R. Nelson has spent two winters there. Mr G. H. Lewis has worked at Vanda Station in winter and summer and was in charge of the summer team in 1979-80.

Polar Medals are awarded by the Queen from time to time, under the terms of a Royal Warrant, in recognition of individual merit arising from enterprise and hardship, outstanding personal contribution in exploration, scientific research or general service on polar expeditions (both in the Arctic and Antarctic) for no less than 12 months. The medal was first awarded for Arctic expedition service in 1818, and until 1904 was known as the Arctic Medal. In that year it became the Polar Medal, and first awards for Antarctic service were made to members of Scott's first expedition (1901-04).

Seventy-four New Zealanders

Since 1957, 74 New Zealanders have received the Polar Medal for service in the Ross Dependency. The latest awards are the sixth since the awards to 24 New Zealanders who wintered at Scott Base and Cape Hallett in 1957. Medals are now awarded on recommendations from the British and New Zealand Governments. The Australian Government decided this year to recognise Antarctic service under its own system of honours and awards. In future members of Australian expeditions will not qualify for Polar Medals but for their own country's Antarctic medal.

Dr McKelvey, a graduate of Victoria University of Wellington, is now with the Department of Geology and Geophysics, University of New England, Armidale, New South Wales, where he gained his doctorate. He was a third-year geology student at

VUW in 1957, and he and a fellow-student, now Dr Peter Webb, managed to make their way south and join biologists with the Trans-Antarctic Expedition summer party on their examination of the dry valleys north of the Ferrar Glacier.

Webb won the toss and was first to go with the biologists into the Victoria Valley. In January and February, 1958, McKelvey and Webb both worked in the Taylor Valley and on the Upper Taylor Glacier. With the biologists Drs R. W. Balham, R. E. Barwick and Mr A. Packard, they made the first extensive geological and biological examination of the dry valleys.

VUWAE — 1

In the 1958-59 summer McKelvey and Webb returned as members of the first independently sponsored expedition of New Zealand's Antarctic programme which made a biological, geological and geophysical examination of the Wright Valley. This expedition became known as Victoria University of Wellington Antarctic Expedition No. 2 (VUWAE-2). The Webb-McKelvey "infiltration" was given the honour of VUWAE-1.

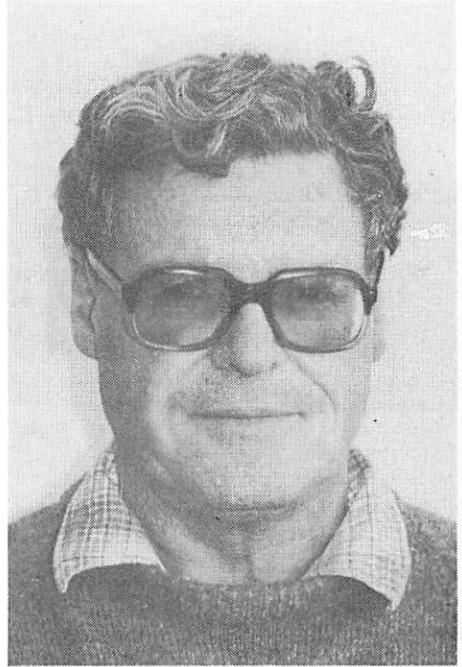
Dr McKelvey left New Zealand in the 1960's but returned to the dry valleys again during the 1977-78 season. Since then he has worked in the New Zealand programme as a project geologist with the United States/New Zealand/Japan Dry Valley Drilling Project (DVDP), and in the 1979-80 season was one of two New Zealanders who



Dr Barrie McKelvey

headed the scientific team in the New Zealand MSSTS project (McMurdo Sound Sediment and Tectonic Study). This was undertaken to drill into the seafloor of McMurdo Sound and obtain samples of sediment which would provide a clue to the early history of Antarctic glaciation.

Dr McKelvey spent a short time in Northern Victoria Land during the 1979-80 season. He returned in the 1981-82 season to take part in a major international geological investigation of mountains in the area which was conducted by United States, New Zealand and Australian scientists. Since then he has worked with scientists from VUW, the United States and Japan on a major New Zealand project — Cenozoic Investigations in the Ross Sea (CIROS), a long term offshore drilling operation in McMurdo Sound. Last season he was among scientists from New Zealand and other nations who worked with a major United States geological project in the Beardmore Glacier area.

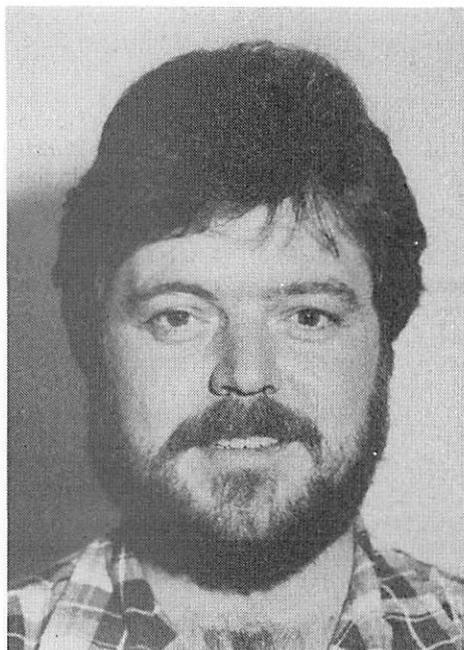


Cas Roper

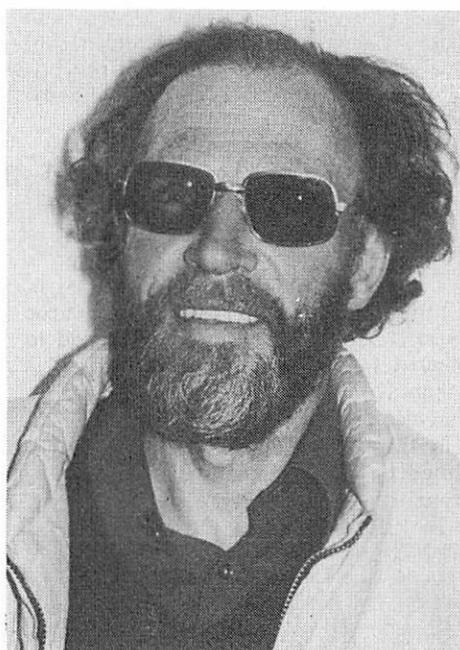
Mr Charles Roper, of Christchurch, a senior technical officer with the Physics and Engineering Laboratory's Geophysical Observatory, Department of Scientific and Industrial Research, wintered at Scott Base in 1980 as officer-in-charge and senior scientific officer. He has worked in the sub-Antarctic at the meteorological and ionosphere station on Campbell Island and went south first in 1974. Since then he has made many regular visits to Scott Base each season in the course of his duties. These have taken him to Vanda Station, the Amundsen-Scott South Pole Station, and Siple Station in Ellsworth Land.

Mr Leo Slattery, postmaster at Leeston, near Christchurch, was a Post Office clerk at Scott Base in the 1973-74 season. He returned as postmaster in the 1979-80 season and remained there for the winter. During his second winter (1982) he was officer-in-charge and the 1981-82 postmaster.

In 1984 Mr Slattery flew back to Scott Base for the fourth time to serve once again



Leo Slattery



Eric Saxby



Gary Lewis



Peter Nelson

as postmaster for the summer and the 1985 winter. When the officer-in-charge had to return to New Zealand for health reasons, he was appointed officer-in-charge for the winter.

Mr Eric Saxby, of Christchurch, now the Antarctic Division's field operations officer, started his Antarctic service in the 1974-75 summer as an assistant maintenance officer at Scott Base. He completed the season as leader of the Vanda Station summer team. In the 1975-76 season he was an Antarctic Division field leader and was assigned to work with the American team at Dome C in Wilkes Land on the recovery of crashed Hercules aircraft.

In the 1977-78 season, Mr Saxby returned to Vanda Station as leader for the summer. He was New Zealand field coordinator at this base camp during the 1981-82 geological study of the mountains

of North Victoria Land, and in the 1983-84 season was deputy officer-in-charge at Scott Base, remaining in charge for the 1984 winter.

Mr Gary Lewis of Wellington, formerly a senior technician with PELGO in Christchurch, served first at Vanda Station in the Wright Valley in the 1969-70 season. He was senior technical officer there and wintered through 1970. In the 1979-80 season he returned to Vanda as leader for the summer. In past seasons he has made several trips to Scott Base in the course of his duties with PELGO.

Mr Peter Nelson, of Whangarei, has wintered twice at Scott Base. He went south first as a mechanic in the 1981-82 season and remained there until early November, 1982. In the 1984-85 season he returned for a second term as a base mechanic and wintered through 1985.

Wilkins papers obtained by Ohio State University

Ohio State University, which acquired Rear Admiral Richard E. Byrd's personal papers and the records of his seven Arctic and Antarctic expeditions from 1925 to 1957, has now obtained the papers of Sir Hubert Wilkins, one of the pioneers in Arctic and Antarctic exploration and photography. Wilkins, who died in 1958, was the first man to use an aircraft in Antarctica, and the first to take a submarine under the Arctic ice.

Wilkins, who was born in South Australia, had his first polar experience with Stefansson's expedition to the Canadian Arctic from 1913 to 1917. He went south first as second-in-command of J. L. Cope's British Imperial Antarctic Expedition of 1920-22. He left this expedition and was appointed naturalist in Shackleton's last expedition aboard the *Quest* in 1921-22.

In 1928 Wilkins led his own expedition to Graham Land and on November 16 took part in the first flight ever made in Antarctica.

After taking the submarine *Nautilus* under the ice in 1931 he returned to the Antarctic and between 1933 and 1939 accompanied Lincoln Ellsworth on four expeditions. His last visit south was in 1957 as an adviser to the United States Army on Arctic and Antarctic clothing and survival.

Because of his marriage to an actress Wilkins had many theatrical friends. After his death two of them, Winston and Marley Stevens Ross established the Wilkins Cultural Centre in Montrose, a small town in Pennsylvania, where his papers were housed. Winston Ross is remembered by an earlier generation as a popular singer back in the 1930s under his stage name, Lanny Ross.



Obituaries

Veteran of major sledging and mapping journeys

Sir Holmes Miller, second-in-command to Hillary for the 1957-59 Commonwealth Trans-Antarctic expedition, leader of the 1963-64 North Victoria Land expedition, former chairman of the Ross Dependency Research Committee and a President of the New Zealand Antarctic Society, died suddenly in Los Angeles on 7 February, 1986.

Born in Waimate, South Canterbury, Holmes (Bob as he became known) attended Willowbridge Primary School and was dux of Waimate High school. He came to Wellington in 1936, joined the Department of Lands and Survey in 1938 and volunteering for overseas service in 1939 became a member of the New Zealand Independent Company sent to Australia for commando training. When the company was disbanded he went to the Middle East in the 4th Field Regiment (artillery) with the 2nd NZEF. Wounded in Tunisia he returned to New Zealand in 1943 and subsequently completed a BA at Victoria University where he was a well known athlete, running fourth in a national mile.

Bob Miller became a member of the New Zealand Institute of Surveyors in 1948. In 1949 he was chosen to lead the survey team with the New Zealand American Fiordland Expedition. It was to supply ground identification points for the aerial mapping of a little known and extremely steep region of deep valleys and razor like edges in the area between George and Casswell Sounds. For four months the team of four operated in a block of 100 square miles of possibly the wettest temperate zone and most inhospitable part of New Zealand. The work of the expedition earned for Bob Miller the Fulton Medallion, an annual award made by the New Zealand Institute of Surveyors for outstanding services to the profession.

In 1950 Bob Miller made his first visit to the sub-Antarctic as a member of R. A.

Falla's Bounty and Antipodes Islands expedition and subsequently returned with Sir Robert Falla in 1978 on the Acheron with government ministers.

Bob Miller was approached to join the New Zealand section of the Trans-Antarctic Expedition of 1955 to 1958 and subsequently appointed second-in-command. He was one of three senior men sent south by the Ross Sea Committee to gain experience in the Weddell Sea region. Flying with Hillary to Montevideo they joined Dr (later Sir) Vivian Fuchs on the Theron taking the advance party of the British team to establish Shackleton base from where they would begin the Trans-Antarctic Crossing.

Afterwards he stayed in London to assist in assembling the New Zealand party's stores which were accumulating there, making a brief visit to Norway to test modifications to tractors better equipping them for soft snow. He then returned to Wellington with Dr George Marsh, his subsequent sledging companion, to help the New Zealand part of the expedition.

At 1.30 p.m. on December 15, 1956 the Endeavour left Wellington and after visiting Lyttelton, Dunedin and Bluff was by January 4 beset in ice close to Beaufort Island. With assistance from USCGC Glacier she was anchored eight miles east of Butter Point by late that afternoon. She was subsequently moved closer as Pram Point was confirmed as the site for Scott Base.

As Arthur Helm writes of Bob Miller: "There was no harder worker among those of us at Scott Base that first hectic summer when we toiled on an average 17 hours a day to establish the base and find a route to the plateau so that food and fuel depots could be laid for the Trans-Antarctic team".

On February 1 Miller and Carlyon each with 11 dogs left Scott base to reconnoitre and map the entrance of the Skelton Inlet and lay baselines for the subsequent mapping of the Lower Skelton Glacier. Away for a month they obtained for the first time information about ice shelf conditions between Minna Bluff, the inlet and the lower glacier adding detail to existing maps and correcting magnetic declinations which were in error.

Winter preparations

During the winter the team prepared equipment and supplies in readiness to support Fuchs. Bob Miller contributed to base management and preparations for the coming season, conducted church services, gave lectures on polar navigation and worked on the results of previous summer's surveying.

Epic journey

With Dr George Marsh he left Scott Base on October 18, 1957 on an epic four and a half month dog-sled journey that has gone down in polar history as one of the most successful ever undertaken. It was to involve trail breaking, guiding aircraft to supply depots and extensive mapping of previously unexplored areas.

The men, each with a team of 11 dogs, were flown into the Skelton Depot and subsequently joined by the two others teams on the Plateau. The tractors, which went all the way, were to carry the heavy loads where necessary while the dogs broke the trail in doubtful going.

Plagued by influenza, to which most of the expedition succumbed, the teams made their way up the glacier, each following the tracks of the others when they were discernible in the frequent blizzard and whiteout conditions. Temperatures were as low as -40°F .

The dog and the tractor men sometimes camped together but more frequently on

their own as they progressed at different rates through the various conditions on the route towards the plateau. On one occasion it took Miller and Marsh 90 minutes to make camp on a glassy surface with a 50 knot wind whipping the canvas from their hands. When they were able to keep their feet pitching the tent normally took about 90 seconds.

By early November the dog support party had reached the polar plateau. Travelling between 13 and 14 miles a day with loads of about 1,000 lbs, half of which was dog food, the rest kerosene, camping and survey equipment, they blazed a trail across the plateau deviating from a direct course to avoid obstacles observed from the air and directing aircraft carrying fuel to specified points.

Depot 480

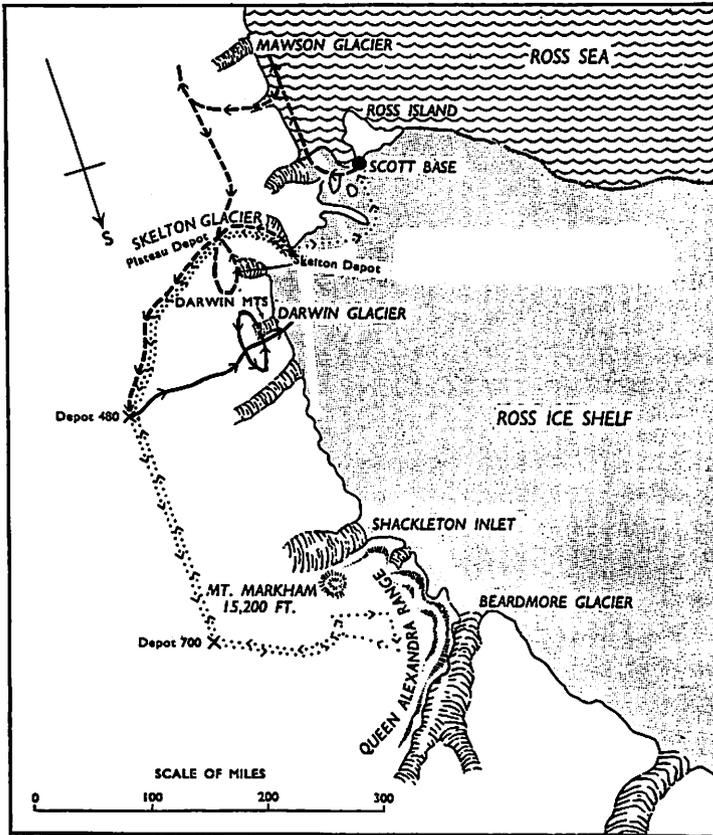
By November 28 they were at depot 480 and on December 1 with 25 days of food and fuel aboard they left for the next southern stage of 230 miles to planned position of Depot 700, selecting and marking with a large cairn and flags the position of the Midway depot which would support the other survey party. In the meantime Antarctic flight continued supplying and relaying drums of fuel to the depots at which landing strips had been marked out.

Between depots 480 and 700 Miller and Marsh initiated a sledging pattern from which they never deviated through the 1,400 miles of the next three months. One team would lead for three days, the other following happily for the first, becoming bored on the second and anxious to lead again by the third. By December 13 they had reached the site for Depot 700 and marked out an airstrip and guided in the first of the supply flights as weather permitted.

Southern party

On December 19 after a brief reconnaissance and with the promised drop of supplies at their position two days later, Miller and Marsh set off to complete their survey work south eastward among the outliers of the Queen Alexandra Range.

With twice weekly radio schedules with Scott Base when they received by voice and



The Southern party of Miller and Marsh carried out the longest of the three major surveys in the summer of 1956-57. The extent of the journey up the Skelton Glacier via Plateau Depot and Depots 480 and 700 to the outliers of the Queen Alexandra Range as shown here. Adapted from *Antarctica* by Helm and Miller; the official account of the expedition.

transmitted by morse, the pair explored and mapped areas around the Queen Elizabeth Range, making measurements, observations and collecting geological specimens. Sometimes they worked at altitudes of 15,000 feet.

On the farthest point of the outward journey they were 900 miles from Scott Base. Between the December 19 and January 16 when they returned to Depot 700 to receive fuel by air for Fuchs they sledged 360 miles, covered a further 50 on foot and collected more than 40 lbs of geological specimens. When on January 17 the planes brought in the fuel, the men made their last immediate human contact before the 550 mile return to Scott Base where their arrival 128 days after their departure coincided with the arrival of the crossing party at the plateau depot at 7.30 p.m. on

February 23.

Miller and Marsh covered 1,670 miles on the surveying leg of the journey, and 2,500 in all; one of the longest sledge journeys ever undertaken in Antarctica. As Arthur Helm writes "probably no dog teams engaged on strenuous missions in polar regions ever had better masters than Bob and George or ever performed better".

"It speaks much for their temperament too that they could live in such close confinement in a small tent in over 100 different camps in Antarctic conditions and remain friends for 30 years after the expedition". Bob Miller was awarded the polar medal for his work with the Commonwealth Trans-Antarctic Expedition. Following his return home he, more than anyone, maintained his contacts and friendship with the British members of the expedition.

Bob Miller, previously in private practice as a surveyor in Masterton, became executive officer of Antarctic Affairs for the DSIR 1958-59 in Wellington before going into private practice in 1960.

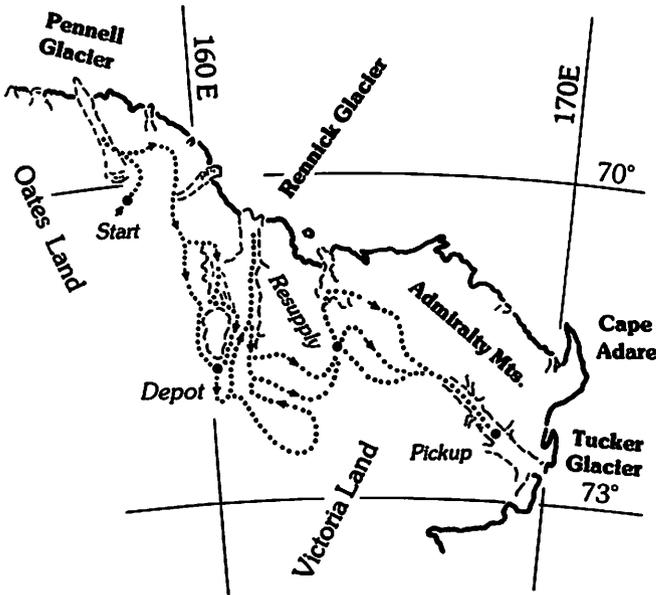
In 1963-64 he returned to Antarctica as leader of the Northern party of a New Zealand expedition mapping and studying the geology of Oates Land and Northern Victoria Land. It was to be the largest dog sledge expedition mounted by New Zealanders since the Trans-Antarctic days and it made one of the last major journeys in Antarctic exploration, covering an area which had received only scant attention by Russian parties landed by aircraft from the Ob in 1958 and Australian teams in 1961-62. Americans had surveyed the periphery.

Comprising two surveyors, two geologists and two field assistants, the Northern field party flew in a US C130 Hercules from McMurdo to Hallett Station 350 miles to the north on October 20, 1963 with four teams of nine dogs and four tons of supplies. For five days they camped on the sea ice until conditions were favourable for two US Dakotas to lift them into the Pennell Glacier region. From here they were to work

eastward first to a depot to be placed just west of the Upper Rennick and then east across the Rennick to a Christmas-New Year resupply point north of the Leitch Massif and finally towards and down the Tucker Glacier to a pick up point in late January.

On October 24 a depot was established in the Upper Rennick by Bob Miller and his deputy leader who were joined a day later by the rest of the party. Operating in three splinter groups they surveyed and studied the geology as they moved south east through the Wilson Hills to the vicinity of Mt Gorton.

Dividing into two teams, Miller led his party through the eastern elements of the northern portion of the Arctic Institute Range. In temperatures as high as plus 15deg F and at altitudes of 1500 to 5000 feet, they worked their way north, in and around Mt Ellery and south through the centre of the range to exchange equipment with the second party on 19 November. One day in every three was lost by bad weather, which became continuous making travel towards the depot extremely difficult. Rations for men and dogs were seriously short.



The route of the Northern Party, the last of the major expeditions in which dogs were used, was led by Bob Miller.

From the depot activities were curtailed by the weather but some geological work was achieved before the party crossed the Rennick Glacier and divided again. Miller's group made their way through and south of the two main 'Island' ranges taking two days to negotiate an extremely broken and difficult portion of the glacier ten miles from the eastern bank where they were further hampered by a broken sledge.

Leaving supplies at Depot Corner on the eastern bank, the team made their way south to the head of the Rennick and then turned south east, skirting the area of a previous survey. By late December a circuit of 160 miles had brought the group down a tributary glacier back to Depot Corner from where they moved eastwards across the northern extent of the Leitch Massif and down the Lillie Glacier to a resupply point and the other party. Splitting again, Bob Miller's team worked the area between the Leitch Massif and the head of the Tucker Glacier. The entire party descended at the end of January to a pick up point 10 miles southeast of the junction of the Pearl Harbour and Tucker Glaciers.

They had sledged over 1,200 miles during their three months in the field and mapped and studied the geology of a vast area. It was to be the last major expedition in which dogs were used and the last in which Bob Miller was directly involved. It was not, however, the end of his interest and commitment to Antarctica.

Firm commitment

A founding member of the Ross Dependency Research Committee established in 1958, Bob Miller was chairman from 1981 until 1984; president of the New Zealand Antarctic Society from 1960 to 1963, a member of the New Zealand Geographic Board from 1962 and its off-shoot the Antarctic Place Names Committee and chairman of the Royal Society National Committee for Antarctic Research from 1970 to 1977. He was also involved with Outward Bound, the World Wildlife Fund, the Nature Conservation Council of which he was a member from 1972 and chairman from 1983.

His world wide interests and professional skills as a top-line surveyor came together in his association with CASLE, the Commonwealth Association of Surveying and Land Economy. On the world executive from 1969 to 1971 he chaired and conducted the assembly of his organisation in 1973. At the time of his death he was world president.

Bob Miller was awarded the O.B.E., in 1958 for his work with the Trans-Antarctic Expedition and in 1979 was made a Knight Bachelor "For services to the Ross Dependency, conservation and surveying". He also held an honorary degree of Doctor of Science from Victoria University, was a Fellow of the New Zealand Institute of Surveyors, and a Fellow of the Royal Institute of Chartered Surveyors.

The Miller Range (83deg 5min S / 157deg 15min E) in Antarctica is named for him. It is a range of mountains extending south



Bob Miller with Butch in Trans-Antarctic days.

from the Nimrod Glacier for 50 miles along the western edge of the Marsh Glacier. It stands as an enduring monument to his great sledging feats.

The Wellington Branch of the New Zealand Antarctic Society which Bob Miller served in various capacities, has initiated an annual Sir Holmes Miller memorial lecture, the first of which was given by Dr Trevor

Hatherton, Chairman of the Ross Dependency Research Committee. Dr Hatherton succeeded Sir Holmes in this position. Sir Holmes was a patron of the society at the time of his death.

"Antarctic" is grateful to Arthur Helm and Sir John Marshall for their assistance with this obituary.

Frank Simpson, editor of "Antarctic Today"

A New Zealand author and journalist, Frank Alexander Simpson, who edited "The Antarctic Today", the New Zealand Antarctic Society's first major contribution to reference literature on Antarctica, died in Auckland on April 14. He was 71.

Frank Simpson, who began his journalistic career in Wellington, played a leading part in the revival of the society in 1949 after its war-time recess. He was a council member and in 1950 served on a sub-committee which worked out a plan for New Zealand participation in Antarctic research.

In 1951 the council decided to produce a book to collate the best information available on Antarctic research and exploration. Simpson, who was working at the time on a history of the Ross Dependency, was appointed honorary editor, and was assisted by Dr John Cumpston, a career officer with the Australian Department of External Affairs, who was a council member during his term with the Australian High Commission.

"The Antarctic Today — A Mid-Century Survey by the New Zealand Antarctic Society" was published in November, 1952, by A. H. and A. W. Reed in conjunction with the society. The book, which earned Simpson a fellowship of the Royal Geographical Society, was described by overseas reviewers as a landmark in polar literature and the "best general work on the Antarctic available today".

By arrangement with the society a Spanish edition of the book was published in 1962 by an Argentine publishing firm under the title "La Antartida de Hoy". A Russian

edition was published without the society's authority but when advised of the breach of copyright the Soviet Union's International Geophysical Year Committee replied, enclosing a cheque for £292.

Simpson continued his interest in Antarctic affairs after he moved to Auckland. In 1954 he was chairman of a group called the Auckland Committee for the Discussion of Antarctic Matters (ACDAM) which drew up plans for New Zealand's first expedition to the Ross Dependency. ACDAM's 16 members decided to join the Antarctic Society in urging the Government to establish a New Zealand presence in Antarctica, and in 1955 formed the Auckland branch which survived until the early 1960s.

As well as editing "The Antarctic Today" Simpson wrote the section on New Zealand's sub-Antarctic islands in the book. He also wrote books on the Chatham Islands, Parliament and its procedures, and the Royal tour of New Zealand by Queen Elizabeth and Prince Philip in 1953-54.

★ ★ ★

A complete record of the 1957-58 Commonwealth Trans-Antarctic Expedition is included in a collection of some 13,000 photographs and supporting negatives which Sir Vivian Fuchs has given to the Royal Geographical Society. The collection also contains boxes of slides, 15 albums, and three steel cabinets. It is indexed and cross-referenced. Sir Vivian is a past president of the society.

Readers' write.....

Pioneers of whaling in Ross Sea

In the autumn issue of "Antarctic" there was a footnote to an obituary of Tasman Louis Young, one of the young Australians with Larsen's 1923-24 whaling expedition to the Ross Sea. The footnote said that the story of the expedition was told by Alan Villiers, another Australian, in his first book, "To the Frozen South", published in 1974.

Mr R. A. Swan, who has written extensively on Australia in Antarctica, has questioned whether "To the Frozen South" was the first book by Villiers, and the date of its publication. Our information about the book came originally from the late Sir Robert Falla, who was with Mawson's 1929-31 expeditions. According to him the story appeared first as a series of articles in the Hobart "Mercury" in May and June, 1924, and in book form under the title "To the Frozen South" in August.

"To the Frozen South" was published by Davies Brothers Ltd, Hobart, and the

author's preface is dated August 6, 1924. In 1925 the book was published under the title "Whaling in the Frozen South" by Hurst and Blackett (London) and Bobbs-Merrill (Indianapolis, U.S.A.). Mr Swan has a copy published by R. M. McBride and Co., New York, in 1925 and later in 1931. It contains additional material on Larsen's second expedition (1924), his death in December, 1924, and later Norwegian whaling expeditions in the Ross Sea area.

"Antarctic Miscellany", which lists books, periodicals, and maps relating to the discovery and exploration of Antarctica up to 1980, refers to two other whaling books by Villiers, presumably "To the Frozen South" in a different guise. They are "Whalers of the Midnight Sun" (Geoffrey Bles, London, 1934) and "Whalers of the Midnight Sun; a story of whaling in the Antarctic" (Angus and Robertson, London and Sydney, 1949). Mr Swan says in his letter that he does not possess a copy of the 1974 book. He was correct in querying the year. The footnote was in error; the year should have been 1924.

Editor

"Ike" Schlossbach in the Arctic

Hal Vogel, Ph.D., Assistant Professor, Glassboro State College, New Jersey, U.S.A. has drawn our attention to a little known expedition involving an Antarctic veteran whose obituary was published last year.

It is understandable that Antarctic (Sep '85) would have omitted mention of the 1937-38 MacGregor Arctic Expedition in the Schlossbach obituary on page 417. Few know of Ike's participation in this expedition, because few know of this expedition.

Dubbed the "All-New Jersey Expedition" (because almost all of its members were from that state in the USA, and it headquartered and departed from there), the ten-person party primarily was to assist its leader, C. J. MacGregor (a U.S. Weather

Bureau meteorologist), conduct research to support his theory that better long range Northern Hemisphere forecasting could be made if we had better knowledge of air mass movement in the high Arctic.

It left Newark, NJ, on 1 July 1937 aboard the wooden, schooner-rigged General A. W. Greely, bound for the ill-fated Greely expedition's campsite of 50 years earlier. The marginally-equipped, private expedition discovered what many before already knew. Ice conditions very often make it impossible to land at Ft. Conger, Ellesmere Island. They had to retreat for a winter at Etah, Greenland.

There they did some exploration, collected synoptic weather data and even were remotely involved in the Levanovsky search. When arriving back at Newark on 4 October 1938, they could credit most of their success, and some of their more spectacular achievements, to their mild-mannered veteran, Schlossbach.

His presence would have had great value had he done nothing more than skipper the ship and serve as second-in-charge. This is because MacGregor's leadership aroused serious resentment among the party, which Ike helped to prevent from reaching a dangerous level. He performed a similarly valuable role on the later Ronne Antarctic Expedition (1946-48).

He also flew the expedition's Waco aircraft through problems and crashes that

resulted in his probably becoming the first to fly solo over Ellesmere, and possibly also to land there. When not flying, he helped polar novices Murray Wiener, Roy Fitzsimmons and Paul Furlong prepare well for their future high latitude assignments.

Ike kept this expedition from becoming more memorable (for the wrong reasons) and gave it some of its few highlights that deserve remembering.

The Erlangen's fate

On page 42 of Volume II, Number one, of Antarctic, it was reported that the eventual fate of the Erlangen is a matter of some debate. We are grateful to Jim Caffin and Baden Norris for their clarification.

Three New Zealanders, all members of the New Zealand Antarctic Society, knew about the eventual fate of the Erlangen for many years. One of them, the late Gareth Williams, was aboard the British cruiser Newcastle which intercepted the Erlangen when Captain Grams was attempting to take his ship back to Germany.

Baden Norris, honorary director of the Lyttelton Historical Museum, who is an authority of ships and seamen sailing from Lyttelton, particularly to Antarctica, and who has been twice to the Auckland Islands, saw the Erlangen leave the port for Dunedin in August, 1939. More than 40 years later he told the story of the ship and her fate in a Christchurch newspaper.

During the Second World War James Caffin, later editor of "Antarctic", was a newspaperman in Christchurch. He learned about the presence of the Erlangen in Carnley Harbour, the discovery by a party of coast watchers of the forest clearing where the crew cut rata wood for fuel, and the hammer which was left behind. The late Sir Robert Falla, who was in charge of the Auckland Islands coast watchers from February, 1943 to January, 1944, told him the full story of the Cape Expedition, the name

given to the coast watching teams whose task was to report strange ships visiting the Auckland and Campbell Islands and continue reporting without being detected.

Although it was known that coast watchers were stationed on these islands nothing could be published in the Cape Expedition's early years because its presence was classified as "most secret" and enemy raiders were still active. James Caffin had to wait 18 months before he was able to write what he knew about the expedition. But he did not learn all about the Erlangen's end until Gareth Williams — an old friend — returned home.

In his account of the Erlangen Baden Norris referred to a faded postcard of the Bowker Fountain in Victoria Square, Christchurch. It was brought back to New Zealand by Gareth Williams. How he obtained it is part of the story of the Erlangen's last hours.

In June, 1941, Captain Grams left Puerto Montt and steamed up the Argentine coast in territorial waters to Mar del Plata. There he waited for a chance to slip past British ships of the Royal Navy's South American Squadron. He left port on July 24 under cover of fog which blanketed the whole area. But British agents had been monitoring his movements and the Newcastle, told by radio of the Erlangen's course and speed, set an intercepting course.

Unluckily for Captain Grams the skies cleared. The Newcastle came racing out of the fog and a salvo from her guns straddled the Erlangen, changing the captain's decision to make a run for it. Captain and crew abandoned ship, denying a British boarding

party of the prize which was to be towed to the Falkland Islands.

Before the Germans were taken aboard the Newcastle they set explosives on a time device. An explosion followed by fires rocked the Erlangen which began to settle as the boarding party tried to stem the damage. It was impossible to tow the ship, and the Newcastle left the scene for Freetown, Sierra Leone, with her captives.

But the boarding party came back with a number of souvenirs, including the Bowker Fountain postcard. This was autographed by Captain Grams and presented to the sole

New Zealand rating aboard the Newcastle — Gareth Williams. His widow, Mrs Margaret Williams, a former Antarctic Society member, still has the historic souvenir.

Lyttelton also has a photographic link with the Erlangen — a series of photographs taken by Captain Grams and presented to the Lyttelton Historical Museum some years ago. After the war Captain Grams sent the photographs to the late Captain J. Maloney, the Dunedin pilot who guided the Erlangen out of the harbour in 1939.

Baden Norris
James Caffin

Russkaya's gales

Sir, In your issue of June, 1984, you say that "Russkaya reported wind speeds up to...116,26 (sic) knots (215.65 km per hour)...that wind strength was the highest recorded anywhere..." I know of course, that all the records whatsoever the field are held by the society but this one goes a little too far.

"As you know Adelie Land is the 'Home of the Blizzard'. At our base, Dumond d'Urville, winds of 200 to 250 km/h (107.95 to 161.93 knots) are quite frequent every year. The real record was recorded at the base in July, 1972: speed 327 km/h (approx 176 knots). I am not especially proud of this, but these figures are true."

Yours etc.

Paul Emile-Victor (*Honorary Director, Expeditions Polaires Francaises*)

[Tass, the official Soviet news agency, claimed that wind strengths at Russkaya early in February, 1984, were the highest recorded anywhere, not "Antarctic". A note in the May, 1984, issue of "Polar Record" said that Soviet scientists reported a world record wind velocity of 77m a second (215km or 173 miles an hour).

As Paul Emile-Victor knows well media reports on record high winds can be misleading. They have claimed records but have not said whether the wind speed was the maximum or the average. Russkaya lies in the track of deep depressions; gales are

recorded on more than 300 days a year. It is possible therefore that the record claimed was for Marie Byrd Land or West Antarctica, not the whole continent.

"Polar Record" gives its sources as (1) USSR weekly economic report, February 10, 1984; (2) BBC summary of world broadcasts. But the figures given do not tally with the Tass report of speeds up to 116.36 knots (215.65km or 133.98 mph). "Polar Record" says that 215km is 173 mph but refers to a velocity of 77m a second which corresponds to 149.57 knots (227.20km or 172.24 mph).

Perhaps the World Data Centre in Moscow will give us the exact figure. In the meantime Adelie Land is still the "Home of the Blizzard". But it is a pity that Paul Emile-Victor was too modest about the record of 176.45 knots at Dumond d'Urville in July, 1972. It was one for the record books but I could find no mention of it in any French reports printed in "Antarctic".

Paul Emile-Victor's national pride has led him to make in his letter a rather invidious comparison of the respective abilities of buildings at Russkaya and Dumond d'Urville to withstand gales. His comment is not in the spirit of international co-operation which has distinguished Antarctic research for more than 30 years.

J. M. Caffin *Editor, "Antarctic", 1973-84*

Books: Shackleton

Written by Roland Huntford, published by Hodder and Stoughton, London, 1985. ISBN 0 340 25007 0, hardback 774 pages, 60 b/w plates and maps. 240 x 160 mm New Zealand \$88.50.

Fresh from the Antarctic, Ernest Shackleton's son was in Christchurch late last year on his way home to England from visiting Cape Royds.

I asked Lord Shackleton if he thought Roland Huntford's new book "Shackleton" added significant information to that already well-known about his father through the publications "The Life of Sir Ernest Shackleton" by Hugh Robert Mill (1923) and "Shackleton" by Margery and James Fisher (1957).

The reviewer, Colin Monteath of Christchurch, is a freelance photo-journalist, photographer and publisher specialising in polar and mountain photography and writing.

The reply was direct and emphatically positive. Lord Shackleton thought that as so many diaries had become available in recent years by those who had travelled with the "Boss" or knew the many sides of his father's nature, such as Edgeworth David, Hurley, Mawson, Joyce, Orde-Lees and even Amundsen, that Huntford's book was a spirited advancement of understanding into Shackleton's character.

Impressed by the intensity and depth of his research for the controversial "Scott and Amundsen" (Hodder and Stoughton 1979) I was intrigued to see how Huntford handled Shackleton, the old school-boy hero.

I came away inspired by his ability to develop and plait together the very complex threads of Shackleton's psyche. This helps draw together a credible explanation for the motivation behind his launching poorly-funded and badly equipped expeditions. Huntford also positions Shackleton perfectly in the British polar initiative of the day.

Huntford continues his ruthless debunking of Scott, which is a feature of his first book and taken to extremes. He goes to considerable length to explain the origin of

the conflict between Scott and Shackleton during the 1901 Discovery expedition and heightened after Shackleton's 'unauthorised' use of a Ross Island base for the 1907-09 venture that eventually took him within a whisker of his goal. Scott does not come out of it well at all.

Both leaders are portrayed in this book as paranoid and egocentric individuals who were tossed around like gladiators by the public and polar bureaucrats of the day.

While Shackleton obviously went out of his way to grind his axe with Scott he didn't spare himself either. Shackleton always considered himself and his expeditions to be failures. History has honoured these defeats as examples of courageous decision-making and stamina when all the bridges are down. Huntford celebrates these triumphs of survival as never before. At the same time other characters such as Orde-Lees and Worsley are developed so much better than in other books I have read on the epic journey to Elephant Island and South Georgia.

These vivid descriptions are juxtaposed with a questioning of the old imponderables of why dogs together with professional dog drivers and skis were not persevered with when so many examples of their efficiency stared Shackleton in the face.

By delving into Shackleton the dreamer (in politics) and the schemer — a man always with a pot of gold on the horizon from his various money-making ventures in Europe and Britain, Huntford highlights the rationale behind the somewhat shambolic and hurried preparations for his expeditions.

Shackleton's gradual estrangement with his wife and increasingly sensitive correspondence with various other women helps to piece together the driving force behind the man.

One wonders in the light of recent clashes of Governments with the Transglobe expedition and now 'Footsteps of Scott', what treatment Shackleton would have received today at the hands of polar pundits.

Clearly Amundsen didn't beat about the bush: "Sir Ernest Shackleton's name will for evermore be engraved with letters of fire in

the history of Antarctic exploration".

Every page of Huntford's book is written with fire. It is hard to put this book down. I can but hope Nansen soon comes in for similar treatment. If you only have money for one Antarctic book this year, then "Shackleton" has to be it.

Aurora Australis reprinted

The book of the 1907/8 British Antarctic Expedition, edited by E. H. Shackleton and published by Paradigm Press and Bluntisham Books, 1986. ISBN 0 948285 06 0, hardback, approximately 100 leaves un-numbered as in the original, 13 etchings, 200 x 270 mm U.K. £29.95.

One of the (estimated) 90 copies of *Aurora Australis* printed at Cape Royds by members of Shackleton's 1907/9 British Antarctic expedition sold at Sotheby's in London on November 18, 1986 for £7,500 or NZ\$20,500. Interested readers unable to afford an original can now obtain one of the thousand copies of the first public edition published on May 20, 1986 by Paradigm Press and Bluntisham Books in the U.K. for £29.95. Of the fifty-eight facsimiles also produced by the Press at £295 one is known

already to have exchanged hands in California for US\$795.

As Lord Shackleton, son of Sir Ernest, writes in the preface of the public edition: "The official accounts of expeditions fulfil many roles. They document the objectives, detail the attainments and the scientific work

The type case and printing press for the production of the "Aurora Australis" in Joyce and Wild's cubicle known as "The Rogues Retreat".



and set a seal on what was the real adventure for the participants. However, they don't always recall the trivial human details that make the reader realise that they were real people.

"Occasionally a personal diary is published and when it contains interesting and perceptive comments on expedition members, such as those made by Edward Wilson on Scott's expeditions, a whole new light is cast on expedition life."

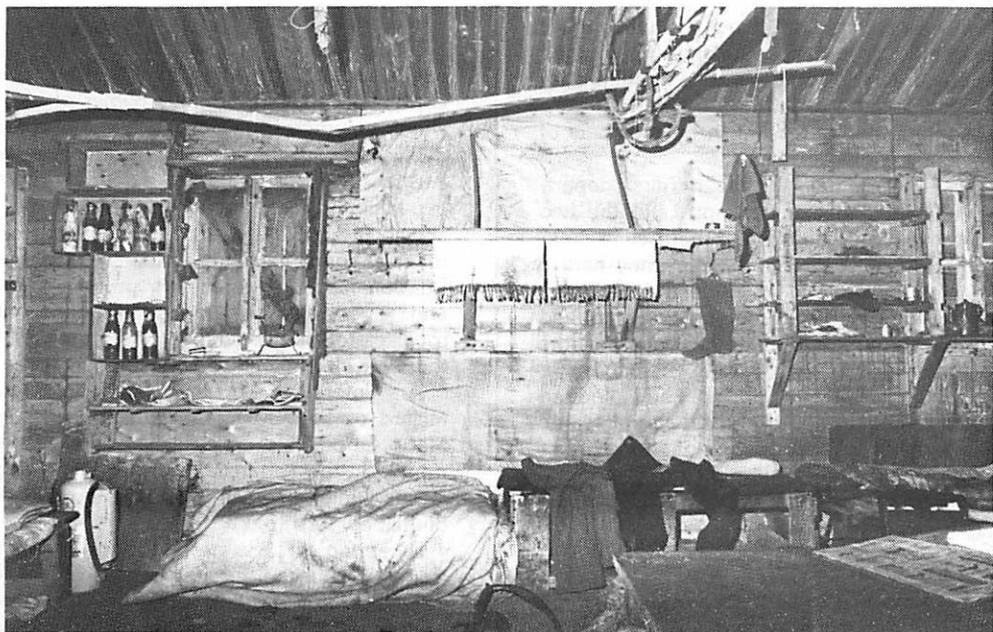
The production of an "unofficial" publication by an expedition such as Shackleton's follows closely a tradition established in the Arctic by the Royal Navy during the early part of the nineteenth century "when the desire to expand the empire took expeditions around the north west passage. During the long winter months strict routines were laid down for the men so that there would be no idle moments." In addition to a programme of entertainment some form of magazine was often produced to help combat boredom.

Following tradition Scott's expedition produced the South Polar Times edited by

Shackleton. It is not known why he was chosen for the task but a 'literary bent' and previous experience in co-producing "O.H.M.S., an illustrated record of the voyage of SS Tintagel Castle," from Southampton to Cape Town, March 1900 is assumed to have had a bearing on it.

Reminiscent of a schoolboy magazine, contributions to the South Polar Times were approved by Scott, typed by Shackleton and illustrated mainly by Wilson. All members were encouraged to contribute and most did. One copy of each of the four issues was produced during the winter months and circulated; each contained an editorial, summary of events, weather conditions, articles about the work being done, the surroundings, poetry, stories, caricatures, acrostics, puzzles and other interesting features. As Wilson noted "It was not to be made use of

"The Rogues Retreat" as it is today. It is assumed that the printing press was returned to England and may have been destroyed during the war. Photo — David Harrowfield.



for personal spite or as a perpetuator of any feelings that are not up to its high standard as a pioneer paper in the far south. Shackleton also produced a copy of the "Blizzard" containing contributions considered unsuitable for the South Polar Times. Bernacchi continued as editor for the winter after Shackleton's return to the United Kingdom in 1903.

On his own expedition Shackleton decided to do better with a publication. The records of Joseph Causton and Sons have not survived but it is known that they donated a printing press and small etching press as well as all the necessary high quality papers, inks and type and provided three weeks on instruction in printing and typesetting for Ernest Joyce (in charge of general stores, dogs, sledges and zoological collections) and Frank Wild (provisions) and in lithography and plate etching for George Marston, the expedition's artist.

All contribute

Of the publication Shackleton in his official account of the expedition writes... "When we had settled down in the winter quarters, Joyce and Wild set up the little hand press and sorted out the type, these preliminary operations taking up all their spare time for some days, and then they started to set and print all the various contributions that were sent in by members of the expedition.

"The early days of the printing department were not exactly happy, for the two amateur type setters found themselves making many mistakes, and when they had at last "set up" a page, made all the necessary corrections and printed off the required number of copies, they had to undertake the laborious work of "dissing", that is, of distributing the type again. They plodded ahead steadily, however, and soon became more skilful, until at the end of a fortnight or three weeks they could print two pages in a day.

Lamp for warmth

"A lamp had to be placed under the type rack to keep it warm, and a lighted candle

was put under the inking-plate, so that the ink would keep reasonably thin in consistency. The great trouble experienced by the printers at first was in securing the right pressure on the printing-plate and even inking of the page, but experience showed them where they had been at fault.

"Day meanwhile prepared the binding by cleaning, planing and polishing wood taken from the Venesta cases in which our provisions were packed. (Vanesta was an early form of plywood, usually made of three layers of oak or chestnut glued together with waterproof cement.)

"Marston reproduced the illustrations by algraphy, or printing from the aluminium plates. He had not got a proper lithographing press, so had to use an ordinary etching press, and he was handicapped by the fact that all our water had a trace of salt in it. This mineral acted on the sensitive plates, but Marston managed to produce what we all regarded as creditable pictures. ...and it had at least assisted materially to guard us from the danger of lack of occupation during the polar night."

Final form

Shackleton notes that in its final form the book had about one hundred and twenty pages. Scott's publisher, Smith Elder and Co, produced 250 facsimile copies of each winter volume of the South Polar Times for public sale in 1904. It is possible that Aurora Australis was originally intended to boost expedition funds, but it appears that in addition to the copies given to each expedition member some were subsequently collated in London from the remaining printed pages and given away, avoiding questions of royalties to the printers. A large number of these are described by Shackleton.

An interested polar historian, John Millard of Toronto in Canada, inspired by Mary Goodwin's article "The first book printed in the Antarctic", set about locating all surviving copies and tracing the passage of their ownership.

By spring of 1985 he had found 58 with evidence of further existing copies. In his introduction to the public edition Millard suggests that it is possible that up to 100 copies

printed but differences in individual copies and incidence of missing leaves in others suggests that there was never enough printed material to make up even 90 copies. Although the surviving copies have not been collated for comparison each appears to have individual differences. On the basis of the number traced, fifty-eight facsimile copies were produced, each containing all known pages.

The public edition contains essays, poems and drawings by expedition members. They include an account of the "Ascent of Mt Erebus" by T. W. Edgeworth David; "Midwinter night" by Nemo (Shackleton); "Trials of a messman" by A Messman (Priestly); "A pony watch" by Putty (Marston); "Southward Bound" by Lapsus Linguae (Marshall); "An interview with an emperor" by A. F. M. Mackay; "Erebus" by Nemo; "Ancient Manuscript" by Shellback (Wild); "Life Under Difficulties" by James Murray and "Bathybia" by Douglas Mawson.

It is indeed true that the book contains no very important information about the success or otherwise of the expedition affairs but it remains part of the activities of the heroic age and as such is an intriguing addition to Antarctic literature.

A messman records that: "Laying the table is an art in itself. The tastes of all members have to be catered for, and that means that it is necessary to have two or three different kinds of jam, marmalade, honey and golden syrup, dripping and butter. I have seen men spreading chutney on their bread and putting honey in their porridge, and from the way it has disappeared, I have reason to believe that they take worcestershire sauce with their fruit..."

"Another duty new to me is making tea, and it is by no means a light one. The capacity of this Expedition for tea is simply marvellous; some of the members take it in a bath, and among the many things I have learnt is that some Scotchmen take more tea than "whuskie", (though that may be because they can get no "whuskie"), and that they are more particular about it than even Australians. It is either too hot or too cold, boiled too much or not boiled at all, too sweet or not sweet enough, and whether it is good, bad or indifferent, there is never enough of it. Like most other messmen, I have decided now to make it suit myself, and have ceased to pay any attention to criticism."

Key Environments — Antarctica

W. N. Bonner and D. W. H. Walton eds/Pergamon Press/IUCN, 1985 ISBN 0-08-028881-2, hardback 381pp., 24.5 cm, approximately \$62.00

Reviewed by Paul Dingwall, Chief Scientist, Department of Lands and Survey, Wellington.

With mounting pressure on the development of Antarctic resources, and increasing human contacts with the region, particularly the recent growth of commercial tourism, it is important that we all become better informed about the character of Antarctica and its opportunities and constraints for resource use. In this regard we are well served by this authoritative but readable book.

Produced as part of a global Key Environments series, in collaboration with the International Union for the Conservation of Nature and Natural Resources (IUCN), this

volume must be one of the most comprehensive and useful single texts on Antarctica that is currently available. It deserves a wide readership.

The purpose of the book (and the series) is to provide expert information on landscapes, plants, animals and ecosystems, in all realms, atmospheric, marine and terrestrial — to highlight their ecological significance, relate them to environmental changes, and suggest as far as possible effective future conservation strategies.

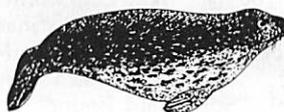
The 18 contributing authors are all experts

in their own fields, and topics range from climate to physical geography; terrestrial flora and fauna including freshwater habitats; marine ecosystems including plankton, benthos, fish, marine mammals and seabirds. There is also discussion of Antarctic food webs and interactions in an overview of the Antarctic ecosystem. Authors are drawn from six countries and include two from New Zealand DSIR Soil Bureau who have written a brief chapter on soils.

The editors have tied together the disparate material very adroitly and introduce the book with an informative summary of the history of scientific endeavour in Antarctic biology. The information throughout is up-to-date, and clearly conveyed with a nice balance of text and illustration, including black-and-white photographs. Personally, I would have preferred

to see inclusion of a fuller discussion of conservation and exploitation issues than the one chapter on these subjects allows. But a useful reference list directs readers to other sources of information.

This book deserves a place on the bookshelf of all who want to keep abreast of advances in the state of knowledge of the Antarctic environment, and current issues in the use and protection of Antarctic resources.



Antarctic Society News

U.S. patron

One of the two New Zealand Antarctic Society's patrons as from this year is a United States cartographer and scientific co-ordinator who has been associated with New Zealand's Antarctic research programme for 25 years. Mr Walter Seelig, who spent 10 summers in Christchurch as the National Science Foundation's representative, has been honoured by the society for his generous and active support of all its activities. He fills the vacancy created by the death of Sir Holmes Miller earlier this year.

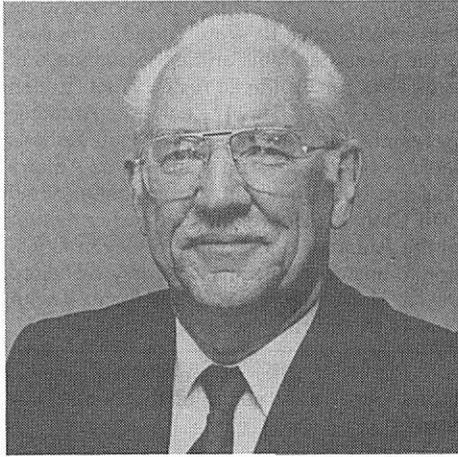
Mr Seelig, who has been international co-ordinator for the Division of Polar Programmes since 1969, retired at the end of May from the NSF which he joined in 1960. He was the United States Antarctic Research Programme (USARP) representative in Christchurch in 1971-72, and then held the position continuously from 1976 until the end of the 1985-86 season.

A New Yorker, Walter Seelig joined the United States Geological Survey in 1942 and was engaged in aeronautical mapping

during the Second World War. He was on the USGS planning staff from 1958 to 1960 and special assistant to George Whitmore, chief topographic engineer, in 1959 when he was sent to Antarctica. Mount Seelig, the largest and highest peak (3020m) in the Whitmore Mountains, was surveyed that year and named for Walter Seelig who has been closely associated with Antarctic mapping and research since 1957.

When the NSF decided to develop an Antarctic mapping project Walter was borrowed for a nine-month period in 1960 and never went back to the USGS. He became the NSF geodetic liaison officer, and in 1964 associate director of the international co-ordination and information programme.

During his 26 years' association with Antarctic research Walter made 17 visits south. He went to the South Pole five times and three times to the Soviet Vostok Station. In addition he made several cruises in the NSF research vessel *Eltanin*, one to the South Sandwich Islands and another to the Antarctic Peninsula.



— Walter Seelig

Walter's first close association with the New Zealand programme was in the 1964-65 season when he was scientific co-ordinator of the NZ/US Ross Sea Islands Survey which included 13 New Zealanders and eight Americans. Between January 10 and March 5 this expedition aboard the United States Coast Guard icebreaker *Glacier* visited Beaufort, Franklin, and Coulman Islands, the Possession Islands, and Robertson Bay, Cape Adare, and made landings on three of the Balleny Islands. It also continued research at Macquarie Island before returning to Lyttelton.

In the last 15 years Walter Seelig's links with the Antarctic Society were not confined to attendance at branch functions. His particular interests were the Canterbury Museum's Antarctic Centre, and the Kinsey cottage at Ferrymead, which was once part of the property of Sir Joseph Kinsey, who acted as Christchurch agent for the Scott and Shackleton expeditions. He also gave much of his limited spare time each busy summer season to other society projects, helped the Canterbury branch with arrangements for the Christchurch celebrations of the society's 50th anniversary in 1983, and provided a regular flow of information to assist successive editors of "Antarctic".

Each year Walter and his wife Josephine returned home to tell people about New

Zealand, Christchurch, and the society. In doing so they were and still are among our best "unofficial" ambassadors.

Treaty philosophy enunciated 110 years ago.

In "Science, Antarctica and Humankind", the inaugural Sir Holmes Miller memorial lecture given as part of the mid-winter's day programme of activities organised by Wellington Branch, Dr Trevor Hatherton divided Antarctic history into phases from Grecian times. He drew attention to an Austrian with a passion for polar exploration who was to develop a philosophy which was to have a profound effect on science and Antarctica.

"Karl Weyprecht, a physicist and naval officer, was co-leader of the Austro-Hungarian North Polar Expedition of 1872-74 during which he became convinced that geographic exploration for its own sake or for national glory should be replaced by international science carried out according to a co-operative plan.

On his return he campaigned vigorously in the Academies of science and prestigious scientific institutions of Europe for a new approach to the study of polar regions. He stated that the traditional polar exploration had been nothing more than an international steeplechase to reach the poles, where "immense sums were being spent and much hardship endured for the privilege of placing names in different languages on ice covered promontories, but where the increase in human knowledge played a very secondary role."

Weyprecht drew up a set of principles some of which as Dr Hatherton explained are very pertinent in the light of present discussions on Antarctica. "The earth should be studied as a planet. National territories and the Poles themselves have no more and no less significance than any other point on the planet, according to the opportunity they offer for the phenomena to be observed. Science is not a territory for international

possession; small nations must be able to take part in polar research. Scientific knowledge of lasting value can result from co-ordinated and co-operative studies undertaken according to an agreed plan, with the results of observations freely shared without discrimination.

Dr Hatherton, Chairman of New Zealand's Ross Dependency Research Committee, was the major speaker in the day of activities and displays attended by 220 members of the public. Other speakers included Dr Paul Robinson, "The Antarctic

— what is it?", Paul Dingwall who spoke on the subantarctic, Dr Paul Broady, on Antarctic plants, animals and conservation and Alex Pyne on Antarctic rocks. Hugh Logan explained the New Zealand Antarctic Research Programme and Nigel Roberts talked of New Zealand's interest in Antarctica and both speakers subsequently joined with Cath Wallace, New Zealand convenor of the Antarctic and Southern Ocean Coalition to answer questions in a session chaired by Dr Harry Keys. Professor Tony Taylor chaired the morning session.

From Adelies to nematodes

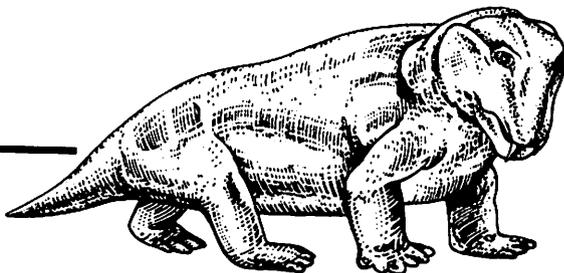
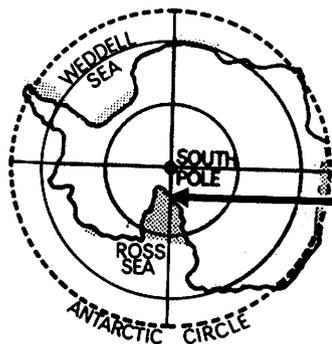
A zoologist with the New Zealand Soil Bureau, DSIR, Dr Gregor Yeates, whose earliest research as an honours student was on Adelie penguins at Cape Royds, has been awarded a D.Sc. by the University of Canterbury. He was one of the first two holders of the bursary awarded by the Canterbury branch of the New Zealand Antarctic Society for an advanced student to work in the Antarctic or sub-Antarctic in the summer vacation.

When the bursary, worth £120, was first awarded for work in the 1964-65 summer it was shared by Dr Yeates and John Hay. They went south as members of the University of Canterbury Antarctic Biology Unit to study Adelie penguins and climate respectively under the direction of Dr Bernard

Stonehouse, now editor of the "Polar Record".

Dr Yeates had to return to Cape Royds in the 1965-66 season for an unusual reason. On December 17, 1964, he developed symptoms of appendicitis. Scott Base was called and he was flown by US Navy helicopter to McMurdo Station and later to Christchurch by a Hercules aircraft for hospital treatment.

In 1966 Dr Yeates graduated B.Sc. with first-class honours and in 1968 gained his Ph.D. After working in England and Denmark he joined the Soil Bureau at the end of 1970. Since then he has worked principally on nematodes — the subject of his doctoral thesis — in England, Orkney Islands, Vanuatu, Chatham Islands, Antarctica, and on New Zealand tussock grasslands and in kauri forests.



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