

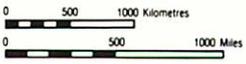
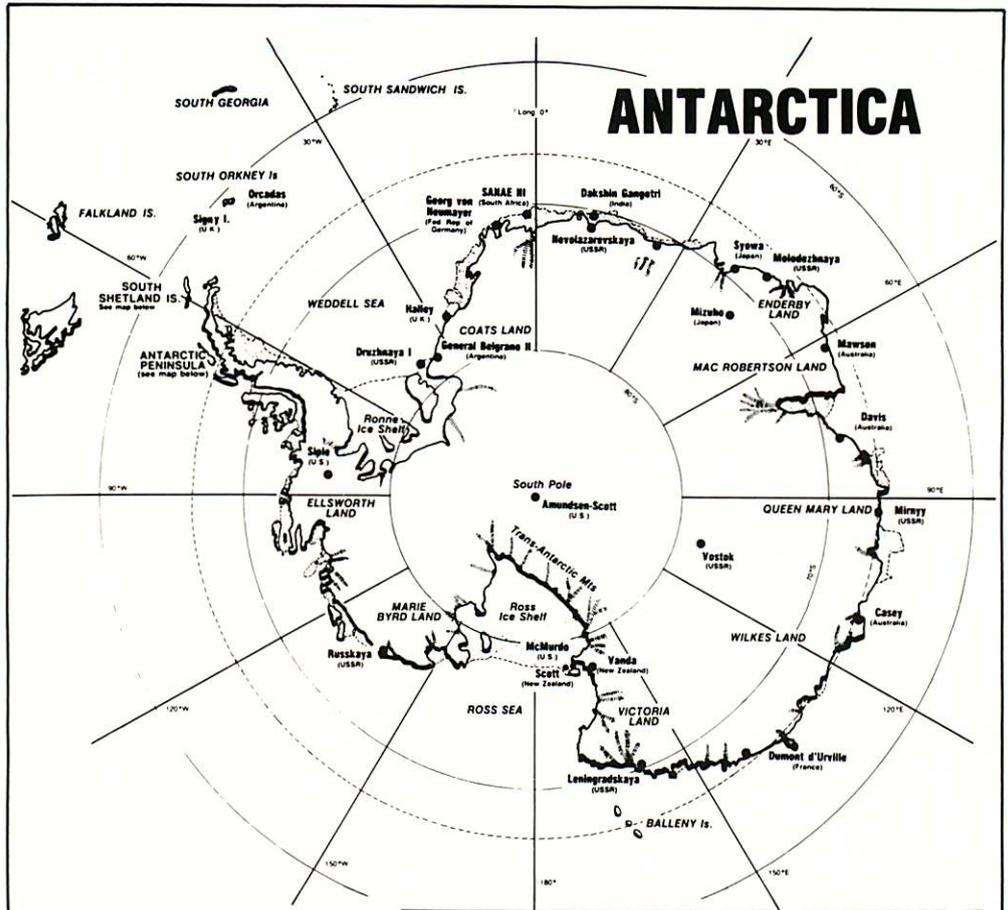
ANTARCTIC



Bulletin Vol. 12 No. 10

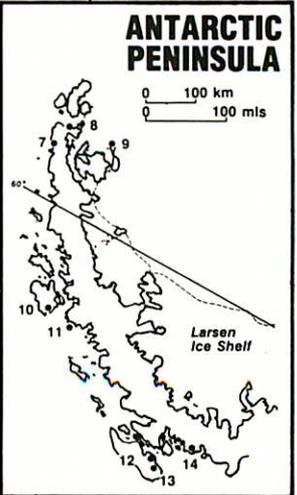
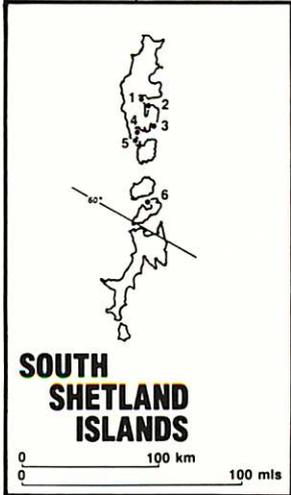


ANTARCTICA



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



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Cover: *Aurora Australis*, Australia's new icebreaker. Photo: ANARE

NZAP

Debate: Antarctic ice sheets and global warming

A new view.

Knowledge of how the Antarctic ice sheet is likely to respond to expected global warming is important for our future, and one approach is to study its behaviour as climate has varied in the geological past. For the last two decades scientists have believed that significant ice first formed on the Antarctic continent when it cooled around 40 million years ago, with extensive ice covering the continent 14 million years ago and persisting until the present day. This view was based on estimates of global ice volume and water temperature from oxygen isotopes of shell material in deep-sea cores covering the last 50 million years and pioneered by Jim Kennett (then at the University of Rhode Island) and Nick Shackleton (University of Cambridge).

A controversial new view was published in 1984 in "Geology" by Peter Webb, Professor of Geology at Ohio State University, and David Harwood, a graduate student and diatom specialist. They had found marine diatoms (plant fossils) only three million years old in glacial moraines at several places high in the Transantarctic Mountains. (Figure) The only way they could account for their presence was to propose that they had lived and died in a sea in the Antarctic interior at that time, which implied much reduced ice and that they were later eroded by ice from below sea level and transported from the interior to the mountains at the edge of the ice sheet. The clear implication was that the Antarctic ice sheet was a much younger and possibly less stable a feature than was generally believed.

The view has been widely challenged on several points, the most critical being the origin and age of the diatoms. It is now clear that the diatoms do truly lie within the glacial debris (the wind-blown origin has been discounted), but many thought that the de-

bris and the diatoms they contained must be much older (tens of millions of years) than the age implied by the diatom species suggested.

1984 was also the year in which the New Zealand Antarctic Research Programme drilled CIROS-2 (Cenozoic Investigations of the Ross Sea) in Ferrar Fiord, an inlet cut in the south Victoria Land coast opposite Ross Island. The hole was one of two planned to provide a history of glacial advance and retreat in the region over the last 40 million years (See *Antarctic Vol 11 No's 2 and 3*) 1984/85 and 1986/87.

CIROS-2 was drilled in 211 metres of water and through 165 metres of sediment to basement. One of the features of the core, first recognised by Alex Pyne, science manager for the project, was a volcanic ash layer 30 cm thick and 125 metres below the sea floor. Samples of the core were sent for dating using the diatom species to David Harwood, who found that the ash lay in the middle of an interval he dated at around three million years and containing some

of the same species he used to date the Sirius Group and the deglaciation of the Antarctic interior. Microscopic study showed the ash to be mainly silt-sized basaltic glass particles with a few small feldspar crystals. Now the diatoms could be dated using independent radio-isotopic methods, and the debate could be settled one way or the other.

The dating process turned out to be long and arduous because the ash contained finely divided debris from the 450 million year old basement rocks of the region. The first ages, in 1985, were determined by Chris Adams at DSIR, Gracefield, near Lower Hutt, Wellington, using K-Ar method, and ranged eight to 22 million years. The spread of ages from the same layer clearly indicated that the ash contained material from a mixture of ages. Several separation techniques were tried, but none yielded a sample of pure volcanic glass.

Then in 1990 a new approach was tried by VUW graduate student Gary Wilson. He took a sample of the volcanic ash, carried out a separation in volcanic and basement-rich portions and dated both fractions. He then used simultaneous equations to give model ages for pure basement material (450 million years) and pure volcanic material (3 ± 0.6 million years). This spurred on attempts to find a separation process that would give a clean volcanic sample - the best that Chris Adams has now been able to achieve is 3.4 ± 0.2 million years.

Since 1988 Peter Barrett had been trying, with help and advice from Bill Macintosh, to persuade the Geochronology Centre, Berkeley, to use their laser fusion Ar-Ar dating facility on single crystals from the ash to get individual ages and hence avoid the contamination problems that plagued the bulk samples needed for the several grams required by the K-Ar method. However, it was not until 1991 that the technique was sufficiently miniaturised to date crystals as small as those from the ash. The results (2.8 ± 0.3 million years old) - in other parts of the world were about the same age in Antarctica also. The results were submitted to "Nature"

magazine, and accepted after peer review, appearing in the 29 October, 1992 issue (Vol 359, pp 816-818.) They immediately caused something of a stir in media as diverse as the *BBC Discovery Programme* and *Time* magazine.

The new view of Antarctic climate history, which these ages confirm, has Antarctic glaciation beginning around 40 million years ago but with temperate ice sheets waxing and waning since that time until around two and a half million years ago when the present ice sheet formed, about the same time coincidentally as the first northern Hemisphere ice sheets formed. This different climatic history has wide implications for the evolution of flora and fauna of the region, and for the role of the ice sheets in past ocean circulation.

The contrary views

Not everyone, however, has been convinced. David Sugden, University of Edinburgh, writing a *News & Views* comment in the same issue of "Nature", outlines the case for the view but also lists three arguments against it. He quotes first the work of George Denton, University of Maine, and David Marchant, University of Edinburgh, who have been dating similar volcanic ash deposits in the Dry Valleys of the McMurdo Sound region also by the laser fusion Ar-Ar technique. The ash deposits, some of which give ages as old as 14 million years, overlie non-glacial features such as wind-scoured surfaces and are trapped in frost-wedges, which form in perennially frozen ground. In Sugden's words "The intimate association of ash with cold desert features and the fact that the ash has survived on slopes as steep as 30 degrees is best explained by invoking cold desert conditions without any water activity."

Sugden's second argument is a claim by Kennett that measurements in deep-sea cores of oxygen isotopes, strontium isotopes and ice-rafted debris show no sign of the sort of change expected from a collapse of the Ant-

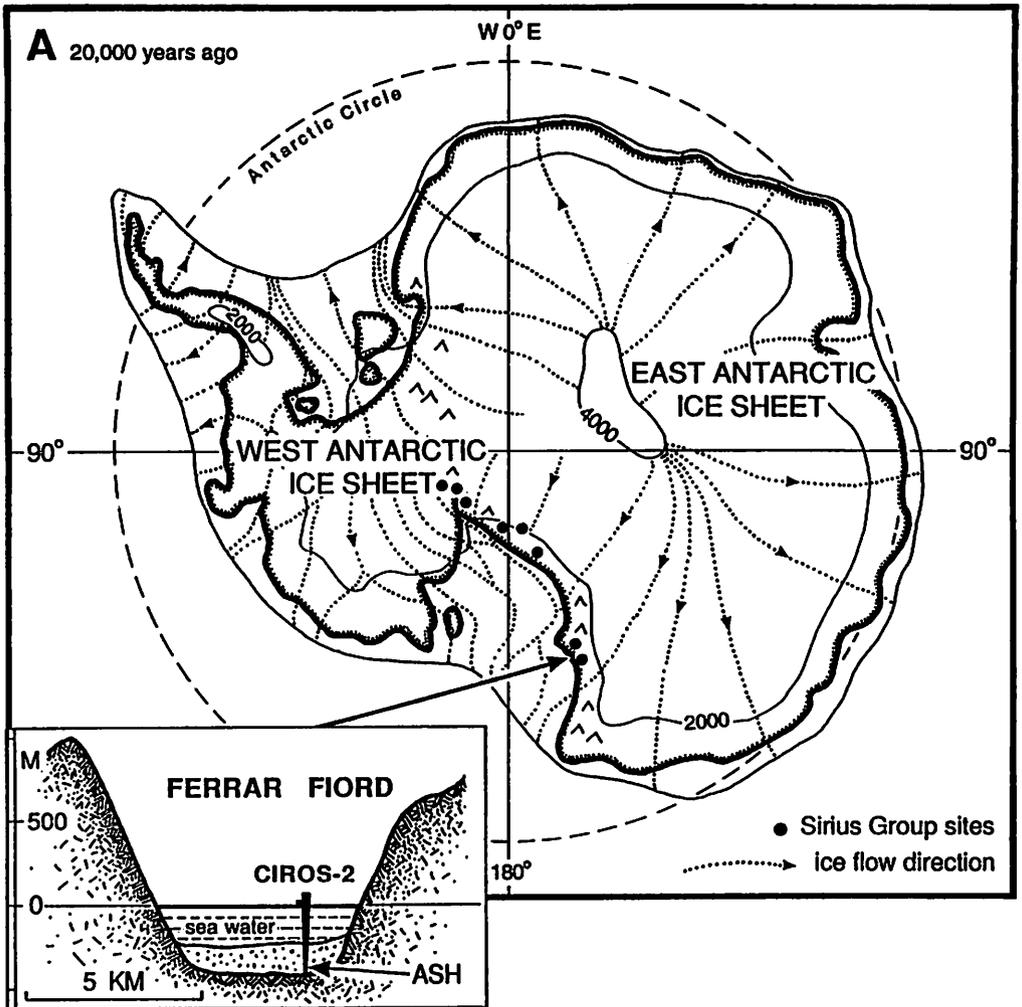
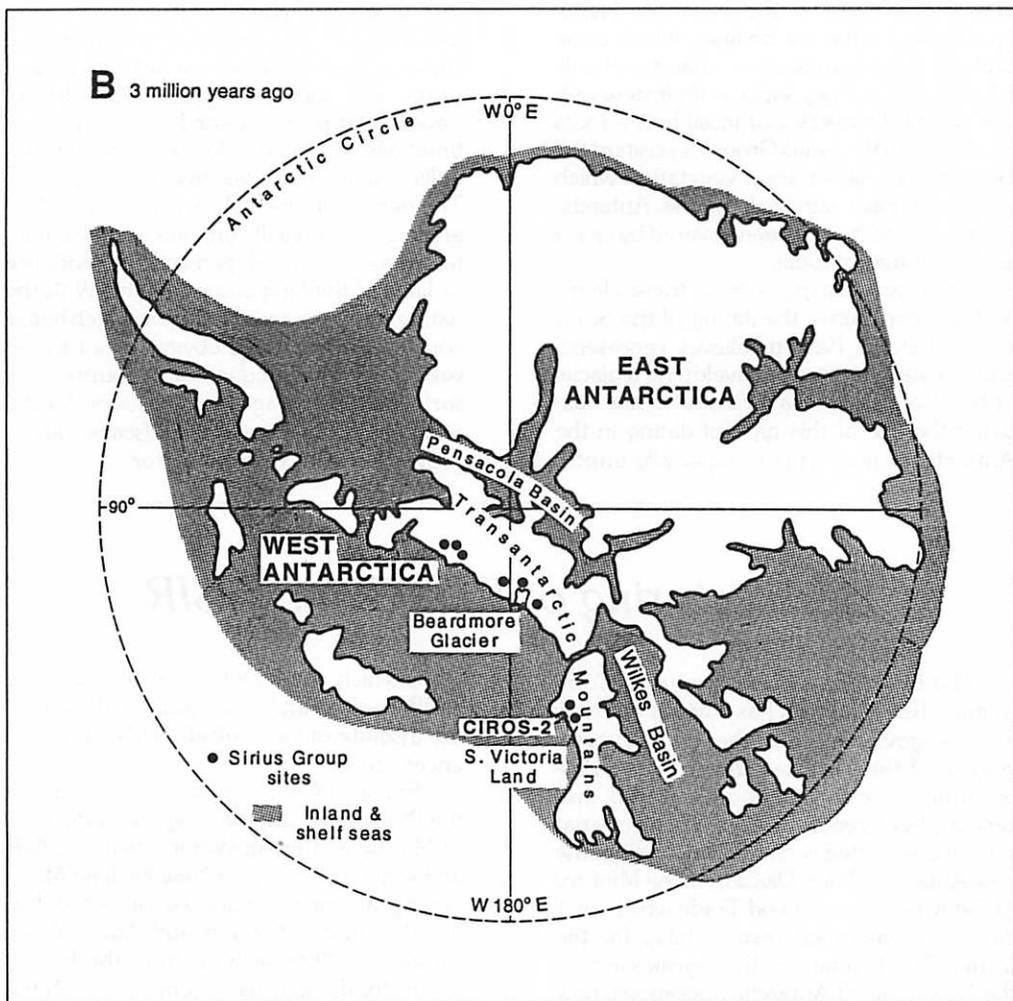


Figure. A. Antarctica, and the ice sheet at its greatest recent extent around 20,000 years ago (from Denton, Prentice & Burckle in *Tingey's Geology of Antarctica*, Clarendon Press, 1991.) The ice flow lines show how glacial deposits of the Sirius Group must have come from the East Antarctic interior.

arctic ice sheet. However Shackleton and others reported to a workshop on Cenozoic climate change in Haarlem in September on variations in the deep-sea isotope record that are consistent with large changes in global ice volume around three million years ago.

For his third argument Sugden used glaciology. An increase of a few degrees in temperature would most likely increase snow-fall and expand and not decrease the ice sheet. He also notes that P. Huybrechts, glacial modeler from the Free University of Brussels, calculates an increase of 20 to 25



B. The Antarctic landmass around 3 million years ago, according to the Webb-Harwood hypothesis, with seas inland of the Transantarctic Mountains. Sirius Group sites with Pliocene marine diatoms are marked. A warmer climate at this time is also indicated by fossil beech leaves at the head of the Beardmore Glacier in these same deposits whose age has been confirmed by radio-isotopic dating of volcanic ash associated with the diatoms in strata cored by the CIROS-2 drillhole. Diagrams: Sally Rowe, Victoria University

deg C would be necessary to remove the present ice sheet from the East Antarctic interior.

This last argument against the new view is valid, Barrett says, only if you assume that

there was a large cold ice sheet like the present prior to the three million year warming. The Webb-Harwood view, outlined earlier, does not make that assumption. They claim that earlier ice sheets were large but

warm, like those of the Northern Hemisphere during the last ice ages, which came and went with temperature changes of only a few degrees. They support their view with the recent discoveries of fossil beech roots and leaves in the Sirius Group deposits of the Beardmore Glacier area, vegetation which could not have survived on the Antarctic continent had it once been covered by an ice sheet like that of today.

Whatever transpires from these claims and counter-claims, the dating of the Sirius Group diatoms, Barrett believes, represents a major step forward in developing a glacial history for Antarctica because it has validated the use of this type of dating in the Antarctic region. This is especially impor-

tant when you consider that diatoms are much more common than volcanic ash in Antarctic sediments of the last few million years, and there are around 30 diatom "events" (appearances or disappearances in time) whose timing is known to within 0.2 million years in the last five million years.

The debate on the style and history of Antarctic glaciation will continue as new dating techniques are developed and new evidence or lines of thinking come to light. With the dating of marine sediments now much better controlled there is an obvious need to develop reliable techniques for measuring rock surface exposure ages so that claims for the antiquity of the Antarctic landscape can be properly tested. *Barrett-editor*

Restructuring of RDRC and DSIR

The Ross Dependency Research Committee, (RDRC) which has advised the New Zealand government on the scientific component of the New Zealand Antarctic Programme since its inception in 1958, has recently been reconstituted. The secretariat for the committee is now located within the new Antarctic Policy Division of the Ministry of External Relations and Trade which on 1 July 1992 assumed responsibility for the former DSIR Antarctic, the logistics arm of the New Zealand Antarctic operations, now known as the New Zealand Antarctic Programme. The Ministry is currently calling for nominations for the newly constituted research committee.

The change is part of an extensive government restructuring of science in New Zealand which has involved the complete disbanding of the old Department of Scientific and Industrial Research and the creation of a series of crown research institutes.

Many of the Divisions of the DSIR were involved in Antarctic research. Among them Geophysics Division and Geological Survey

DSIR which combined in 1990 to become DSIR Geology and Geophysics and are now the Institute of Geological and Nuclear Sciences Ltd.

Some of Chemistry Division, some of the Physics and Engineering Laboratory, all of Marine and Fresh Water Sciences DSIR and some staff from the New Zealand Meteorological Service have become the National Institute of Water and Atmospheric Research. Other sections from the former chemistry division have combined with the Communicable Diseases section of the Department of Health to become the Institute of Environmental Health and Forensic Sciences Ltd.

Landcare Research New Zealand Ltd is an amalgam of what in 1988 was the Soil Conservation Group in Water and Soil, Division of the Ministry of Works, the Forest and Wildlands Division of the Forest Research Institute of the Ministry of Forestry, the Soil Bureau, Animal Ecology, Botany and part of Information Technology Divisions of DSIR and the Rabbit and Land

Management Research Group of MAF. The former Industrial Processing division of DSIR together with part of Physics and Engineering and part of Chemistry Division is now Industrial Research and Development Ltd.

(Other new organisations include the Horticultural and Food Research Institute of New Zealand and the New Zealand Institute of Crop Research Limited and the New Zealand Pastoral and Agricultural Research Ltd. DSIR Social Sciences has now become the Institute of Social Research and Development Ltd.)

These institutes have assimilated some of the former Department's functions and acquired some of their own. The CRI's are now financed independently of government but also use government funds.

Two completely new organisations have been created; these are the Ministry for Research, Science and Technology and the Foundation for Research, Science and Technology. The Ministry is the principal science policy department of government while the Foundation is a crown owned enterprise which purchases scientific research and technology on behalf of government through the Public Good Science Fund and the Technology for Business Growth Fund. As such, it is a major provider of money for the Crown Research Institutes which also draw their funds from other sources in government and the private sector.

The functions of the new Ross Dependency Research Committee shall be as follows.

1. To advise the Chief Executive of the Ministry of External Relations and Trade (MERT) on the scientific component of the Annual New Zealand Antarctic programme (AP) including the matching of programmes and the prioritising of proposals to available logistics so as to maximise the overall level of scientific input;

2. To this end the RDRC will:

-call for proposals for Antarctic scientific research in a form acceptable to the Founda-

tion for Research, Science and Technology (FRST);

-develop a proposed annual scientific research programme, taking into account:

a) logistic feasibility

b) sources of funding

c) assessments and other information provided by the different funding agencies

(d) national science priorities as endorsed by the Minister of Research, Science and Technology

e) quality and relevance of the science

f) international cooperation, and

g) environmental assessments;

-liaise with the Foundation for Research, Science and Technology (FRST) regarding the finalisation of the Public Good Funded science programme in accordance with FRST's statutory obligations;

ensure that satisfactory environmental assessments are undertaken in respect of all components of the proposed annual scientific research programme;

submit the proposed annual scientific research programme to the Chief Executive of the Ministry of External Relations and Trade (MERT) for approval by the Minister of External Relations and Trade and the Minister of Research, Science and Technology;

-review and evaluate projects undertaken as part of the scientific research programme

-prepare an Annual Report on the scientific research programme;

-advise on the publication and dissemination of the results of scientific research and investigation, and the custody of records;

3. To advise on the impact of other activities in Antarctica on the science component of the New Zealand programme, including other AP activity in the Ross Dependency, and the operations and expeditions of other countries;

4. to Advise the Ministers of Research, Science and Technology and of External Relations and Trade on future directions for Antarctic research, as appropriate; and

5. To receive submissions and coordinate recommendations on appropriate recipients of Polar Medal awards.

In brief

>Daylight saving, introduced in New Zealand in the mid 1980's, has finally been accepted at Scott Base bringing the area into line with New Zealand time. This is the first summer season clocks have been moved forward to facilitate air movements to and from the ice and phone calls to and from New Zealand.

The decision to adopt daylight saving required the mutual consent of both the New Zealand and American programmes and overcomes the need to accommodate lunch breaks at both ends. Some scientists have had to adjust experiment times for the sake of consistency but this is not new as many working, particularly in the field, have been reversing day and "night" to suit their research during the summer when it is light for 24 hours a day.

>Four scientists have returned to Scott Base to complete a programme thwarted by equipment failure last summer. They are Drs Tim Haskell, Matthew Jury and Simon Gibson of Industrial Research Ltd in Wellington, and Dr Pat Langhorne of Otago University. Working out on the sea ice near Tent Island the party are using a \$60,000 ditch digger to cut beams of ice 10 metres long which are then subjected to different loads to test for signs of fatigue.

Information on ice strength is particularly useful because the summer programme relies heavily on sea ice runways for aircraft and roads for vehicles. With 24 hours of daylight the team has been working in stints of up to 20 hours at a time to complete their field trials.

>Two parties of distinguished visitors have travelled south this season with the New Zealand Antarctic Programme. The first, comprising the Hon. Dr Lockwood Smith, Minister of Education; Joy McLauchlan, Member of Parliament for Western Hutt and Dr Morgan Fahey, Deputy-Mayor of Christchurch spent five days in Antarctica in

mid-November. Accompanied by Malcolm MacFarlane from the programme in Christchurch they visited McMurdo Station, the historic huts and the dry valleys.

A second group comprising the Governor General Dame Catherine Tizard, her personal assistant Shona Scott and Professor Pat Bergquist from the University of Auckland were accompanied by the Director of the Programme, Gillian Wratt. They are scheduled to be in Antarctica from November 23 to 28 and were to visit much the same areas.

Antarctic Heritage Trust

Work on the restoration of the historic huts of the Ross Dependency will be continued by the Antarctic Heritage Trust this season. A party, under the leadership of John Charles was scheduled to travel south on December 10.

Members comprise David Woodings, Susan Harrison from the Trust in Christchurch and Lynn Campbell.

Working at all three of the huts they will continue the routine environmental monitoring, including keeping a record on visitor numbers. Special log books will be established in each hut.

David Woodings will be responsible for continuing the compilation of the museological inventory/condition report of artifacts at Cape Evans onto a computer. In this task he will be assisted by Susan Harrison who will also carry out a photographic programme. The compilation of a museological inventory/condition report on the status of Cape Evans will also be undertaken.

Lynn Campbell's programme involves monitoring and resetting the environmental loggers in each hut and preparing a report on the conditions which have prevailed over the last 12 months. She will also assist with

the compilation of the inventory, continue curatorial and conservation work on broken or damaged objects and on paper objects and consider and report on displays in each hut. The party are scheduled to return to

New Zealand about mid-January.

In June the Trust received a grant of \$10,000 from the Minister of External Relations and Trade as part of the funding for its continuing conservation programme.

ANARE

Australia's huskies resettled in Minnesota

Australia's huskies have now begun a new life in North America. The 22 dogs arrived in Hobart aboard the *Aurora Australis* at 4 p.m. on Monday 23 November to begin the final leg of their long journey to the United States. Their departure from Antarctica was required under the terms of an international agreement that designates the continent a nature reserve. They will live the rest of their lives in the forest and lake country of northern Minnesota, near the North American Great Lakes.

The Protocol to the Antarctic Treaty on Environmental Protection (the "Madrid Protocol") was signed at a meeting of the Treaty parties in Madrid on 4 October, 1992. It designates Antarctica as a natural reserve and requires, among other things, that all human activities in Antarctica be planned to avoid further jeopardy to endangered or threatened species and detrimental changes in distribution, abundance or productivity of animals and plants.

Annex II to the Treaty deals specifically with conservation of Antarctic animals and plants. It prohibits taking of indigenous animals or plants or "harmful interference" with native species (such activities as disturbing bird and seal concentrations with aircraft or land vehicles and using explosive or fire-arms) except where a permit has been issued for scientific or educational purposes.

Article 4 of the Annex deals specifically with "introduction of non-native species, parasites and diseases". It states that "no species

of animal or plant not native to the Antarctic Treaty area shall be introduced onto land or ice shelves, or into water in the Antarctic Treaty area, except in accordance with a permit." Permits may be issued to allow the importation, under strict conditions, of domestic plants and laboratory animals and plants, including viruses, bacteria, yeasts and fungi. All such animals and plants may continue to live in Antarctica only during the period covered by a permit.

Dogs, however, are specifically excluded from consideration for permits. Under Clause 2 Article 4, inserted during the earlier negotiations over the Protocol, "Dogs shall not be introduced onto land or ice shelves and dogs currently in those areas shall be removed by 1 April 1994."

The provisions of the Madrid Protocol have been incorporated into Antarctic environmental protection legislation now before the Australian Parliament.

Australia first introduced dogs into Ant-

arctica in 1950 when the government obtained 12 Labrador and Greenland huskies from a French expedition for use at Heard Island prior to the establishment of an Antarctic Station. Sixteen huskies, including seven pups were loaded aboard the supply vessel on 15 January 1950; they arrived at Heard Island on February 5. Four years later on 21 January 1954, 27 huskies left Heard Island by ship, arriving at the site of the new Mawson Station in Antarctica on 11 February 1954. Between 1957 and 1970 dogs were established at Wilkes and Davis Stations but eventually they were sent to Mawson. In November 1992, 19 of Mawson's working Antarctic huskies and three pups were loaded aboard the *Aurora Australis* bound for Hobart and then by air to Minnesota, USA via Melbourne and Los Angeles.

In considering the future of the huskies in Antarctica the Australian Antarctic Division, with the approval of their Animal Ethics Committee tried, as far as possible, to keep the dogs together. They also tried to ensure that they continue to be working dogs and that the new living conditions should be as close as possible to those which the dogs had known in Antarctica. They sought unsuccessfully to find a suitable location in Australia, and of all the places inspected the facilities offered by the two outdoor recreation and educational establishments near Ely, Minnesota were found to be the most suitable.

Ely is a small town about 35 km south of the Canadian border, at the southern edge of the Northwoods wilderness area. The region is densely forested and contains numerous freshwater lakes. Its normal snow season is over six months from mid-October to late April and its lakes are frozen by mid-November. A network of trails through the forests and across frozen lakes allows extensive wintertime dog sledge activities.

The two new homes are Wintergreen Lodge and Voyageur Outward Bound School. Each provides programmes of recreational sledging very similar to the dogs'

main activities at Mawson. Each of the organisations maintains between 30 and 40 dogs, a size large enough to accommodate the Mawson teams but not so big that the Australian group would lose its identity. They will enable the dogs to continue doing what they have always done - work in teams with humans.

The dogs' new home is, in many respects, very different from the bleak, icy landscape they were born into at Mawson, Antarctica, but there will be substantial similarities with their Antarctic careers. Northern Minnesota is snow-covered for over half the year, and its lakes freeze in winter, enabling the dogs to be used for the same oversnow sledging work they were used to in Antarctica. Each of the two establishments to which the dogs have been sent run 30 to 40 huskies in outdoor education and recreational activities.

Although the deadline for the dogs' departure from Antarctica is not until next year they were moved in December 1992 because the selected operators could not guarantee placement for them after this time.

Travel arrangements

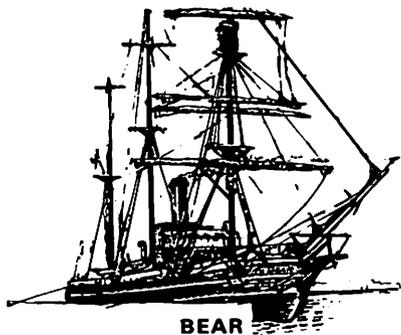
Ensuring the dogs' safety during travel was the task of a Hobart-based veterinary surgeon Barry Wells, who traveled south on the *Aurora Australis* to return to Hobart with them.

All arrangements, once the ship was in Hobart, were subject to Australian quarantine restrictions and were under the control of the Principal Quarantine Officer (Animals) for Tasmania, Dr Roger Hall for although Australian owned, the huskies had "foreign animal" status during their brief stay and were therefore subject to in-transit quarantine restrictions. Special arrangements were made for media coverage of their brief time in Australia but these were strictly in accordance with quarantine directives.

The travel schedule was calculated to minimise the dog's enclosure in their specially designed travel boxes. Having completed the 5500 km journey across the southern ocean and arrived safely they were placed in their individual transit boxes for the journey to the states early in the morning of Tuesday 24 November 1992. At 5.30 a.m. the truck carrying the dogs departed for a charter flight to Melbourne which departed at 7.20 a.m. At 1 p.m. in the afternoon the international flight left Melbourne for Los Angeles. They were accompanied by Alan Rooke and Dave Pottage, two dog handlers who had been with them at Mawson and accompanied them on their sea voyage. During their three-day road journey to Minnesota the dogs were to be checked and exercised by their handlers every four hours. The men were to stay with the dogs for a time to assist in their resettlement process.

The last six

Six of Mawson's dogs remain at the station. They are too old to continue working; a decision on the placement of any remaining at Mawson the end of the 1993-94 summer will be made with their welfare in mind and in consultation with the Antarctic Animal Ethics Committee established by the division.



BEAR

Wanted: Professional people for Antarctic service

"Are you a professional person looking for some time away from it all? The Australian Antarctic Division may have just the job for you."

"Each year," states a recent press release, "more than 100 Australian women and men from a range of backgrounds are recruited to undertake work in Antarctica."

Like other national programmes which draw from a range of scientific and other disciplines the Australian programme advertises for personnel. As early as October 1992 they were seeking professionals who would work for periods from five to 15 months at one of the four permanent research stations, Casey, Davis and Mawson in Antarctica and on subantarctic Macquarie Island. Each of the four stations is managed throughout the year by a station leader, and includes in its personnel a medical officer, who besides undertaking research into human adaptation to the Antarctic environment, is responsible for the surgical, medical and dental care of the expeditioners.

Some of the other positions require work at field locations; glaciologists studying the ice structure and movement and biologists undertake research into life forms varying from penguins to micro-organisms. Other trade and technical staff will be recruited following advertisements in January.

"All," says the press release, will have the experience of living and working in some of the world's most pristine and beautiful places.

The last time the Australian Antarctic Division ran such a recruitment campaign was for trades people, they were besieged with enquiries; the outcome of this campaign was not known at the time Antarctic went to press.

Germany

Eight voyages of the FS Polarstern in current programme

Three voyages, two of which have still to be completed, make up the series of eight being undertaken in the current 1992-93 season by *FS Polarstern* for the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven. A total of 11 German research institutes, organisations and universities have been involved in the three final voyages as well as scientists from Belgium, Brazil, Denmark, Estonia, France, the Netherlands, Sweden and the United States. During the second of the three voyages in this leg the Georg von Neumayer Station located at 70deg 37'S and 08deg22'W in Atka Iceport, Ekstromisen in the northeastern Weddell Sea will be resupplied for the coming winter.

The three legs of Antarktis X/6-8 bring the year long campaign of *FS Polarstern* in Antarctic waters to a close. This year the scientists aboard voyage six operating in the Southern Ocean have concentrated on its role in world matters and energy budgets focussing on the elucidation and quantification of biogeochemical processes, particularly the carbon cycle.

Voyage seven was a continuation of previous studies addressing the circulation of the Weddell Gyre and the magnitude of deep water formation. The work undertaken on both these voyages represents a contribution to the ongoing international programmes Joint Global Ocean Flux Study (JOGFS) of IGBP and World Ocean Circulation Experiment (WOCE) of WCRP.

The last of the three is essentially the return voyage of the *FS Polarstern* to Bremerhaven. Scientists on board will take the opportunity on this south-north transect to study latitudinal gradients in various properties particularly CO₂ partial pressure and ocean optics.

Spring at the ice edge

Antarctic Cruise six began on 20 September at Punta Arenas and ended in Cape Town on 29 November. The vessel was under the command of Captain Suhrmeyer. Fifty one research personnel were involved. The aim of the voyage was to assess the role of this area in the global carbon budget and to elucidate the processes involved in carbon uptake recycling and sequestration. This work is important because currently the role of the Southern Ocean in uptake of atmospheric carbon dioxide is poorly understood but the indications are that this region is of global significance.

Previous studies of the carbon cycle carried out from the *Polarstern* have centred on the biological processes occurring at the receding ice edge or on large scale seasonal distributional patterns of the various biological properties of this southern ocean in relation to the physical-chemical environment. One really important region, the permanently ice free waters of the Circumpolar

Current has up until now only been marginally studied.

It is well known that the seasonal retreat of ice cover induces rapid phytoplankton growth in the melt water zone, however information on the situation prevailing in this broad band of open water which lies between the convergence and the ice edge in early spring, prior to and just following, ice melt is very meagre. The scant information already available to the scientists indicates that this vast area is most productive in winter and early spring just prior or at the start of the seasonal retreat of ice cover. Several reasons have been advanced for this. They include the stabilisation of the shallow mixed layer of low salinity northern water which overlies the high salinity Weddell Sea water just prior to the melt; the stimulation of algal growth rates by the presence of adequate supplies of certain essential elements and the low grazing pressure exerted by zooplankton whose populations have not yet attained their summer proportions.

The scientific work began shortly after leaving the coastal waters of South America and centred on surface registrations of temperature, salinity, chlorophyll, DMSP and CO₂. About the third day of the voyage the vessel stopped to check instruments and equipment prior to reaching their main area of investigation between the area 50 and 62 degrees south. Thereafter the cruise was effectively divided into two sections; the first comprising meso-scale transects from within the ice covered Weddell Sea to beyond the Antarctic convergence, while the second was process oriented with studies being undertaken within selected water masses identified by means of a drifting instrument array.

During the first section, scientists assessed the biomass and species distribution of the various components of the pelagic systems of the different water masses in relation to their physical chemical environments.

The drift stations, which were the main

feature of the second section were occupied for a few days each, with three of up to ten days duration, the first being at the beginning of the voyage with the second at the middle and the third at the end. Each of the longer stops was in the vicinity of a long term moored array comprising sediment traps and current meters which was deployed on voyage three and which it is planned to redeploy on voyage seven. During the other short and long term drifting stations scientists deployed sediment traps, multisamplers and current meters often several hundred metres down. Daily measurements were taken at and around the arrays of the physical, chemical and biological parameters in the water column and on the deep sea floor. From these instrument arrays they obtained samples from which to study the various factors influencing production, grazing breakdown and sinking rates of organic substance in a given body of water. In addition to the field measurements they carried out a variety of experiments on board the vessel to assess the role of specific factors on various processes of the importance to the carbon cycle. The results of these investigations will provide the data necessary for them to realistically model the ocean uptake of carbon. Weather observations were also made and the condition of the sea ice was monitored during the cruise. Other observations included recordings of sightings of seals, seabirds and whales.

The Weddell Sea Gyre Study

Antarctic 7 "The Summer Weddell Gyre Study 1992/93" is part of a series of cruises along the same transect cutting across the Weddell Gyre between Joinville Island at the Northern tip of the Antarctic Peninsula and Kapp Norveiga. The cruise, under the command of Captain H. Jonas, and comprising 52 researchers, began on 3 December 1992 in Cape Town and is scheduled to end at Ushuaia on 22 January 1993.

Assessment of the magnitude and seasonal

and annual variation in circulation patterns of the Wedell Gyre are central to the work being undertaken on the cruise. The chemistry, including carbon dioxide studies and the biology of the water masses is being investigated by different groups. As part of the programme a series of CTD rosette stations are being occupied along the transect, vertical haul nets for zooplankton samples are being taken. Moorings with sediment traps will be recovered and some deployed in the area of the Antarctic Polar Frontal Zone and the northern Weddell Gyre boundary. Six upward looking sonars designed to register ice thickness are being serviced.

Physical and chemical measurements from the moving ship will be started during the transect across the Antarctic Circumpolar Current towards the Neumayer Station.

Once at Neumayer Station technical and scientific overwintering personnel will disembark. Supplies of goods and equipment for the next winter period will also be offloaded. Additional groups of personnel will build an automatic measuring station, carry out a drilling programme in the ice shelf and conduct a meteorological resource project.

Scientifically the marine programme consists of the measurement of vertical profiles of temperature, salinity and natural trace substances at hydrographic stations. In addition 20 moorings with current meters and sediment traps will be recovered and seven redeployed. Six upward looking sonars are currently installed to measure ice thickness. These will be exchanged. The measurements aim to determine the circulation and water mass distribution in the Weddell Gyre with the related transport of mass, heat and salt.

Data acquired from this work will allow scientists to assess the contribution that the Weddell Sea makes to the world oceans' effect on climate. In this context the programme focuses on the rate of bottom water formation in the Weddell Sea which controls

to a large extent vertical exchange and consequently the ability of the ocean to store heat and dissolved substances. These investigations which are part of the Weddell Gyre Study, began in 1989 and contribute to the World Ocean Circulation Experiment (WOCE). An air-sea interaction programme, based on measurements from drifting buoys, aims at the heat exchange between ocean and atmosphere of the ice covered ocean.

The hydrographic station work stops east of Joinville Island from where *Polarstern* will proceed to Drake Passage. The physical and chemical work from the moving ship will be continued across the Antarctic circumpolar current. On 22 January, 1993 *Polarstern* is scheduled to dock at Ushuaia.

The field measurements and the data from the moorings will provide further information on the role of the region in the global budget of water, heat and salt as well as deep circulation induced by the formation of bottom water. Experiments are also planned to address the question of heat flux through the sea ice cover and the influence of UV/B radiation on phytoplankton. The work being undertaken by the scientists participating in this cruise should contribute significantly to their knowledge of the hydrography, biogeochemistry and ecology of the Weddell Gyre.

Homeward bound Final voyage for the year

FS Polarstern is scheduled to depart Ushuaia on 24 January 1993 on her final voyage which should end in Bremerhaven on February 21. The captain will again be H. Jonas and a total of 17 researchers will be involved. During this cruise, ozone and carbon dioxide concentrations in the atmosphere and the sea water will be measured and oxygen, and chlorophyll concentrations in the surface water will be monitored. Other investigations include the determination of optical properties of surface

waters and the first test and measurements with two ship-board LIDAR systems.

As on previous cruises continuous underway measurements of temperature, salinity and optical properties of surface sea-water will be carried out using the hydrographic well of the ship.

These measurements contribute to

- a statistical approach to the accumulation process of fine particles and chlorophyll in convergences of frontal zones. This is part of the field programme for particle flux studies in the south Atlantic;
- improvement of knowledge of optical properties of sea-water with respect to the use of LIDAR systems and satellite remote sensing;
- investigations on the use of Gelbstoff as a tracer of water masses.

A hydrographic LIDAR has been developed jointly by the University of Oldenburg and the Alfred-Wegener Institute in Germany. It will be operated in first test measurements during this cruise. The objective of this development is to devise a method which allows scientists to derive depth profiles of hydrographic parameters in the upper water layers by a remote sensing technique.

The first and final legs of *FS Polarstern* on its way to and from Antarctica offer ample opportunity for underway carbon dioxide measurements. The scientists envisage that this will be the start of a five year survey of the partial pressure of carbon dioxide in surface waters and in the overlying atmosphere across the Atlantic during those legs. The first such work was undertaken on the cruise run in November 1991, in collaboration with Dr Schneider of the Institute for Meereforschung at Kiel. Parameters to be measured are total carbon dioxide, partial pressure in the air and sea water and salinity or conductivity and temperature. Other important quantities are dissolved oxygen, chlorophyll, nutrient concentrations and meteorological observations, notably wind speed, sea state, humidity, atmospheric pressure and air temperature.

A gas chromatograph and an equilibrator for continuous carbon dioxide measurement have been built upon the advice of Dr Watson of Plymouth Marine Laboratory for this project.

The investigation of the atmospheric chemistry group will continue the measurements performed during the *Polarstern* Expedition, Antarctic X/1. The crucial point of the programme is the vertical and horizontal distribution of ozone which will be recorded along the cruise track Ushuaia-Bremerhaven by means of ozone sounding. Apart from ozone, hydrogen peroxide H_2O_2 is a further important atmospheric photo-oxidant. The concentration profile will be measured parallel to the ozone distribution. Photooxidants are key molecules for the oxidation potential of the atmosphere. Thus, measured distributions and mixing ratios are pivotal for atmospheric model systems. In order to simulate the possible impact of anthropogenic emissions on tropospheric chemistry it is decisive to measure the distribution of these compounds on a global scale.

An additional aspect of the research programme deals with the sources and sinks of hydrogen peroxide in concentrations in surface water and in different water depths. In combination with laboratory studies on the hydrogen peroxide formation by photo-oxidation processes, these measurements should elucidate the role of the different sources and sinks in the oceans.

Vertical ozone profiles will be measured with balloon borne ozone sondes, horizontal distribution of ozone by means of a ship based ozone analyzer. Hydrogen peroxide will be measured by a fluorimetric method. The chief scientists for each of the three legs were Professor V. Smetacek, Dr E. Fahrback and Professor G. Krause respectively.



JARE-34

Marine science and drilling programmes involved in 1992-93 antarctic expedition

Fifty-five members of Jare 34, the 34th Japanese Antarctic Research Expedition and two observers were on board the research vessel and icebreaker *Shirase* when she left Tokyo on 14 November 1992. The vessel was due in Freemantle on November 28 for resupply and scheduled to depart six days later for areas 60deg S and Syowa Station. *Shirase* carried the summer science team and winter party for 1993. Her captain this year is Takehiro Hisamatsu and his executive officer is Tatsuo Kato. In addition to resupplying Syowa Station *Shirase* is to support a number of field and marine science projects spread over a wide area.

On board are two Sikorsky S-61A and a Bell 47G-2A helicopters. These will be used to deploy personnel and equipment. The officer in charge of the helicopter detachment is Seiichi Takahashi. Field work at Syowa is further supplemented by logistic support from two aircraft, a Pilatus Porter PC 6/B2-H4 (designated JA 8228) and a Cessna A-185F (JA 3889), owned by the National Institute of Polar Research and flown by civilian personnel.

Science programmes

Biology

Six biological programmes are being undertaken by the Japanese during the 1992/93 programme. Now in its second year the Sea Ice Ecology and Flux Study (SIEFS), is being continued by Y Naito and M. Fukuchi from the National Institute of Polar Research. This programme which

may run for five to ten years aims to clarify the biological processes peculiar to the existence of seasonal sea ice. This involves examination of the temporal changes of primary production and its downward sedimentation and decomposition processes, a study of the dynamics of zooplankton, benthos and nekton, energy transfer into higher trophic levels and paleo-environmental studies of the sea ice area.

SIEFS is being undertaken between 35deg E and 40 deg E around Syowa Station throughout the year, from the ship between 45deg E and 55 deg E and between 55deg and 60 deg E in the Indian sector of the Antarctic ocean. Two other areas, Breid Bay, around 24 deg E and Prydz Bay have also been selected as reference sites. Prydz Bay is already one of the CCAMLR monitoring areas.

Dr Fukuchi is also undertaking mooring experiments on the seasonal sea ice in and around the Lutzow-Holm Bay near Syowa

Station. These should yield information on the temporal and spatial variability of primary production and its downward flux. He will be using a chlorophyll measuring buoy and a time series sediment trap in the study which is long-term.

The metabolic rates of benthic animals will be measured under laboratory and natural conditions in a study designed to estimate their food requirements. This is being undertaken by H. Numanami from the Tokyo University of Fisheries and involves direct measurement of growth and food consumption rates.

Sea-bottom sediment is to be sampled in coastal fast ice areas and on the seasonal sea ice in Lutzow-Holm Bay around Syowa Station. A piston corer will be used in the project which involves examination of the occurrence of foraminifera and plankton. The investigator A. Igarashi of Tohoku University will also study samples collected in a sediment trap.

Working on board the *Shirase* as she sails to and from Syowa Station M. Ishii of JMA, the Japanese Meteorological Agency, and M Fukuchi of NIPR will measure suspended marine materials. Total carbon concentrations both in the air and water will also be measured continuously during the voyages.

A fish and benthic fauna survey, using a beam trawl net, will be conducted at the coastal shelf and shelf break zone of Lutzow-Holm Bay and in the Prydz Bay area during January and February of 1993. T. Iwami of the Tokyo Kasei-Gakium University will be undertaking this project.

(Biological and environmental changes continue to be monitored every five years at SSSI No. 22 in the Yukidori Valley. This was last undertaken in 1991 and is programmed again from 1996. The principal investigators are Y. Ohyama and H. Kanda of NIPR.)

Geodetic and mapping

A Geodetic control survey will be carried out in Langhovde, Skarvsnes, Skallen and

Breidvagnipa using Trimble 4000 SST GPS receivers. Similar equipment will also be used at Syowa Station for GPS observation in response to a call for participation in the 1992/93 GPS, Global Positioning satellite, campaign organised by SCAR. The observer this year is K. Namasu of Geographic Survey Institute in Ibaraki. Aerial photography on a scale of 1:12,000 will be carried out in Skarvsnes for the preparation of colour orthophotomaps.

Geology and geomorphology

Detailed investigations of the petrology, structural geology and geochronology will be undertaken in selected ice-free areas in the Lutzow-Holm Bay region, Prince Harald and Prince Olav Coasts and in the Yamato Mountains. Y. Motoyoshi of NIPR and M. Ishikawa of Tohoku University are the principal investigators involved in this programme.

Geomorphological investigations will be carried out on some ice-free areas in the vicinity of Syowa Station where the focus will be on the problems of raised beaches in relation to environment change. An experimental study on current periglacial processes is part of the programme for which M. Hayashi of Shimane University and T. Sawagaki of Hokkaido University are responsible. These investigators will be joined by M. Ishikawa of Tohoku University in a further geological and geomorphological survey in Enderby Land. This is to be undertaken on a return voyage when *MV Shirase* makes a short visit to Casey Bay and Mt. Riiser-Larsen. Their main purpose is to study petrology of the Napier Complex and glacial geomorphology.

Further detailed geological and geomorphological investigations in selected ice-free areas in Lutzow-Holm Bay and the Prince Olav Coast regions are planned for early 1993. This programme being undertaken by Y. Yoshida of NIPR, will continue until 1995. This season he hopes also to

make a short visit to Enderby Land on each return voyage of *M/S Shirase*.

Solid earth geophysics

Syowa Station was chosen to be one of the class A absolute gravity stations in the International Absolute Gravity Base station Network (IAGBN) at the 19th IUGG/IAG meeting held in 1987. The network is being constructed for monitoring global gravity changes and obtaining accurate gravity value. The first absolute measurement was completed by JARE-33 personnel using a Sakuma-type transportable gravity meter of GSI at a gravity observation hut specially built by JARE-32. Two sets of meter of the Mizusawa type will be used to carry out the observations again in January 1993. T. Tsubokawa and S. Hanada from NAO, the National Astronomical Observatory, are the principal investigators.

T. Sato from the same organisation will be undertaking continuous gravity observation from January 1993 at Syowa. Earth tide observation is also part of his programme. Continuous gravity observation using a superconducting gravity meter is to be continued at least until 1995. VLBI observation to measure the distances between Japan and Syowa and between Australia and Syowa station are to be initiated in the 1993 and GPS measurements will be made continuously at Syowa Station throughout the year. K. Kaminuma of NIPR is the principal investigator.

Glaciology

New oversnow vehicles were tested by Japanese personnel in late July and August of 1992. They are SM-100's, Monster Snow vehicles which have been developed for the research and inland dome project by the Japan Antarctic Research Expedition. They are six and three quarter metres long, are front engined, rear drive, rubber belt-follow tracked vehicles with insulated one-box

cabins. Between October and December an oversnow traverse travelled between Syowa, Mizuho and the Relay station to establish a new route between the Relay Station and Dome-F, Dome Fuji. Glaciological observations including radiò echo sounding and surface snow sampling to determine the chemical snow composition were carried out enroute and around Dome-F. In January 1993 fuel drums are to be deployed in the region in preparation for further work and the glaciological observations will be continued. O. Watanabe of NIPR is the key investigator in this Dome Ice Coring Project in East Antarctica which began in 1991 and will continue until 1996. The project aims at retrieving detailed palaeo-environmental signals as recorded in the Antarctic ice sheet. A 2000-3000 metre deep ice core is to be drilled using a newly developed system.

Airborne and oversnow observations are to be carried out on the sea ice and ice sheet as part of a programme to establish ground and sea truth of the MOS-1 (Marine Observation Satellite) and the European Remote Sensing Satellite ERS-1 satellite remote sensing systems. The data is being received at Syowa Station where acquisition of Synthetic Aperture Radar (SAR) data of Earth Resources Satellite of Japan will also be started.

Atmospheric sciences

Extensive observations of aerosols and CCN together with flights of aerosol-sonde are to be made. Long term in situ observations are continuing for CH₄ and surface ozone. These are being supplemented by visible spectrometer measurements for stratospheric NO₂ and OCIO as well as air sampling for CFC's and carbon isotopes of Co₂.

A new project involving the study of atmospheric chemistry is also planned and will continue until 1996. It is related to the International Global Atmospheric Chemistry Programme (IGAC/IGBP). and com-

prises several co-ordinated observations of greenhouse gases, tropospheric aerosols, stratospheric ozone and associated components as well as horizontal and vertical wind profile work. The stress is to be laid on production and day processes, the horizontal and vertical transport of materials from low to high latitudes and from the stratosphere to the troposphere and cryosphere. The exchange process of minor constituents between the atmosphere and snow or ice needs to be clarified urgently and is tied in with the Deep Ice Core Drilling programme at Dome F. Large facilities such as a GC mass spectrometer, laser heterodyne spectrometer, laser radar, wind profiler and sampling balloon are intended to be developed together with precise and long range continuous measuring systems.

Telemetry data reception from Akebone, the aurora observation satellite is to be continued at Syowa. The signal is received in S-band by a steerable 11 metre parabola antenna constructed in February 1989. M. Sato and E. Ejiri of NIPR are the principle investigators. The programme is to be extended this season with the use of a new multi-band monochromatic aurora imaging system using a low-light-level CCD TV camera developed by Tohoku University. The eight by eight beam riometer installed at the station in January 1992 will continue to operate. An unmanned geophysical observatory, developed and tested in 1988 and 1990, will be tested again in 1992 in the

vicinity of Syowa.

Between December 1992 and January 1993 three polar patrol balloons are to be launched from Syowa. Auroral X-ray, electric and magnetic field and cosmic rays are to be measured from the balloon which will reach an altitude of 30-35 km over Antarctica remaining aloft for one month.

An unmanned geophysical observatory, developed and tested in 1988, 1990 and 1992 is to be tested again at an inland ice field some 50 km south of Syowa. This is a joint project being undertaken by O. Saka from Kyusyu University and N. Sato from NIPR.

Observations of tides, the ocean and antarctic circumpolar currents will be continued from drifting buoys and a bathymetric survey is to be conducted off Luzow Holm Bay. Gravity and geomagnetic surveys are to be continued aboard *M/S Shirase*.

Psychological studies are also being undertaken in cooperation with JARE personnel. Part of the programme is associated with the Antarctic Space-related Human Factors Research Project conducted under the auspices of SCAR.

The *Shirase* is scheduled to leave Syowa and the Antarctic Treaty area about 14 March. She should arrive in Sydney about one week later and depart on 27 March for Tokyo where she is due on 13 April 1993. The winter team at Syowa Station will be led by Natsuo Sato. The officer in charge of the summer programme is Renji Naruse.



A field camp at the foot of the Sor Rondane Mountains

South Africa

Four Hercules' involved in US rescue of injured South African

A South African electronics engineer, who fractured his femur in a snowmobile accident near a remote geological field station in western Queen Maud Land was picked up by a ski-equipped Hercules aircraft early in November, flown across Antarctica to McMurdo Station and then on to New Zealand for hospital treatment in Christchurch.

Four ski-equipped Hercules aircraft took part in the mercy mission which began on November 12 and ended in the early hours of November 14. United States Navy VXE-6 Squadron crews flew three of the aircraft, and the fourth was flown by a crew from the New York Air National Guards. One aircraft was sent from McMurdo Station to backup the mission plane which had a generator failure at the South Pole and had to be replaced.

To pick up 31 year-old Jan Abraham Joubert Hattingh, who was also badly gashed on the arm and left buttock in the accident, the first Hercules had to fly to the South Pole to refuel, and then make a potentially hazardous landing on non-treated snow three kilometers from the field station Grunehogna, which is 25 km south of the main South African base, SANAE IV on the Finbul Ice shelf off the Princess Martha Coast. After transferring Mr Hattingh at the Pole the mission aircraft then flew onto McMurdo Station, completing a round trip of 6502 km.

Late in October Mr Hattingh, leader of the winter team of nine men at SANAE IV, took five of them on a snowmobile journey to Grunehogna. Their task was to prepare the station for use by the summer teams, which arrives at SANAE IV early in December.

Grunehogna, which has accommodation for 18 men, was built in the 1982-83 season at the base of the 70 metre long Ahlmann Ridge. It has no permanent radio aids for navigation or instrument landing facilities.

On November 12 Grunehogna had a fine day, and the team decided to make a snowmobile and sledge journey. Mr Hattingh was on the back of a sledge which was being pulled downhill by a snowmobile at the end of a long rope.

Suddenly the sledge accelerated toward the snowmobile. Mr Hattingh managed to abandon the sledge before it struck but was thrown over the vehicle. He landed on his left side. His femur was fractured, and there were cuts on his leg and arm.

His five colleagues bound his legs together with a splint, and took him back to Grunehogna. The snowmobile driver escaped injury. Back at the base they started the generator and called SANAE IV. A radio operator at the German Georg van Neumeyer Station monitored the calls and stood by to help.

While the medical officer at SANAE IV gave instructions by radioing Mr Hattingh's team, who had done a first aid refresher course before going into the field, cleaned his worst wound and stitched it. He was then

removed from the kitchen table and made comfortable while efforts were made to organise a rescue mission.

Twin Otter ski-equipped aircraft operated by the British Antarctic Survey were all committed and there were no suitable refuelling points for any aircraft flying from South Africa. The two South African Air Force long-range Puma helicopters used for summer air support were not expected until the arrival of the research and supplyship *Agulhas* in early December.

A request for assistance was then made to the US Naval Support Antarctica, by the Antarctic Division Department of the Environment, in Pretoria. This was agreed to and approved by the US National Science Foundation, which owns the aircraft flown by the US Navy crews.

Notification of the request and flight was given to McMurdo Station at 1.15 p.m. local time on November 12. With an augmented crew of 10 and medical assistance on board the first Hercules lifted off the annual ice runway in McMurdo Sound at 9.45 p.m. The pilot in command of the aircraft was Lieutenant H. Heysel. With him were Lieutenants G. Feltz and M. Brennan (second and third pilots) and two polar navigators, Lieutenant-Commander H. Black and D. Johns. Also aboard were two flight engineers, AMHCS Mansour and AE1 J Lavery; two polar loadmasters AE2 S. Powell and AMS1 McTeague, and a medical corpsman HM1 W. Head.

By 1.05 (local time) on November 13 the Hercules was at the Amundsen-Scott South Pole Station to refuel for the 1902 km flight to the landing site near Grunahogna. It took off at 2.10 a.m. (local time) and reached the site at 6.19 a.m. (local time).

Tailwinds up to 60 knots assisted the Hercules on its way to Grunahogna, with half the distance covered the plane was in touch with the South African team, and the pilots and navigators were told of the wind conditions and the roughness of the ice in the area.

By the time the crew sighted the

Grunehogna huts and the 4000 metre peak in the Ahlmann Ridge behind them everybody aboard was aware that landing would be difficult.

After circling the area twice the Hercules made one run in to land on the ice, aided only by a red smoke signal put up by the South Africans. There was no really smooth ice below. The surface was full of sastrugi, and the plane's run was checked quickly by hard ice.

Mr Hattingh had a bumpy ride through sastrugi to the aircraft. It was minor compared to the pounding suffered by the Hercules as it tried to escape from the waves in a sea of rough ice.

Ten times the crew attempted to lift the plane off the ice in different directions. Finally they were released at 8.05 p.m. local time, but not without damage to the aircraft's pressurisation systems which forced the Hercules to fly lower and meant higher fuel consumption.

A loose wire in one section of the navigation system, dislodged by the constant shaking on the ice, shorted, and set off a minor electrical fire and put the whole system out of action. Other aids to navigation enabled the Hercules to carry on.

For the first half of the journey to Pole Station, the plane faced headwinds of up to 60 knots which required constant attention to the fuel supply. Despite all these difficulties the return from Grunehogna took only 41 minutes more than the outward journey. While the Hercules was returning to the Pole a second aircraft was on its way from McMurdo Station to provide backup. It was on the ice with its engines running when the flight from Grunehogna arrived at 12.53 p.m. (local time).

Mr Hattingh barely glimpsed the South Pole Station. By 1.31 p.m. he was on his way to McMurdo Station.

When the second aircraft reached McMurdo Station at 3.49 p.m. (local time) Mr Hattingh was transferred to a third aircraft after he had been examined by a Navy medical officer and passed as fit to fly. This

time the last stage was flown by one of the two Hercules Aircraft of the New York Air National Guard which is again providing additional support for Antarctic operations this summer.

Soon after 5 p.m. the NYANG aircraft was on its way to Christchurch. It landed at 12.40 p.m. on November 14.

Mr Hattingh was taken by ambulance to Christchurch Hospital, and was operated on immediately after his leg had been x-rayed. Having been in Antarctica since December last year Mr Hattingh appreciated the taste of fresh fruit and vegetables, and enjoyed seeing trees, grass and cars again after nearly 12 months at SANAE IV.

South African Programme for 1992/93

South African scientists are working this summer out of their stations SANAE IV and Sarie Maris, and from *mv Agulhas* which will make two trips to the continent and support a marine science programme.

The principle logistic support for the South African programme is being provided by *mv Agulhas*. This vessel has a gross tonnage of 5,359.13 tons and is registered with Lloyds Register in Shipping Class C1 which means she is ice-strengthened for Antarctic operations. Her service speed is 13 knots and maximum speed 14.25 knots. Over the season the officers in charge of the vessel will be Captains W.M. Leith and R. Heather-Clark. She carries a crew of 41.

The *Agulhas* was scheduled to leave Cape Town on 3 December 1992 and arrive at SANAE on 16 December. After unloading and other support operations she was destined to leave for Bouvet Island on 2 January

Mr Hattingh was discharged towards the end of November. He flew back to South Africa, and will return to SANAE IV to brief his replacement.- *Jim Caffin*

Flight distances

The total distance flown by the three aircraft was 9955.12 km. The first from McMurdo to the Pole and onto Grunehogna and back to the Pole covered 4856 km. The second from McMurdo to the Pole and back covered a distance of 2698.21 km and the third flying from McMurdo to Christchurch covered 2400.91 km.

arriving there seven days later and departing on 14 for SANAE for a further few days before returning to Cape Town on 23 February. After two days there she would return to SANAE concluding her summer Antarctic operations in Cape Town on 18 March, 1993.

SANAE IV which lies at 70 deg 18'36" South/02deg 24' 10' West was erected during January-March 1979 on the Fimbul Ice Shelf. The station is manned for summer and winter operations. Mr A.N. Other is in charge of the base for the summer and Mr R. Heather-Clark will be winter leader.

The principle research programmes being undertaken from SANAE cover auroral work, cosmic ray studies, geomagnetics, seismology and VLF Emissions.

Sarie Marais is a geological field base which was erected during December 1982 and February 1983. It lies at 72 deg 01'35" South/02deg 14' 18" West, approximately 250 km south of SANAE near Grunahogna Mountain in the Ahlamannryggen Mts and is to be manned this season for summer operations only. Geological and geophysics programmes mounted, supported and controlled from this station during the summer will be undertaken in the HU Sverdrupfjella,

Ahlmannruggen and Borga Massivet Mountain Ranges.

Two Puma SA 330 J helicopters normally carried aboard *mv Agulhas* will be used to support field operations from SANAE and Sarie Marais stations from December

1992 until March 1993. The officer in charge of the aircraft is Major J.C. Kriegler. Programmes being undertaken from the ship and involving some 30 marine scientists will focus broadly in areas of oceanography, marine biology, and iceberg observations. Cosmic ray work will also be undertaken.

USAP

The Peninsula programme for 1992-93

Both the *R/V Polar Duke* and the *R/V Nathaniel B. Palmer* are being used to support United States operations in the Peninsula area for the 1992-93 summer and winter seasons. In all they will undertake a total of 21 cruises during which they will resupply Palmer Station, support scientific programmes being undertaken in the area as well as on King George Island, and in the Weddell, Ross and Amundsen Seas.

Between 12 September 1992 and the 23 September 1992 *R/V Polar Duke* will undertake 13 cruises and spend a total of 316 days at sea. The vessel is scheduled to support various science programmes during the summer season and marine work during the winter.

The first cruise commenced on 12 September 1992 at Punta Arenas in Chile from where the vessel sailed for Palmer to support the Station opening for the summer research programme and return to the port by September 25.

Seventeen projects are being carried out at Palmer this year, approximately nine of which depend on the *Polar Duke* for implementation insofar as they involve either a research cruise for monitoring of oceanographic parameters and/or trawling for the collection of marine organisms.

graphic parameters and/or trawling for the collection of marine organisms.

Six of the 17 projects will be conducted throughout the year by the contractor's science technician. Work involved in the six includes the monitoring of spectra of the ultra-violet bands for their intensity and seasonal occurrences, satellite images from the Defense Mapping Satellite Program (DMSP), sampling of ambient air, and measurements of very low frequency (VLF) radio waves. The science population at Palmer Station is due to remain high until the departure of the *Polar Duke* on the fourth cruise on 22 May 1993 when one seasonal research project and the six year round projects will remain.

The LTER project

Seasonal science projects were due to commence with the arrival of the *R/V Polar Duke* cruise on 6 October 1992 carrying the first members of the LTER project. This comprehensive measurement programme involves Long-term Ecological Research on the Antarctic marine ecosystems in an ice dominated environment and is being undertaken by investigators from six universities.

They are attempting to define the ecological process linking the extent of annual pack ice with biological dynamics of different trophic levels within antarctic marine communities. In general the focus is on the annual variations in representative populations from the marine food web and on the mechanistic links controlling the observed variations.

Broadly this involves observations, sampling and collection of other data on Adelie penguins, skuas, krill and antarctic silverfish. The methods being used include remote sensing, annual monitoring, a series of process-oriented research cruises and modeling to link spatial and temporal scales between biological and environmental components of the ecosystem. Broad characterisations that can be applied to other large marine environments in the form of models which can be developed from the data and will provide scientists with a predictive capability for issues related to global environmental change.

Not all of the six universities are participating in the project this season but those that are include four parties from the University of California at Santa Barbara. One group of 14 comes from the Department of Biological Sciences and is under the leadership of Dr Barbara B. Prezelin. The party will be involved in shipboard sampling and deck incubation on three voyages of the *Polar Duke* or the *Nathaniel B. Palmer* as well as work in the Palmer Station area and diving for collection of under-ice samples. A group from the Marine Science Institute from the same university is working under the joint leadership of Drs Robin M. Ross and Langdon B. Quetin - as co-principal investigators. Their party of 16 will be participating in two of the cruises during which they will collect krill and silverfish by trawling from the vessels and zodiacs at Palmer Station. A third party of 11 come from the Computer Systems Laboratory (CRSEO) at the same University and will be under the leadership of Raymond C Smith. Their experimental work will focus on the measuring

and defining of the hydrographic and bio-optical properties of the LTER sites from the *Polar Duke* but within a 200 to 400 km limit of Palmer Station and from the Station itself. Another group of 12 led by David M. Karl of the Department of Oceanography at the University of Hawaii at Honolulu, will deploy sediment traps for sampling of material for biogeochemical cycling of carbon and associated biological elements.

Second cruise

The second cruise of the summer season departed from Punta Arenas on 1 October 1992. The vessel sailed directly to King George Island to deliver the research team operating at the U.S field station "Copacabana."

The scientists in the party are studying the reproductive success and population dynamics of the surrounding penguin rookeries. Led by Dr Wayne Z. Trivelpiece, the party, which come from the Old Dominion University and are based at Bolinas in California, are engaged in a comprehensive project monitoring penguins and their role in the antarctic marine food web. The adelies, chinstraps and gentoos nest at Point Thomas near the Polish Arctowski Station. For several years they have been banded at this site for study purposes, the work is intended to expose the age specific demographic parameters of Adelies and compare them with other populations; to compare the foraging behaviour and ecology of the three species as well as the feeding proficiency of the young inexperienced breeders with the older experienced breeders. The information will improve significantly the scientific understanding of the trophic relationship among the penguins enabling hypotheses on how age affects foraging proficiency and in turn breeding and recruitment patterns.

From Copacabana the vessel sailed directly to Palmer Station to offload the LTER researchers and their equipment. It departed Palmer on 11 October 1992 and arrived

back at Punta Arenas on 15 October, 1992. The third cruise of the *R/V Polar Duke* was scheduled to depart from Punta Arenas on 18 October, 1992, again with a full complement on board. Among the personnel were the remaining members of the early season research projects being undertaken at Palmer and also at the Copacabana field camp. The cruise ended at Punta Arenas on 28 October, 1992.

On 2 November the vessel was scheduled to depart again from Punta Arenas for Palmer Station. From there it was to proceed on a 13 day cruise in support of a major biological and physicochemical oceanographic project involving 18 scientists who are conducting research in the Gerlache and Bismarck Straits and at Dalhman Bay. Their work focuses on nitrogen dynamics. New nitrogen (the photosynthetic production of organic material based on nitrate) as a nitrogen source represents the organic matter that is available for export from a system in equilibrium. Environmental factors controlling new production in the Antarctic appear to be quantitatively different from those in temperate areas. The work being undertaken by this party under the leadership of Dr Walker O. Smith from the Graduate Program in Ecology at the University of Tennessee is aimed at determining the relationship between new production and such factors as irradiance, heterotrophic use of nitrogen compounds and concentrations of urea and ammonia.

During the cruise they were collecting water samples and measuring various physical and chemical parameters in water columns. The project is scheduled to continue on two international, multidisciplinary cruises aboard British and French ships. In the meantime the *Polar Duke* returned briefly to Palmer on its way back to Punta Arenas where it was scheduled to arrive on 23 November 1992.

The final cruise for 1992 departed from Punta Arenas and was operated in further support of the LTER project as well as the

delivery of researchers to Palmer Station. It is scheduled to end at Punta Arenas in Chile on 28 December, 1992.

On January 14 the *R/V Polar Duke* again departs from Punta Arenas. After a brief stop at the Copacabana field camp it will be involved in more support of the LTER project until February 8 when it assumes the support of a Special Assignment of the Airlift Mission (SAAM) flight delivering a delegation of media, senior science, and operations managers to King George Island. The vessel is then scheduled to make several round trips to Palmer station to provide the delegation with an extensive overview of the Peninsula operation of the US Antarctic Programme. On February 21 the vessel is due back at Punta Arenas.

Five days later she leaves the port again. This time she will be away until 16 March 1993. During her time at sea she will conduct several short two-to-three day fishing operations out of Palmer in the Low Islands area to collect samples for experimental work and then continue to provide local support of other marine biology science projects which include a further assessment of the fuel spill in the area caused by the wreckage of the Argentine vessel *Bahia Paraiso*.

Fishes caught by bottom trawling during these cruises will be kept in Palmer Station aquaria until they are used in laboratory investigations. Information yielded from this work will help scientists compare tubulins from antarctic fishes with those from related temperate fishes and warm-blooded vertebrates revealing the molecular interactions and structural features necessary for microtubule assembly at low temperatures. The long-term goals of the project are to determine at the molecular level how the tubulins of antarctic fish have structurally adapted to polymerize at these low body temperatures and to examine the dynamics of fish microtubules. The principal investigator of this project is Dr H. William Detrich III of the Department of Biology, North-

eastern University in Boston who will work with a further five researchers.

Between February and April a group of six from the Geochemical and Environmental Research Group under the leadership of Mahlon C. Kennicutt II will be aboard the Polar Duke to obtain fish by bottom trawling from Dallman Bay and Low Island. As part of their project analysis of the samples will be undertaken at Palmer Station for hydrocarbon contamination from the grounding of the *Bahia Paraiso*.

By examining in detail the hydrocarbons sampled from the various sources and their altered by-products, the relative importance of differing inputs can be documented and an insight obtained into the processes that determine their destruction. In addition to sampling of fish, cores will be taken close the stations and at remote sites for analysis to document the onset, composition and magnitude of hydrocarbon pollution caused by the human presence on the Antarctic Peninsula. It is hoped, through this investigation, that the relative importance of local anthropogenic, global anthropogenic and natural combustion hydrocarbons will be determined.

The next cruise will depart from Punta Arenas on 22 March 1993 to continue support of the projects in the vicinity of Palmer Station as well as implementing the rotation of scientific staff on shore. During the 37 days away from the port she will conduct short fishing operations and provide support for coring of sediment samples in the Palmer basin. The cruise ends on 28 April 1993.

Further marine science support will be provided during the next cruise scheduled to depart from Punta Arenas on 3 May. On her return to the port she will be carrying the science teams who arrived at the Station on the February cruise. On 31 May she will set out again to support late season krill studies in open water off the Peninsula south of the antarctic circle. Diving operations will be conducted from the vessel as will as krill

collection. Acoustic measurements will be made to establish densities. Investigations into the winter physiochemical processes within the Peninsula water column will also be conducted before the vessel returns to Punta Arenas on 30 June, 1993.

Support of marine geology and geophysics investigations are the main purposes of the sixth cruise for 1993 which departs Punta Arenas on July 5. The investigations, to be undertaken in the Southern Chilean canals and fjords, will focus on the history of the Patagonian ice sheet during the late Wisconsin glacial maximum. This cruise returns to Punta Arenas on 4 August 1993.

Among the parties on board will be a group of seven from Rice University under the leadership of Dr John B. Anderson from the Department of Geology and Geophysics. Their objective is to examine fundamental questions concerning the dynamics of the Patagonian ice sheet during the late Wisconsin glaciation and the ice sheet's response to changing marine and terrestrial climate change during the transition between the last glacial and interglacial period. Dr Jay A. Stravers from the Department of Geology at Illinois University will lead a group of five researchers working on different aspects of the same problems.

Eight researchers from the Byrd Polar Research Center at Ohio State University under the leadership of Dr Amy R. Leventer will also be on board. Southern South America provides a natural and almost continuous transition from polar to temperate climatic settings. To establish the temporal and physical links between the oceanic, atmospheric, and terrestrial systems in the southern hemisphere however, high resolution late Quaternary paleo-oceanographic and paleoclimatic records are essential. This group will be working on the late Quaternary marine record contained in marginal sediments off the Pacific rim of southern Chile from which they hope to establish the relationships between the timing and extent

of late Quaternary glacial/climatic fluctuations between the Antarctic Peninsula and South America. This will help them complete a regional framework for future paleoclimatic studies of the neogacial history of southern South America and the Antarctic Peninsula region.

The final cruise of the current programme departs from Punta Arenas on 9 August, 1993 in support of a 45 day long programme for the LTER project. The marine biology research conducted during the cruise will include dives to collect samples from under the ice at the edge of the winter limit. In addition investigations of the early season bio-optical properties will be accomplished.

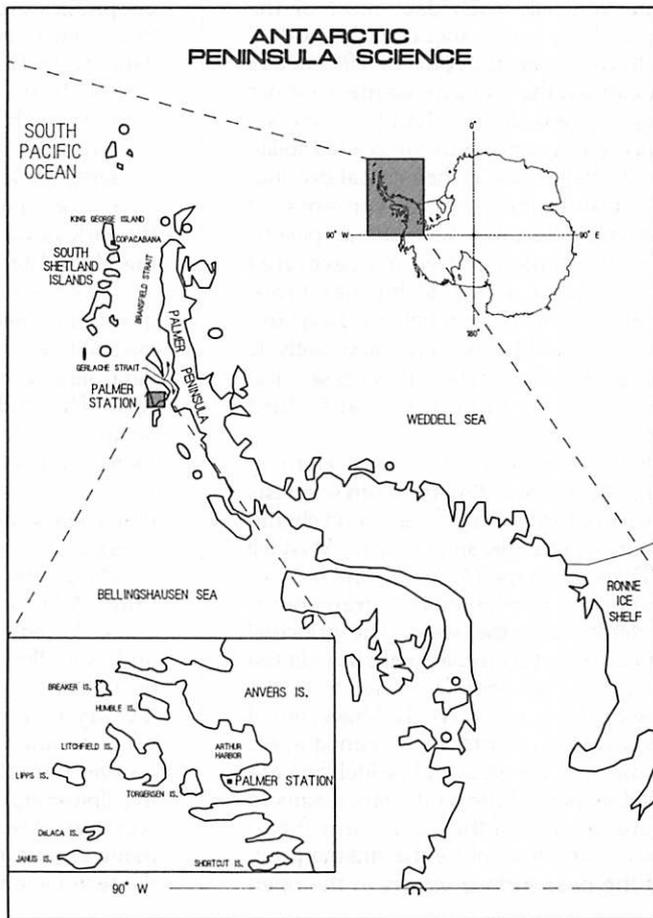
search cruises and spend 335 days at sea during the 1992-93 season. She will be supporting a full field of marine scientific investigations including marine geophysics, geology, biology and physical and chemical oceanography. Much of the work will be conducted in ice-bound areas of the Weddell Sea and the waters surrounding the Palmer Peninsula. These areas were not previously accessible to USAP research vessels.

The first cruise of the *Nathaniel B. Palmer* departed Punta Arenas on 18 September 1992. The focus was on marine biology research in the Weddell Sea in ice covered and ice free areas to determine the micronekton population and distribu-

The R/V Nathaniel B. Palmer

This vessel was completed in 1992. She is ice-classed to the new ABS rules, ABS-A2 and capable of breaking three feet of level ice at three knots. She is 308.5 feet in length and has a draft of 22.5 feet, and can accommodate 37 scientists working in her eight laboratory spaces which total 5,550 square feet. The vessel is operated for the National Science Foundation by the contractor, Antarctic Support Associates (ASA) on a long term lease from Edison Chouest Offshore, Galliano, Louisiana. This is her first full season of research.

R/V Nathaniel B. Palmer will conduct eight scientific re-



tion. Extensive use was made of the vessel's advanced sonar systems and of traps. She returned to Punta Arenas on 10 October, 1992.

On board was Dr Kenneth L. Smith Jr and a party of eight from the Scripps Institute of Oceanography at the University of California at San Diego. Their project is of particular interest because recently scientists have discovered deep-sea fish in the stomachs of surface-feeding seabirds that forage in open areas of pack ice. This suggests that a prey-predator relationship may exist between two apparently disjunct communities. Although many of the deep-sea species found in the stomachs of the birds are known to migrate vertically each day, most of these fish have been caught in open waters away from the ice at depths of 100 meters or greater but the seabirds sampled are not known to forage deeper than five meters.

This season's programme is a feasibility study to determine if the vertical distribution, abundance and movements of acoustically-detectable fish in the pelagic zone are the same in ice-free and ice covered oceanic regions. If the techniques prove successful, a more comprehensive, long term study is planned to examine quantitatively prey-predator links between deep-sea and sea-ice fish communities and bird populations.

On October 20 ten days after returning to Punta Arenas she departed with scientists whose work focused on physical and chemical oceanographic parameters in the Weddell Sea. They also hoped to locate and recover several moored sedimentation traps previously deployed in the area. The principal investigator for this project with its field ten of ten is Dr Theodore D. Foster from the Marine Sciences section of the University of California at Santa Cruz. Two oceanographic expeditions to the western Weddell Sea are planned as part of the study which aims to measure the flow of the newly formed bottom water and to explore the sinking process of the near-surface waters in the open

ocean to see how these affect the deep water flows. The programme is part of the scientists attempt to produce a coherent picture of the importance of this unique region to the structure of the world ocean.

The final cruise for 1992 departed on December 6. Like the *R/V Polar Duke* the *Nathaniel B. Palmer* was to support the media, senior science and operations management visit to King George Island and the SAAM flight for an orientation of the US Antarctic Peninsula Programme. She was employed in transporting delegates from King George Island to Palmer Station until December 15 when she provided support for a physical oceanographic and marine geophysics cruise in the Amundsen Sea. She is due to return to Punta Arenas on 29 January 1993.

On board the vessel for this cruise was a party of eight implementing a programme for which Dr Robin E. Bell from Lamont-Doherty Geological Observatory is the principal investigator. Their project focuses on the early history of seafloor spreading along the Marie Byrd Land margin.

To obtain data the magnetic lineations, gravity anomalies, and topography will be mapped, and where possible the party will determine seismically the depth of basement rock. The study will integrate the tectonic lineations determined from gravity, bathymetric and seismic information with magnetic anomalies. With this data it is hoped that a new seafloor-spreading history can be constructed for this region.

On 3 February 1993 the vessel departs Punta Arenas again, this time for a 45 day cruise during which high-resolution seismic and heat flow investigations will be conducted in the Powell Basin. The principal investigators on this cruise will be a party of 10 under the leadership of Dr Lawrence A. Lawver from the Institute of Geophysics at the University of Texas at Austin. Their work is important because although scientists have made important progress in understanding the tectonic evolution of the Antarctic plate

significant questions remain about the Mesozoic to recent tectonic evolution of the continental margin. This season heat flow measurements will be used to determine the age and mode of extension of the Powell Basin at the end of the west Antarctic Peninsula and its relationship to the opening of Drake's Passage.

A late summer marine biology and physical oceanographic research cruise lasting 52 days will begin on 25 March 1993 in support of the LTER project. This cruise ends at Punta Arenas on 15 May.

The RV *Nathaniel B. Palmer* is then scheduled for a 30 day upkeep and maintenance period from July 1 to 31 at the Asmar shipyard in Talcahuano, in Chile.

Her last cruise of the current season begins on 1 August 1993 and ends on October 15. During this time, she will undertake a programme requiring daily access to ice floes for ice coring and snow sampling in the Ross, Amundsen and Bellingshausen Seas. The four scientists from the Geophysical Institute at the University of Alaska at Fairbanks under the leadership of Dr Martin O. Jeffries will be studying the deformation processes that are active in the antarctic pack ice and the large scale thermodynamics and heat-exchange processes of the ice-covered oceans, the physical and structural properties of the ice in the three oceans in order to define the geophysical variability of various ice types. By integrating observations and synthetic-aperture-radar data analysis with modeling studies a better understanding of sea-ice parameters and their geophysical controls will be possible. The analysis will also be useful in defining the kind of air-ice-ocean interactions that can be studied using SAR data, as well as having broader relevance and application to atmospheric, biologic and oceanic investigations of the southern oceans.

This 75 day study of the winter ice conditions will test the maximum capacity and endurance of the vessel and bring her first season of full operations to a close.

Sub-antarctic

An oral history to document life on Heard Island

The experience of ANARE expeditioners at Heard Island between 1947 and 1955 is the focus of a new programme being undertaken by the Australians G.J. Davison and G.D. Munro this year. It is part of a Master of Arts in Public History Programme established at Monash University in 1988. This programme aims to foster advanced history research of broad community relevance, especially in the areas of oral and local history, environmental history, public policy, the history of science and government and Australian social history. Oral sources are considered critical to the writing of the history of Australia's involvement in the Antarctic and the foundation years at Heard Island are a very significant part of that story.

The objectives of the interviewers are not only to document the experience of Anare expeditioners at the island but to record personal accounts of living and working conditions there and how expeditioners adapted to them. The data yielded will supplement existing documentary records.

Eradication of feral cats on Marion Island

Feral cats, the *Felis catus*, have been present on Marion Island since 1949 and subject to much research since the early 1970's. In 1977 control measures introduced included disease, shooting, trapping and poisoning. Since 1986 when a programme of night shooting and further trapping was begun as a control measure, 1080 cats have been removed by these methods. During the 1991/92 year, six

hunters deployed 1,200 gin traps and distributed bait but only eight cats were accounted for. Since May 1991 there has been no indication of a continued presence of the cats despite continued and intensive hunting and trapping. The need for continued measures is to be reviewed at the end of the 1992/93 season. If they are now extinct this is likely to be the first time that feral cats have been eliminated from a subantarctic island by active control measures and their reduction has already resulted in greatly improve

breeding success of burrowing petrels. *This item has been adapted from a paper written in 1992 by John Cooper of the South African National Antarctic Programme in which he outlines the current conservation status of the Subantarctic Prince Edward Islands. The paper was presented at the SCAR/IUCN Workshop on Protection Research and Management of Subantarctic Islands, Paimport, April 1992.*

SCAR meets at Bariloche

The 22nd meeting of SCAR was held this year at San Carlos de Bariloche in Argentina from 15 to 19 June, 1992. In addition to the executive it was attended by delegates from Argentina, Australi, Chile, China, Ecuador, Finland, France, Germany, India, Italy, Japan, Korea, Netherlands, Norway, Poland, Russia, South Africa, Spain, Sweden, the United Kingdom and Uruguay and associate members from Colombia, Pakistan and Switzerland as well as observers from WMO, the World Meteorological Organisation, COMNAP, Canada and the USA.

Prior to the formal opening by the Argentine National Antarctic Director, General de Brigada (R) D Jorge Edgard Leal, the delegates heard presentations of Antarctic achievements and aspirations from representatives of Ecuador, Pakistan and Estonia. Delegates agreed to admit Ecuador to full membership of SCAR and Pakistan and Estonia to associate membership.

Among the main topics of discussion were aspects of what was termed SCAR strategy, its functions and a report on the Antarctic Science Conference which had been held in Bremen, Germany in September 1991. Reports from a number of other organisations were tabled and as a result of a review of the SCAR working groups it was agreed that the eight currently existing would

continue and that a new one comprising specialists from a range of disciplines would be established covering Global Change and the Antarctic.

Canterbury Museum sends exhibition to Japan

At the request of the citizens of Konoura, the birth place of Japan's Antarctic Explorer, Nobu Shirase, the Antarctic section of the Canterbury Museum produced an exhibition featuring Captain Scott and Ernest Shackleton. It comprises relics from their expeditions to the Ross Dependency early this century.

The exhibition was officially opened on 10 September 1992, in the Shirase Antarctic Exhibition Memorial Museum at Konoura, by Baden Norris, the Canterbury Museum's Antarctic Curator, who was invited to Japan to help set up the display. Baden then gave a series of lectures to high school students at Konoura and Hidaka before visiting Echigo, Hikaka, Kobe, Nagoya and Tokyo.

Baden said afterwards that he was very surprised at the depth of knowledge in Japan about Scott but that relatively little was

known of Shackleton. He was pleased that Shirase and his ship the *Kainan Maru* are remembered with memorials both in Tokyo and at Konoura and impressed by the Antarctic Museum has been established aboard the historic icebreaker *Fuji* at Nagoya. "I have always believed that the Antarctic past is little more than a branch of maritime history and at Nagoya, that point is well proven."

The Canterbury Museum's exhibition will be transferred to Hidaka and Nagoya before being returned to Christchurch in April 1993

Sledge recovery

Plans to recover Scott's Motor Sledge from beneath the ice at Cape Evans have again been deferred for a year. (see *Antarctic* Vol. No 5 pages). It has been pointed out that this article contained a number of errors. The motor sledges in fact left Cape Evans at 10 a.m. on 24 October, 1911 and arrived at Cape Armitage on 27 October, not a week later as stated in the article.

The Arrol Johnson motor car used by Ernest Shackleton on his 1908 expedition is not in the Canterbury Museum, but is believed to have been washed overboard from the *Nimrod* on her journey back to England. The Museum, however, have Shackleton's motor tractor of 1914 vintage which was also produced by the Arrol Johnson Motor Company and which was designed by Shackleton, used by the Ross Sea Party of the Imperial Trans Antarctic Expedition and abandoned at Cape Evans.

The team estimates that the depth of water over the motor site is 600feet yet Dr Edward Wilson talks of 100 metres and other men present use a number of estimates between these two conflicting figures. The problems of relying on such estimates to locate the machine will be obvious. -

Baden Norris, Antarctic Curator, Canterbury Museum, Christchurch

Voyage to the South Sandwich Islands

Colin Monteath presents a personal view

Clinging sheets of spray lash the ancient blue iceberg. Chinstrap penguins huddled on a rutted platform are drenched as the icy water is sucked back into the Scotia Sea. Beyond the grounded berg, jets of volcanic steam hiss from the ochre pock-marked cliff. The acrid stench of sulphur and penguin guano pervades the air. Forbidding headlands with names such as Reek Point and Noxious Bluff leer out of the driving sheet as we search for a safe anchorage. With a heavy swell running against the rocks our Zodiac landing on Zavadoski Island is anything but assured.

Arriving in the South Sandwich Islands, one of the remotest, wildest parts of Antarctica, we are struck with a sense of awe and respect for the mariners who have preceded us to this desolate spot.

In January 1775 James Cook on *HMS Resolution* was the first to sight some of the eleven islands in the South Sandwich group, though he failed to recognise them as active volcanoes. At 59 degrees south Cook called them Southern Thule, the most southerly known landmass. The Imperial Russian Expedition of 1819 commanded by Bellingshausen with corvettes *Vostok* and *Mirny* discovered the northern islands of the group at 56 degrees South naming them after his Russian officers.

In the wake of Cook and Bellingshausen,

American and Norwegian sealers made sporadic furtive hunting voyages to these islands though difficult surf landings undoubtedly made the lucrative, relatively sheltered killing-fields of nearby South Georgia a more attractive prospect. Following the highly-successful Discovery Expedition in 1930, most recent scientific work in the South Sandwich Group has been carried out during spasmodic visits by British Antarctic Survey, landing field parties by helicopter.

Prior to our visit in February 1992, hardy passengers on the tour vessel *Lindblad Explorer* back in 1982 have been the only others willing to trade dollars for the privilege of a dunking in South Sandwich surf. For our group, braving the elements on one island alone, Saunders, brings the unusual reward of close encounters with five species of penguins and five of seals. It is said there are 14 million penguins on the rugged slopes of Zavadoski though I'd like to meet the brave biologist who counted them!

Never before in Antarctica have I seen such dramatically colourful icebergs. The intense cobalt-blues and jade greens indicate these are weary old travellers that have finally escaped from the maw of the Weddell Sea. Many bergs are virtually black with penguins. Newcomers have to literally 'fly' out of the water and claw their way up the polished vertical sides to hitch a ride.

Chartered by Australian Mike McDowell's Quark Expeditions, the 70 metre ice-strengthened hydrographic vessel *Professor Molchanov* carries a complement of 38 passengers, four staff members and 22 Russian crew. This tight-knit operation means our two Antarctic Peninsula trips as well as this final voyage to South Georgia and the South Sandwich Islands engenders an intimate expedition atmosphere, retains a highly flexible itinerary and importantly, has the least possible impact on wildlife or environment. With ice-handling experience second to none the Russian crew are by far the most competent I have ever ventured with to the Antarctic.

Antarctic sea-borne tourism continues to struggle for survival. With the sudden demise of well-established US companies, Salen Lindblad Cruising, Society Expeditions and Lindblad Travel, the charterers of the *Frontier Spirit*, *Ilyria* and *Ocean Princess*, large vessels which operated on the Antarctic Peninsula, this past summer must be looking closely at the structure and viability of their operations.

Following a successful 1991 traverse of the Arctic Ocean via the North Pole in a Soviet nuclear-powered icebreaker, Mike McDowell was quick to realise that the collapse of the Soviet Union meant excellent ice-class vessels such as *Molchanov* would be lying idle and available for charter. By effectively cutting the price for an Antarctic Peninsula voyage in half to \$US4,300, Quark Expeditions has opened up Antarctic cruises to a younger market normally excluded from the larger more luxurious vessels.

New Year's Eve on beautiful little Half Moon Island in the South Shetland begins with a sombre moving ceremony for the crew. The lowering of a massive hammer and sickle from the funnel to the deck symbolises the transfer of ownership of the *Molchanov* from Soviet to Russian control. The Soviet flag is lowered while a Russian one, made from a modified Dutch flag, is hoisted in its place. The crew then fire flares into the night-sky to kick off a rock and roll party on the Zodiac deck for passengers, crew and visiting Argentine, Indian, American and English scientists.

Dr Bernard Stonehouse from the Scott Polar Institute in Cambridge, England is among the revellers. In the 1960's Stonehouse cut his "Antarctic teeth" with the New Zealand Antarctic Research Programme while working as a University of Canterbury biologist. He has since become a highly-respected prolific author of polar research. In recent years he has specialised in educational books on both polar regions for a lay audience. In the *Molchanov* mess-room, crammed with passengers,

Stonehouse stimulates a discussion on the pros and cons of Antarctic tourism. He highlights why he is here living at the Argentine base with his students.

"Antarctica needs friends. As a scientist in the Antarctic for the past thirty years I have witnessed the enormous impact an ever-increasing number of government bases have had on the continent. Science has a lot to answer for. This must change. I am here to commence a five year study on the numbers and effects of commercial visits to Antarctica so I can present an accurate picture of tourism to Antarctic Treaty planning meetings. Antarctica cannot tolerate the potentiality of hotels serviced by aircraft coming into permanent runways nor do we need large tour vessels carrying many hundreds of passengers. I must say that properly organised and controlled sea-borne visits in suitable ice-strengthened small ships such as yours or the sort of voyage pioneered by the *Lindblad Explorer* in the 1960s are highly educational and can continue to play a significant watchdog role in the future management of the Antarctic."

Inspired by Stonehouse's comments the *Molchanov* passengers spontaneously decide to begin removing man-made objects found at each landing spot. It is amazing just how much junk fills the Zodiacs each time we set off back to the ship. Abandoned science equipment, bottles, barrels and rusty metal dating from the by-gone whaling era are all fed into the *Molchanov*'s high-temperature incinerator. As we realise our efforts are only a token gesture when confronted with an entire base abandoned in the middle of a gentoo penguin rookery, further debates ensue on board. Determination emerges among individuals to pursue the matter further with their own governments upon returning home.

To maximise time spent with wildlife, Quark Expeditions has a policy of only visiting one operating science base on each cruise. In the past, at efficiently and highly-productive bases such as the British Faraday

and US Palmer Stations this has often been a positive and educational experience for passengers who gain an appreciation for the excellent marine or upper atmospheric work in progress. This season, while on crowded King George Island in the South Shetlands, we feel obliged to visit the Soviet (Russian) station Bellingshausen.

Bellingshausen, situated only metres from the large Chilean Marsh base complex, has always been an environmental nightmare. The river of petrol I have photographed before still flows into the sea as we beach the zodiacs. This gives passengers a foretaste of a further catalogue of abuse around the base itself. To make matters worse winter-over personnel are dispirited and confused by events in their homeland, not knowing when or even if they are to be relieved by ship. Morale would have plummeted further a few days after our visit when the leader was run over and killed by a tracked vehicle. The Russian Antarctic programme, is in considerable disarray with environmental considerations at many bases around the continent seemingly the least of their worries.

During *Molchanov*'s cruises we meet several yachts, some on private quests while others are chartered by film crews, government biologists or climbing groups. Yachts range in size and strength from the fine engineless wooden "*Curlew*" built in 1898 to the multi-million dollar aluminium French giant *Antarctica*. Skippered by Trans-Antarctic dogsled veteran Jean-Luis Etienne, *Antarctica* is undoubtedly the most powerful and sophisticated polar yacht ever built - the standard by which others will now be judged. Following a charter to a French television company making a children's programme on *Antarctica*, Etienne plans to freeze his yacht into the pack ice near the Balleny Islands in the Ross Sea to conduct marine research with French and Australian scientists. Next summer French specialists hope to conduct research on Mt. Erebus using *Antarctica* as their mobile home and

laboratory.

The word is out that for the well-prepared yacht the Drake Passage is not the formidable barrier it was once thought to be. With the steady increase in yacht traffic to the Peninsula region experienced charterers Sally and Gerome Poncet, from Beaver Island in the Falklands, have been motivated to publish a manual "Southern Ocean Cruising." The book highlights the do's and don'ts and provides an awareness of Specially Protected Areas. It specifically does not go as far as documenting Peninsula anchorages so as to retain the magic of finding your own private harbour.

The Dunedin-based top-rigged schooner *Tradewind*, which has pioneered sailing charters to New Zealand's subantarctic islands in recent years, made its first foray to the Antarctic Peninsula last summer with 19 passengers. We first met *Tradewind* as *Molchanov* pulled out of the Tierra del Fuego Port of Ushuaia, Argentine. *Tradewind*, under full sail is a magnificent sight in the Beagle Channel as she ends her five week voyage round the Horn from New Zealand.

We encounter *Tradewind* again on Deception Island in the South Shetlands. Nearby, the new and most impressive 75 million pound British Antarctic Survey research vessel *James Clark Ross* is at anchor on her maiden voyage. After a tour of the ship I come away convinced Britain has made a significant statement of commitment to polar science. Meanwhile, BAS personnel scurry about on the volcanic gravel beach backloading old fuel to the ship. The fuel dates back to 1969 when the BAS base was abandoned after a violent volcanic eruption. It has recently been siphoned out of badly rusted, leaking barrels into new ones by Greenpeace and was the focus of a strongly worded report circulated to all Treaty nations. It is pleasing to see the message getting through.

Our three week voyage to the South Sandwich Islands is the final trip for the

season with each leg of the journey from Ushuaia broken by extended visits to the north coast of South Georgia. Anticipating fresh Antarctic experiences, landings in the South Sandwich are an undisputed magnet for me, however, there is no denying that South Georgia, with its stunning glaciated mountain backdrop, is the grandest wildlife sanctuary on Earth.

At the old Norwegian whaling station Grytviken I am honoured to meet another highly-respected name in Antarctic biology, grey-bearded Englishman Nigel Bonner. BAS science on South Georgia has all but ground to a halt since the 1982 invasion by Argentine. Scientists at King Edward Point beside Grytviken have been replaced by a garrison of Royal Marines. After near-constant pilaging of the four mail whaling stations on South Georgia by fishing fleets, BAS personnel and now troops, Bonner is in the process of creating a whaling museum centred around the restored manager's house and nearby church. The church still contains the old altar, organ and pews littered with Norwegian hymn books.

Bonner comes on board to give a lecture on shore-based whaling operations. He concludes with comments on the 1991 clean-up at the stations which disposed of tonnes of sulphuric acid (flushed into the sea), asbestos (buried) and bulk fuel (pumped onto ships). In 1984 fuel leaked from bulk storage tanks into the harbour when board British soldiers holed the tanks with bullets.

As the sun sets behind the peaks beyond the Bay of Isles we all sit in the tussock witnessing the sexual courtship dance of the Wandering Albatross. With dusk upon us we reluctantly leave them to prance around their chosen mate. Bills 'clack' together as powerful wings are skyward. Descending to the Zodiacs we elbow past dozens of fur seal pups cavorting in the mud. Despite vivid memories of the raw beauty found in the South Sandwich Islands and the serenity of this soft peaceful evening with the albatrosses our voyage has made us aware it is a

time of rapid change in so-called wilderness Antarctica. Bound for the Falklands and

fresh adventures we ponder our inherited responsibility.

Two Englishmen, four American women, and a Norwegian travel to the Pole the hard way

Two Englishmen, four American women, and a Norwegian are on their way to the South Pole from the Weddell Sea sector of Antarctica. They were flown to their starting points on 10 November 1992.

Sir Ranulph Fiennes and Dr Michael Stroud are attempting to make the longest unsupported journey in polar history. They plan to cross Antarctica without any support team, dogs, or airborne supplies, and intend to ski all the way, towing sledges with loads at the start of 117.9kg (food) -24.9 kg (fuel) and 38.5 kg equipment.

Because of blizzards in the area at which they proposed to start, at the edge of the Ronne Iceshelf - Fiennes and Stroud were unable to begin the first stage on October 31. Originally they expected to reach the Pole on January 4 next year, taking 65 days after 900 miles of manhauling. The timetable set 35 days for the final stage to Scott Base by way of the Mill and Beardmore Glaciers and the Ross Ice Shelf.

Fiennes and Stroud are both experienced Antarctic and Arctic travellers. In the 1980-81 season, Fiennes, then leader of the Transglobe Expedition and two companions cross Antarctica in 66 days. They covered close to 450 km in snowmobiles from a winter base in the Berga Massif, Queen Maud Land to Scott Base by way of the South Pole, starting on 29 October, 1980 and arriving on 11 January 1981.

In 1982 the Transglobe Expedition completed another stage of its planned circumnavigation of the world by sea, ice and land. Fiennes and one companion reached the North Pole on 11 April after a journey of over 833 km over sea ice which began on February 26.

Both the Antarctic and Arctic stages were completed with the aid of support teams, supplied by air, and sophisticated communication systems.

Since then Fiennes has made four unsuccessful attempts to return to the North Pole on foot. The first was made in April 1986, when he and Stroud set a new record for unaided travel on foot towards the North Pole pulling sledge loads of 160 kg they crossed 189 km in two weeks.

Michael Stroud, who once worked with the British Antarctic Survey in the Falklands, gained his Antarctic experience with the Footsteps of Scot Expedition in 1985-86. He was medical officer at the expedition's base at Cape Evans, and replaced Gareth Wood as leader when he joined Robert Swann and Roger Mear on their ski journey to the South Pole.

On their present journey Fiennes and Stroud will not be entirely without support. A miniature satellite global positioning system and radio will enable an air rescue to be mounted in an emergency. The radio and a special rescue insured with Adventure Network International are conditions on which Stroud, who has two young children, has agreed to join Fiennes.

A radio operator, Mrs Morag Howell, whose husband worked with Transglobe during the Arctic Operations will be stationed at ANI's comfortable base camp at Patriot Hills (80deg, 19 min S/81 deg 20 min W) in the Heritage Range of the Ellsworth Mountains, which is close to a bare ice runway. It is 1080 km from the South Pole.

Another aid in the journey will be parachute windsails attached to the sledges. These are expected to be used on the final 643kg leg of the journey across the Ross Ice Shelf, and reduce the number of days in the Pole to Scott Base section.

Fiennes and Stroud expect to battle strong winds of up to 86 knots on their way from the Ronne Ice Shelf to the Pole. They will traverse Berkner Island to avoid crevasses in the ice shelf, and then will have to climb from 3200 feet up the Support Force Glacier in the Pensacola Mountains to reach the Polar Plateau where the winds are no expected to be as fierce.

Timing and diet are the greatest problems. Fiennes and Stroud have a food allowance which will last 100 days. On the first leg of the journey they will each use up 6,500 calories daily, but will eat 5,500 calories. Each man expects to lose about 9.5 kg.

The second leg to Scott Base, is not expected to be as tough, they will use 5,500 calories a day and eat the same. Their weight should stay constant. But any delays on their way to the Pole would mean that they would use more food than planned, leaving less for the second leg, and at 105 days, the maximum tolerable weight loss could rise to 14.9 kg.

Support for the Pentland South Pole expedition, as it is called, will raise funds for The Multiple Sclerosis Society to extend scientific and clinical work of some of the most challenging and promising research into the most common potentially disabling disease of the central nervous system in young adults. The research will build on the establishment of the first phase of the Society's new inter-disciplinary unit at the University of Cambridge, made possible with an appeal spearheaded by the North Pole 90 Expedition previously undertaken by the two explorers.

By 28 November 1992, Feinnes and Stroud had reached 80deg55'south/39deg55'W and were therefore further

ahead than they expected. Their daily average distance was 12 nautical miles but there were still 545 nautical miles to be covered.

The women

Ann Bancroft, co-leader of the American Women's Trans-Antarctic Expedition, which is crossing the continent on skis was the first woman to reach the North Pole in 1986 by surface Transport. She was a member of the United States/Canadian expedition led by Will Steger and Paul Schurke, which used dog teams but no air support or special navigation equipment.

This time the four experienced cross-country skiers will be hauling sledges each loaded with 150 kg of food, equipment and gear. But Adventure Network International will supply air and cache support. Three caches will be located half-way between the Filchner Ice Shelf and the South Pole, the South Pole and the Beardmore Glacier. The team's debris will be picked up at these sites.

A 24 year-old Californian skier and Mountaineer, Reinette Senum, who has climbed in Europe, Africa, and North and South America, is the co-leader. She developed the idea of a women's expedition crossing Antarctica on skis. Originally the team intended to make the crossing in 1991-92.

The plan this year was to start on November 1 from the Filchner Ice Shelf, and reach McMurdo Station at the end of February (about 120 days). From the Filchner Ice Shelf the team proposed to cross the Polar Plateau to the South Pole, continue across the plateau and descend the Beardmore Glacier and then cross the Ross Ice Shelf. Using an Argos Satellite Transmitter Communication System the party expected to travel 2400 km. Its daily rate was estimated at 19 to 20 km.

Ann Bancroft, who is 35, comes from St. Paul, Minnesota. She is a former teacher of physical and special education, and now works for Wilderness Inquiry, an outdoor

educational programme to benefit abused and disabled individuals. In addition she is a cross-country skiing instructor.

Kellie Erwin-Rhoades (34), comes from Idaho. She and her husband have worked as guides in Colorado since the late 1970's. Kellie has had more than 14 years climbing experience on mountains throughout the world. She took part in the first Nordic Traverse of Mt. McKinley, and has been a member of Everest expeditions in 1987 and 1989.

A computer programmer, Sue Eiller (44), in Boulder, Colorado, is the team's most experienced mountaineer. In the last 20 years she has taken part in numerous Himalayan expeditions to Everest, Annapurna II, Ama Dablam, and other 8000 metre peaks. She has served on the board of directors of the American Alpine Club, and in 1991 led an expedition to the South Col of Everest.

As medical advisor, the expedition has Dr Pat Frye Walker (34), of Minneapolis, Minnesota. She is director of a medical clinic for South-East Asian refugees, and has been influenced to study cold weather medicine after 20 years of backpacking, winter camping, and cross-country skiing.

Both parties heading for the Pacific side of the continent have based their programmes on arriving in time to meet a tourist cruise ship that sails from McMurdo Sound on 17 February 1993. The ship is the *Frontier Spirit*, which is scheduled to leave the New Zealand port of Bluff early in February and end its final cruise at Hobart.

Twenty-nine year old Erling Kagge, who is a lawyer with a large Norwegian oil company Norsk Hydro, has planned to be the first to walk alone to the Pole. He started his journey of 1310 km from Berkner Island, which lies between the Ronne and Filchner Ice Shelves and expects to finish his venture in about two months. Bad weather delayed him initially but he hopes still to be at the Pole, in the middle of January and on his thirtieth birthday. An aircraft will pick him

up.

A walk to the South Pole may be a relatively simple assignment for Kagge as his job often takes him abroad to negotiate contracts; his most recent commission was in Yugoslavia.

This is not his first polar adventure however. Two years ago Kagge set out with two companions to walk unsupported to the North Pole, pulling all their equipment on sledges behind them. But, when one of the party injured his back and had to be evacuated while just north of Canada, Kagge and his friend continued. Some of his polar competitors (including Feinnes) criticised the project, claiming that the expedition could no longer be called "unsupported" when one member had to be flown back.

Another Norwegian, who was part of a group which skied across Antarctica in 1990-91 concluding his journey at New Zealand's Scott Base has just completed a skiing trip to the North Pole with Mike McDowell.

Initially Suur Mordre, his brother Simon and three others making a party of five had planned to ski across the entire continent but in the event six went as far as the Pole and three to McMurdo.

Their objectives were to be the first Norwegians to ski to the South Pole since Amundsen's and they arrived on 14 December, 1990 79 years to the day after Amundsen. They also celebrated the 75th anniversary of Shackleton's dream to cross the continent.

This party had left Norway early in October 1990 for Punta Arenas where they were flown by Adventure Network International's DC6 to Patriot Hills on October 22.

Two days later a party of six comprising the two brothers, and a photographer Hallgrim Odegard, set off with 11 dogs, three sleds and skis. They were accompa-

nied by Herman Mehren, Ralph Hoibakk and Carl Emil Petersen on ski. This group were resupplied three times at 82deg S, 86deg S and 87deg S by ANI on their way to the Pole.

From there three of the party, the two brothers and the photographer covered the remaining 1650 km to Scott Base on ski without resupply.

The journey took them 105 days and sailed from McMurdo to Hobart on the *World Discoverer*. Since their return to Norway, the party have produced a book about their adventure and a film which has been well received in Norway.

Non-government flying in Antarctica during the summer of 1991/92

A brief survey of non-government aircraft flying in Antarctica in 1991/92 has been compiled by Charles Swithinbank and was published in the *Polar Record* Vol 28, Number 166, July 1992. It shows that by far the majority of private sector flights during that summer were made by Adventure Network International, a company based in Vancouver. They used a DC-6B, a DHC-6 Twin Otter, a DHC-3T Twin Otter and a Cessna 185. It was their seventh consecutive season of operations undertaken by Antarctic Air, a branch of their organisation

ANI however owns only the Cessna. The DC-68 was leased from Allcair Air Transport of Alberta; the Twin Otter from Aklak Air of Inuvik and the turbine Otter from Ketchikan Air of Alaska. The Twin Otter, turbine Otter and Cessna were all fitted with wheel skis.

In addition to their normal tourist operations (which during the season included guiding 26 climbers in six groups up the Vinson Massif), ANI provided major support for the Shirakawa Antarctic Photographic Expedition 1991-93 (see *Antarctic* Vol 12 No 11 and 12) who were taken to the emperor

penguin rookery at Dawson-Lambton Glacier with ornithologist Frank Todd; the Kazama Motorcycle Expedition to the South Pole and a film crew supporting actor writer Michael Palin in his quest to travel from "Pole to Pole," which has since been the subject of a book and a series of television films. In all 11 people, including three film crews were taken to the South Pole.

Support was also provided for the Norwegian Aurora Projekton on the Filchner Ice shelf. This project includes a plan to recover Amundsen's tent from the South Pole (See *Antarctic* Vol 12. No.8)

The flying season for ANI began on 11 November with the Twin Otter and turbine Otter taking ANI staff from Punta Arenas to Patriot Hills. The first DC6 flight was on 17 November when 14 passengers were taken to the base. By 18 February operations were complete and a total of 88 clients and staff of ANI had made the trip.

Swithinbank records only two other non-government flying activities. These were the Twin Otter flights operated by Aerovias DAP of Punta Arenas to the Chilean Station Teniente Rodolfo Marsh on King George Island and the Twin Otter from Greenlandair which supported the Norwegian project on the Filchner Ice Shelf.

Adaptable camper for Antarctic conditions

A Tasmanian business, Malcolm Wallhead and Associates, which has been manufacturing Igloo Satellite Cabins for the polar and mountain market for nearly ten years is extending its range to a camping sledge. Designed by Malcolm Wallhead from Kettering near Hobart, it is a sledge with an insulated canopy that can be removed and used as a rigid tent.

Weighing just on 140 kg, the camper is three metres long and stands 1.6 metres high, made of fibre-glass and insulated with foam. It has been designed to withstand

blizzards and temperatures of -50deg C.

The sledge will carry up to six adults or 500 kg of fittings such as bunks, boxes or scientific equipment. It would normally sleep two but can provide shelter for up to six in emergencies. There are two double-glazed windows made of polycarbonate and a rear door wide enough for a stretcher so that it can double as an ambulance.

"SnowCamper", as the sledge is called, can be towed by a snowmobile or small tractor at speeds up to 50 km an hour across

snow and ice. Its base can be used as a boat on calm water when an outboard motor can be attached or it can be towed. When fitted with a fin to stop it spinning, it can be carried by a helicopter at speeds of up to 140 km an hour.

Priced at Australian \$4,600, the sledges have already been sold to America and Germany and the Australian Antarctic Division has just completed trials and suggested modifications for their purposes which are currently being considered.

Society News,

1990 Exhibition still traveling

The Society's exhibition *Antarctic the New Zealand connection* continues to tour New Zealand. Launched at the Canterbury Museum on 8 December 1990, the exhibition comprising panels of photographs and text was shipped to Wellington under the sponsorship of Pacific Shipping Ltd for a two week display at the Michael Fowler Centre from 18-29 October 1991. It was returned to Christchurch and stored at DSIR Antarctic before being taken south to Timaru where it was displayed for two weeks. Between April and February 1992 it was shown at the Southland Museum and Art Galley and subsequently at the Museum in Gore. In June it was sent to Auckland for exhibition at the Aotea Centre and in July it was shown in Taupo for two weeks. It was then returned to the Auckland for display at Kelly Tarlton's Underwater World in Auckland. Further commitments are being negotiated but it is likely to be on display at some alternatives locations in Auckland until Christmas.

Canon John Keith dies

A past president of the Canterbury Branch of the New Zealand Antarctic Society John Frederick Butterfield Keith (Rev. Canon) died in Christchurch on 3 October 1992 aged 80. Canon John Keith was an Englishman who came to New Zealand in 1958 after six years service in North Africa and Europe as an 8th Army Chaplain and was rector of two Anglican parishes between 1946 and 1957.*

In Canterbury (NZ) John Keith served the church for more than 30 years. He was in the Canterbury Branch Committee of the Society in 1969, and became president in 1970 when Vicar of St. Peter's in Upper Riccarton. Because of his transfer to Waimate he was unable to serve a second term. John Keith is survived by his wife Mollie, one son and two daughters. JMC

Society awards science prize to Wellington student

Emily Tuffin, a student at Chilton St. James College in Lower Hutt with a prize winning entry in the regional science fair held in Wellington in August. The fairs, which began about five years ago are held throughout New Zealand, and are designed to foster an interest in science and the environment.

In assembling data on the environmental impact of waste disposal in Antarctica in order to determine what is being done to protect the unique environment of the continent Emily found that environmental pollution has long been recognised in Antarctica.

"Early this century" she says that "it was common practice for the explorers to discard rubbish about their bases or in the sea. Continuation of these practices into the 1970's brought recognition that Antarctica

was not a place where rubbish could be dumped and forgotten."

"Antarctica is essential as a site from which to monitor natural and human change to the global environment such as ozone depletion." She concluded that the basis of waste management in Antarctica is planning and that environmental concerns continue to play an important part in Antarctic development. Humans can damage Antarctica or they can protect it. The choice is ours. Fortunately the decision to see a waste management strategy implemented is not too little, not too late, but is in line with current world-wide trends of conservation."

Emily, who began her research in May, also won the Wellington Polytechnic school of data processing prize for her exhibit.



The New Zealand Antarctic Society Inc.,



The New Zealand Antarctic Society Inc., was formed in 1933. It comprises New Zealanders and overseas friends, many of whom have seen the Antarctic for themselves and all of whom are vitally interested in some phase of Antarctic exploration, history, development or research.

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