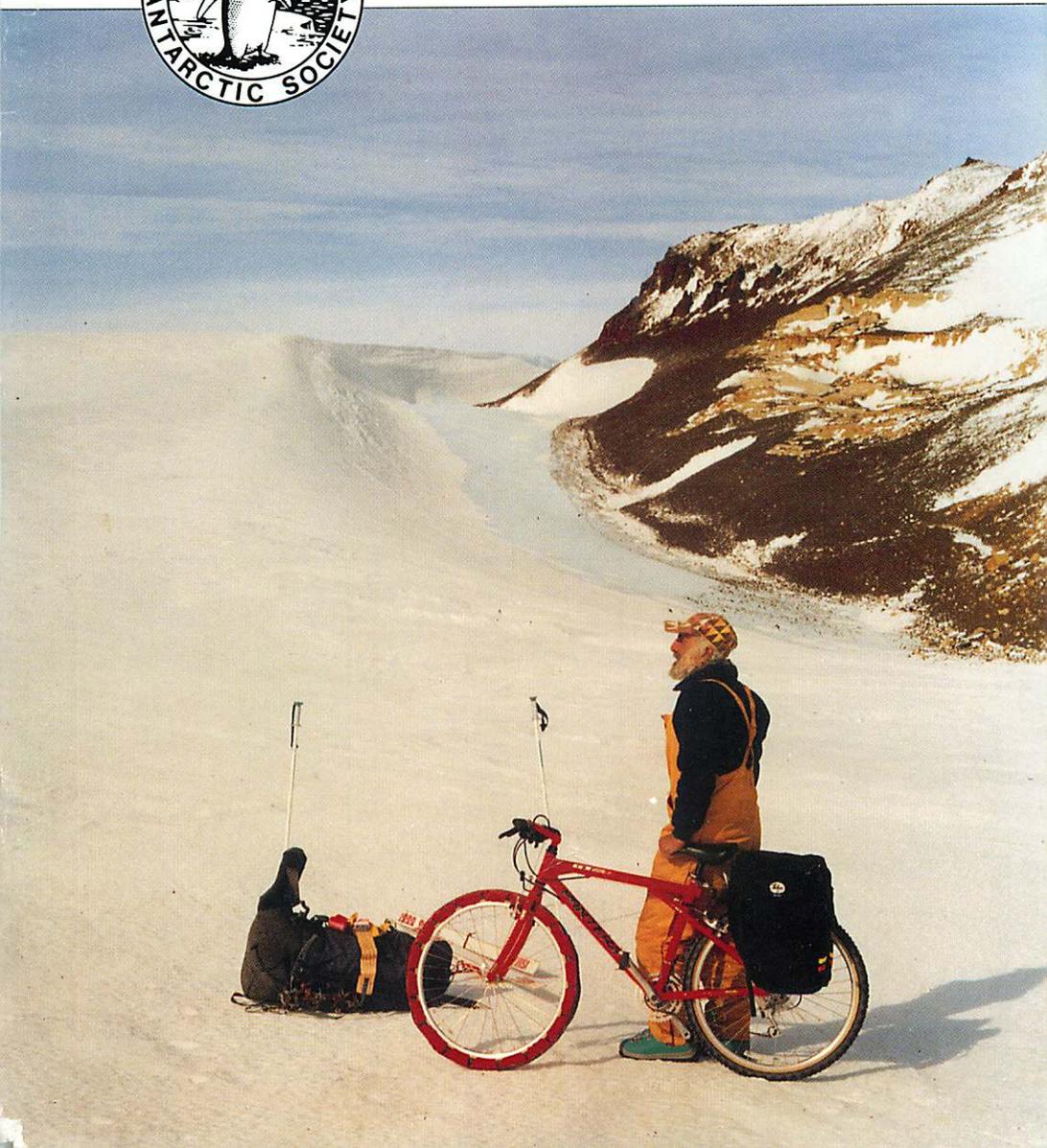


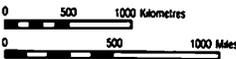
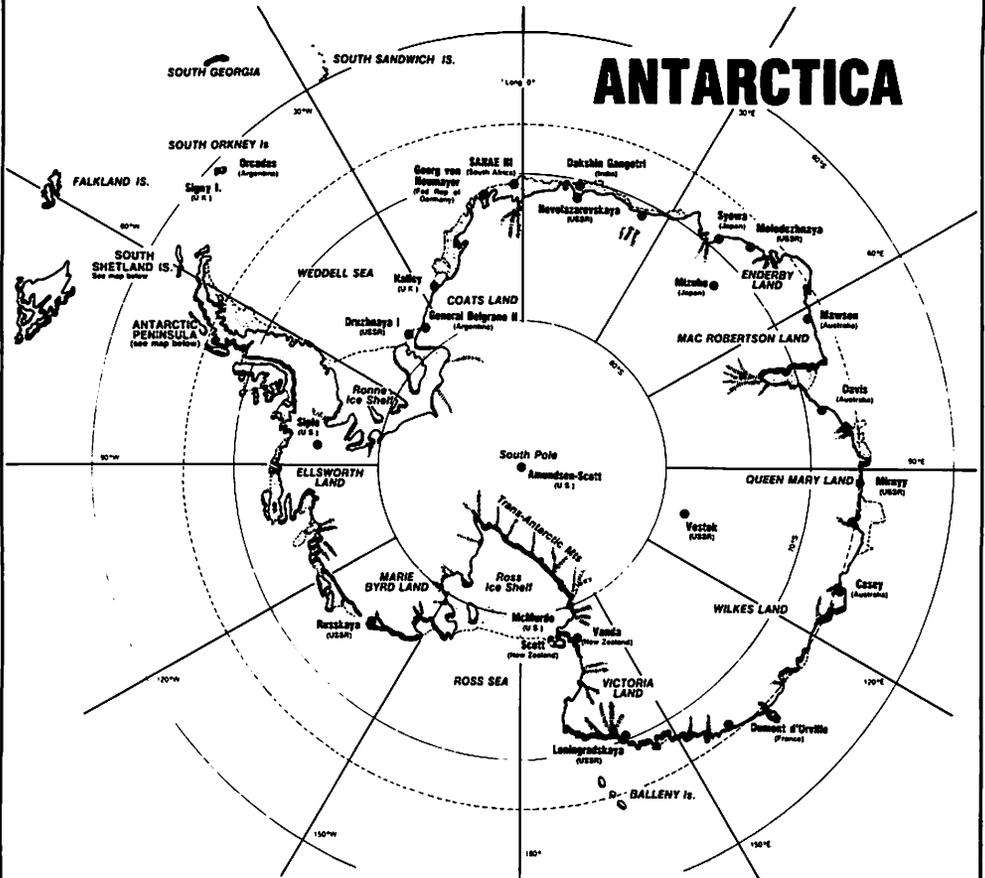
# ANTARCTIC



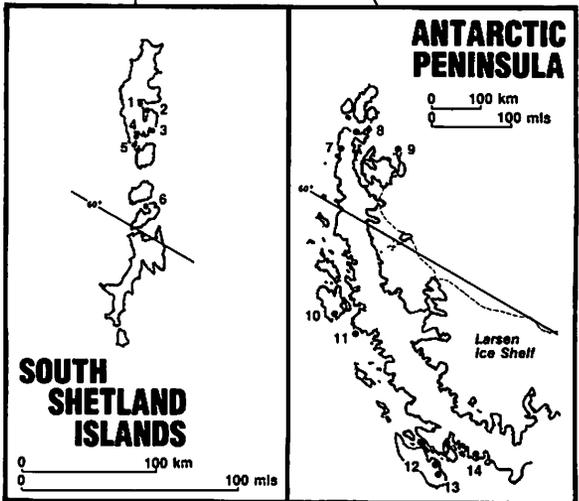
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# ANTARCTICA



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- 2 Henry Arctowski POLAND
- 3 Teniente Jubany ARGENTINA
- 4 Artigas URUGUAY
- 5 Teniente Rodolfo Marsh CHILE
- 6 Bellingshausen USSR
- 7 Great Wall CHINA
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- 11 Vice Comodoro Marambio ARGENTINA
- 12 Palmer USA
- 13 Faraday UK
- 14 Rothera UK
- 15 Teniente Carvajal CHILE
- 16 General San Martin ARGENTINA



# Antarctic

(successor to the "Antarctic News Bulletin")

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Photo: Jane Forsyth

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NZAP

## Field work aimed at solving “geological jigsaw” completed

The third and final season of a major international study of the geology of Marie Byrd Land was completed last summer. It involved two scientists each from New Zealand, the United States of America and Britain. The area is of particular interest because the Southern Ocean is relatively young in geological terms and prior to 85 million years ago, Marie Byrd Land and New Zealand were a single piece of continental crust. Today the eastern part of the New Zealand continent is mainly submerged and extends to a line running southwest from a point beyond the Chatham Islands. Marie Byrd Land provides clues to the geology of the submerged section of the New Zealand continent and a way of investigating the process of continental breakup. Russian and American scientists researching the area 25 years ago produced significantly different results; the work of this new party should resolve these differences.

During the first year of the project undertaken in the 1990/91 Antarctic summer season the party focussed on The Ruppert Coast and Hobbs Coast areas. Like the present season it was supported by BAS Twin Otter. That season's work was limited by bad weather for half the days the party were in the field. The second season concentrated on the many islands in Pine Island Bay with support from a USCG icebreaker *Polar Sea*. Both helicopters and boats were used to reach the outcrops and the work was undertaken in good weather conditions. As the ship returned to Valparaiso the party were able to visit Thurston Island and Peter I Island. The scientific party included staff from the US Geological Survey who reassessed the position of critical islands and headlands on this rarely visited section of the Antarctic Coast.

Throughout the project the three nations have shared the logistic requirements. This season the US provided all the fuel, including aviation fuel, and transported all the equipment and people to the field, the British Antarctic Survey Air Unit provided a Twin Otter and crew; Lee Proudfoot was the pilot and Steve Tucker the air mechanic, and New Zealand contributed the field equipment, food and two field leaders, Andy Harris and John Roberts from their Antarctic Programme.

This season the scientific party involved Associate Professors John Bradshaw and Steve Weaver from the University of Canterbury, Dr's Brian Storey and Bob Pankhurst from the British Antarctic Survey, Dr's David Palais from the University of Michigan and Vic DiVenere from the Lamont Doherty Geological Observatory in New York.



*Expedition members are, from left: standing, Dr Bob Pankhurst of Britain, Dr John Bradshaw, Andy Harris, Dr Steve Weaver, and John Roberts all from New Zealand and Dr Brian Storey of Britain; in front are the two American members, Victor di Venere from the University of Colombia and and Dr David Palais of the University of Michigan. Photo: Josie McNee, Scott Base.*

Late in November 1992 the eight men were taken by a United States Navy Hercules to their field camp which was established at 70deg11minS/113deg 24min W on the south side of the Kohler Range near the northern side of the Smith Glacier in eastern Marie Bryd Land. This e plane made three flights each of four and a half hours to the area which is on e of broad low relief with smooth surfaces and moderately soft snow. It was more windy than some of their other work sites but they used it exclusively and did not set up satellite camps as previously.

The main targets for research were the Kohler Range, the Bear Peninsula and the basement of the Mt. Murphy volcano. Rock exposures were limited to the margins of the

Kohler Range, mainly along the Kohler Glacier, the eastern and western sides of the Bear Peninsula and the spurs of Mt. Murphy. The eastern side of Bear Peninsula involving Goepfert Bluff, Barnes Bluff and Eckerman Bluff were considered too risky to visit because of overhanging ice cliffs. Precipitation is high in this region and they saw abundant evidence of recent snow, ice and rock avalanche activity making other sites also too hazardous to visit.

Because of the weather conditions they party were only able to achieve three days work in first 13 in the field, but during the next 15 days they were able to work for all but one. They left the area in two flights on December 30. During their stay 36 sepa-

rate outcrop areas were visited during 84 individual Twin Otter flights with a total duration of 36.40 hours. Closer exposures could be reached by the two "skidoos" which covered approximately 550km. They usually operated as two groups and generally spent between two and six hours at each site. Some were visited twice.

They found the basement rocks which are generally poorly known to be mainly granitic intrusions which are strongly deformed in places. The main rock types are granitoids, ranging from mafic diorite to leucogranite, deformed granitoids with mylonitic shear zones and paragneiss. In the Mt. Murphy area there is also a belt of metasediments (paragneiss) which includes a number of lenses of marble, the most extensive carbonate rocks yet seen in Marie Byrd Land. Poorly preserved plant remains were discovered in cleaved volcanic breccia at Rogers Spur.

In all over 3000lbs of rock was collected from the field and laboratory study has already begun. Geochemical analysis is being undertaken at the University of Canterbury, uranium/lead analysis at the University of Michigan, Rubidium/Strontium dating at BAS and fission track dating at New Zealand's University of Waikato. Collections were also made for paleomagnetic work at the Lamont-Doherty Geological Observatory in New York.

Geochemical, isotopic and paleomagnetic results from the first season's work on the Ruppert Coast are now available and work on the rocks from the Pine Island Bay area visited by icebreaker earlier last year is underway.

Preliminary results from the project show general similarities between the Ford Ranges and the Ruppert Coast but marked differences in the details. This is of particular interest to the group because data from the ocean floor and satellite gravity work shows very clearly where and how New Zealand and Marie Byrd Land in the west Antarctica

region fit together. The result is "like a jigsaw" but the geological picture does not match. Pieces of New Zealand that do however match the Marie Byrd Land area include rock units from the West Coast of the South Island but many of the rocks that form the eastern part of the North Island and the Southern Alps have no counterpart in this remote area of Antarctica. With only a third of the laboratory work so far completed the signs are favourable for some interesting results.

## Glaciation

Another party of four spent six weeks in Antarctica studying two different aspects of glaciation. Auckland University lecturer in Geography Wendy Lawson and Chris Nelson, an engineering geologist focussed on the nature and causes of the mechanical behaviour of debris-bearing ice and the implications of this behaviour for ice dynamics. Sean Fitzsimons, a lecturer from the University of Otago and student Kath Humphreys also from Otago examined the linkages between ice marginal sedimentation, the glacier thermal regime and climate.

The Auckland party operated near the snout of the Taylor Glacier where they investigated the effects of the presence of debris on the mechanical behaviour of ice. Their field work comprised a programme of ice strength testing on both *in situ* and sampled ice. The strength tests carried out on debris-laden and clean ice included uniaxial compressive strength tests, shear strength and point load strength tests. The unprocessed field data suggest that the debris-laden ice (10-20 percent by volume) has a peak strength in uniaxial compression of approximately 1.2-1.5 MPa. In point load tests the clean ice was more than twice as strong as the debris laden ice and the modes of failure between the two were quite different with the clean ice acting as a homogeneous material, despite its inherent

anisotropy, and the debris laden ice acting highly heterogeneously and often failing along a layer contact. The results have implications for the dynamics of ice masses

The Otago party mapped described and measured the sedimentology, structure and stratigraphy of the deposits and landforms associated with the small dry based alpine glaciers including the Taylor, Rhone, Hughes, Sollas, La Croix, Suess, Canada and Commonwealth glaciers in the Taylor Valley and the Wright Lower, Clark, Hart, Meserve and Bartley Glaciers in the Wright Valley. Their observations and measurements of the sedimentology and structure of the deposits suggested that previous interpretations of the origin of many of the diamicts associated with the alpine glaciers are oversimplified and in many cases even incorrect. Recognising the sublimation till previously also described by other researchers proved difficult and the team concluded that there were no reliable criteria for recognition and that previous interpretation was speculative. Overall however their work has identified areas in which there are problems interpreting the sedimentary sequences.

## Geological mapping

Geological mapping was undertaken by a combined party from two different branches of the Institute of Geological and Nuclear Sciences Ltd. Led by from Auckland it comprised fellow geologists Steve Edbrooke also from Auckland and Jan Forsyth from Dunedin. They were joined by Trevor Chinn, a glaciologist with the organisation also from Dunedin and flew south on November 2 arriving at their camp site in the Arena Valley some four days later.

The programme was undertaken from field camps at Mount Thor in the Asgard Range, the South Fork of the Wright Valley, McKelvey Valley, Mount Littlepage, Vishniac Peak and the Victoria Upper Glacier neve.

At Mount Littlepage, a nunatak at the Polar Plateau margin south of the Mackay Glacier, they were confined to their tents for three days by a katabatic gale and at Vishnia Peak, three days of snow blanketed much of the rock exposure they had hoped to examine. In all they lost some 22 percent of their field time because of the weather but most of their intended programme was completed and the mapping is now sufficient for publication of the sheets started by Australian led parties in the 1982/83 and 1984/85 seasons.

The party found new areas of granitoid and Koettlitz Group basement rocks, and hope to be able to correlate the granitoids with plutons mapped in adjacent areas. They better defined the Beacon Supergroup in the area of the Balham Valley High, where several Taylor Group units are absent and either Arena Sandstone or Beacon Heights Orthoquartzite directly overlies the basement. Photogeological maps of the Clare Range compiled by Australians showed the prominent bluff-forming unit there to be Feather Conglomerate, but field mapping proved it is Beacon Heights Orthoquartzite, a much older unit raised up east of Skew Peak by differential sill uplift of 400 metres. The field party was flown back to Scott Base on December 16 and all returned to New Zealand two days before Christmas.

*See pages 33ff for details of their individual experiment in logistic support while in the field as featured on the cover of this issue.*

A party from the Department of Geology at the University of Otago continued their studies of the basement rocks in south Victoria Land begun some years ago. Initially these were undertaken by MSc students but this a PhD project was added to the programme. Led by Geology Lecturer Dr Dave Craw, the party comprising Yvonne Cook, a PhD student and Guy Simpson who is studying for his M.Sc, were in Antarctica

for six weeks from mid-November. They were accompanied by Ross Cullen and Brian Alder from the New Zealand Antarctic Programme. Guy Simpson worked mainly in the Renegar Glacier area while the Yvonne Cook divided her time between there, the Skelton Glacier and the Williams Peak area. All field camps were supported by helicopter from Scott Base.

Their results so far indicate that the rocks in the Renegar Glacier area are transposed and recrystallised and have been subjected to structurally controlled veining. Where transportation has been intense these veins are now thought to occur as planar bands parallel to the overall foliation and consequently were previously unrecognised as veins. Elsewhere in the Renegar Glacier area little deformed metasedimentary and melaigneous sequences occur which are distinct from the remaining Keottiltz Group and can be correlated to low grade Skelton Group in the skelton Glacier region. The Keottiltz Group has undergone varying amounts of strain and transposition on a regional scale.

In the field rock types were extensively sampled and mapped and many conclusions were drawn from the structural data. However a considerable laboratory based component involved in both projects will concentrate on the geochemical and mineralogical evolution of the rocks sampled. Radiometric dating is hoped to be carried out on a granitoid intrusion in order to chronologically constrain the structural and metamorphic history of the Wilson Terrane. Future work, to be undertaken by the University, will concentrate on geochemical analysis of the veining found in the Renegar Glacier area and the origins and significance of its structural control. The results will then aid the group in identifying the thoroughly transposed vein arrays found elsewhere in the Keottiltz Group. The contact between the Skelton and Keottiltz Groups will be examined and related to the overall structural and meta-

morphic history of the Wilson Terrane governed by regional deformation and the localized effects of rock rheologies, and developments such as pluton intrusion.

## Mosses

A team from the University of Waikato spent 25 the days of January in Antarctica. Comprising Dr Dieter Adam, a lecturer in genetics, Dr Marie Connett, a lecturer in plant molecular biology and Dr Patricia Selkirk, a senior lecturer from MacQuarie University in Sydney, Australia and visiting bryological expert and Shaun Walsh, an M.Sc. student from the University, they spent time at Cape's Bird and Royds and at Lake Fryxell in the Taylor Valley. Members of the team also went to Garwood Valley and to the Botany Bay. Their objective was collection of moss specimens from these areas for analysis of genetic diversity which may shed light on colonisation patterns. Excellent weather permitted wide-ranging collections of four species. These will be analysed for variation in levels of enzymes and DNA over the next two years.

## Fish studies

Among the adaptations which allow Antarctic fish to survive at a point so close to freezing is a low but variable number of blood cells. During rest the low cell numbers reduce the viscosity of blood and lowers the work carried out by the heart. When the fish is "exercising" the heart beat increases markedly and the cell number increase to allow more oxygen to reach the tissues. Scientists know that such an increase is not caused by adrenergic stimulation but by a lessening of cholinergic inhibition but more knowledge is needed before they understand fully how the heart functions and blood circulates in two species of fish, *Pagothenia borchgrevinki* and *Trematomos bernacchii*. The team

involved in the programme comprised Dr's Bill Davison and Murray Forster from the University of Canterbury and Professor S. Nilsson and Dr M Axelsson from the University of Götteborg in Sweden who are experts in comparative cardiovascular physiology.

A new method of cannulating the dorsal aorta has been developed by scientists. It allows recordings of pressure from this blood vessel to be coupled with simultaneous recordings of ventral aortic pressure, heart rate and blood flow and means that they can measure stroke volume of the heart and systemic and gill resistances. Preliminary work was undertaken at Scott Base but much of the exercising of the fish for recording has been completed at the aquarium at Canterbury University and analysis of blood and tissues samples is being undertaken at Götteborg. The results are still being analysed.

### Survey work

Survey assistance as required by various project leaders and in support of ongoing work undertaken by the New Zealand Antarctic Programme has traditionally been provided by the Department of Lands and Survey. Following restructuring of that department and its subsequent renaming as the Department of Survey and Land Information this arrangement has continued. During the 1992/93 season one surveyor, Kevin Taylor, this year from the department's Gisborne office, travelled south and provided survey support for sixteen different projects. He was assisted when required by other NZAP personnel. His work usually involves levelling/heighting, position fixing, movement monitoring, topographical mapping, site surveys and precise setting out, took to the historic hut sites at Cape Royds and Evans and Hut Point for dislevelment and subsidence work, to Cape Roberts for topographical and site surveys and current meter hole fixing, to the Dry Valleys for the

annual Lake levelling, to the Mackay Glacier Tongue and along the seismic reflection line set up in the Hut Point Peninsula area (see previous issue pages 370ff). In addition he undertook a number of projects around Scott Base.

### Tide gauges

No tidal data was collected at Scott Base during 1992, the installation being rendered inoperable by ice movement at the beginning of the year. Because similar conditions have prevailed during the previous two seasons it was decided not to reinstate the gauge until a more satisfactory site can be found. The tide gauge at Cape Roberts however has continued to collect data throughout the year producing a constant record since 1990. This data is shortly to be forwarded to the World Ocean Circulation Experiment (WOCE) and the Permanent Service for Mean Sea level (PSMSL) data centres.

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### RDRC

#### New committee meets for first time

The newly reconstituted Ross Dependency Research Committee has recently been announced. It will be chaired by Sir Robin Irvine, comprise five departmental representatives and five other individuals appointed in their personal capacity by the government.

Their first meeting was held on Friday 2 April. It was attended by the new members, Dr Tom Clarkson, an international authority on ozone depletion, Dr Clive Howard-Williams, an international environmental biologist with ten years Antarctic experience, Professor John Montgomery, an ex-

pert in Antarctic zoology from the University of Auckland and Professor Vernon Squire from the University of Otago, a noted authority on climate change studies, particularly sea ice research. In addition ex officio members represented the Ministry of Research, Science and Technology, (Professor Don McGregor); the Foundation for Research, Science and Technology, (Sean Devine); Departments of Defence (Lieutenant Commander Peter Hurndell), and Conservation, (Hugh Logan); and the Ministry for External Relations and Trade, (Stuart Prior); and New Zealand Antarctic Programme personnel Gillian Wratt and Malcolm McFarlane. Observers from the Royal Society and Greenpeace were also in attendance; the chairman of New Zealand's committee to scar Dr Fred Davey was unable to attend.

Sir Robin Irvine, who chairs the new committee, has been Vice-Chancellor of Otago University since 1973. He has a medical background but has also had extensive involvement with the New Zealand Planning Council, and been a Director of the Institute of Environmental Health and Forensic Sciences. In releasing details of the appointment the Rt. Hon Don McKinnon, Minister of External Relations and trade said "Sir Robin brings a great deal of experience and wide-ranging contacts to RDRC His substantial involvement in New Zealand social planning and research areas will greatly aid the committee in its role of developing long term priorities for New Zealand Antarctic science. The new appointments are for periods of up to three years.

RDRC, as the committee will continue to be known, advises the Government on long-term priorities and directions for New Zealand's scientific effort in Antarctica as well as assessing and reviewing projects to be undertaken as part of the New Zealand Antarctic Programme.

In addition to the election of the chairman the two priorities for the first meeting

were discussion on the Long term science strategy covering the next five years which was approved in principle and with its final amendments is due to be released at the end of April and the institution of a system of RDRC awards under two young and promising scientists will received some funding for study of subjects of Antarctic interest.

---

## Winter personnel at Scott Base

**Base engineer:** Andy Goodall, 28, Auckland

**Engineering manager:** Roger Moffat, 37, Christchurch

**Mechanic:** Greg Harris, 29, Paraparumu

**Electrician:** Brian Green, 37, Nelson

**Chef:** Catherine George, 28, Dipton (summer 1991-92)

**Domestic:** Pam Davies (summer 1991-92)

**Stores officer:** Dave Brice, 35, (summer 1985-86, winter 1986/87, winter 1988/89)

**Technician:** Mike Mahon, 37, Christchurch

**Senior technical officer :** (telecom) Callum McGowan, Christchurch

**Base assistant:** Rob Johnston, 29, Wellington

## International Antarctic Centre shortlisted for award

The International Antarctic Centre in Orchard Road, Christchurch has been shortlisted for the National Architecture Awards. Designed by Christchurch architects Warren and Mahoney, it is one of three buildings in Christchurch and 15 in the four main centres to be selected from 36 entries. The other finalists include university build-

ings, a children's hospital, a multi-use development, a vineyard complex and a book on a building of major architectural significance.

A jury comprising Jon Craig of Craig, Craig and Moller, architects and interior designers based in Wellington and architects Felicity Wallace from Auckland and

Graeme Scott of Andrews Dvcott Cotton Associates also in Auckland, Wayne Mowatt, presenter for a national radio programme and Cheryl Sotheran, director of the Dunedin Art Gallery visited the sites in mid March this year. The results will be announced at a gala dinner in Christchurch on May 5.

## ANARE

# A deep hole on Law Dome

During this last season a glaciology team from Australia's Antarctic Division has drilled one of the deepest holes in Antarctica. They reached silty ice on bedrock 1200 metres below the surface of the Antarctic ice cap at Dome Summit South on Law Dome, 120 km from Casey Station about 22 February, 1993. The depth is thought to have been exceeded only by American scientists at Byrd who drilled to 2164 metres in 1968 and Russians drilling several times at Vostock between 1980 and 1990 to reach 2,000 metres. The series of cores the Australians have obtained will provide evidence of past environmental changes covering a period to 15,000 years before the present. Ice from the bottom of the hole, however is expected to be as old as 30,000 years.

The site was located and first occupied on 22 December, 1987. During that summer season a hole 95.9 metres deep was drilled through the firm into the impermeable ice. For the first 84 metres the team used a specially constructed thermal drill which makes a hole with a diameter of 270 metres. Glass fibre reinforced plastic casing normally used in artesian well sites was set in the hole to make it fluid proof for subsequent electromechanical drilling. The team led by Vin Morgan and comprised Colin Wookey and Dianna Patterson who were responsible for core analysis, involving stratigraphy, density measurement and isotope ratio sampling; equipment for conductivity measurement was lost on the *Nella Dan* which sank

prior to station and field resupply. Ian Goodwin was the surveyor and Russell Brand, the senior diesel mechanic responsible for field station operation.

That summer, also a 18 x 7 metre pre-fabricated steel arch drilling shelter, weighing some 18 tonnes, was constructed at Penguin Pass ready to be towed to the site later in the year when a three metre deep trench was cut around the borehole casing and the shelter moved into place over it. A 12 metre high access tower with a spiral staircase was built at the end of the shelter and drill winch and tower assembly, a heated control room and an ice core analysis module were set up in the shelter. The hydraulic pump station was installed together the

plumbing and wiring connecting it to the drill tower. The winch and drill were tested. The party for the second season of operations was led by David Etheridge a glaciologist and comprised X.Q. Gao and Colin Wookey, also glaciologists, George Musil and Athony Olejnicki, electronics engineers and technical officers Andrew Fleming and Brett Gogoll. The senior diesel mechanic was again Russell Brand. Operational difficulties with the drill led to a postponement of the programme in 1990-91 while the problems were solved but drilling was resumed the following season when further improvements were made in techniques and procedures.

The party for 1991/92 was again led by Vin Morgan and comprised Colin Wookey (core analysis/analysis organisation), Alan Eklchiekh (electronics/ice drilling/ Russell Brand (PI/station management), Li Jun (ice crystal analysis), Bill Skinner (core conductivity), Mark Richardson (computing ice/drilling), Steve Land (peroxide analysis) and Eric Le febre (ice core cutting/sampling). Three people worked full time and one part time on the drilling which continued for up to 14 hours a day and from which they obtained 20 metres of core. Conductivity was measured continuously and peroxide analysis was used to interpret the seasonal layers giving the team a preliminary time scale for the core.

By the end of the season some 6,500 samples had been sent to Australia where oxygen isotope ratio analysis will yield information relating to climate, snow accumulation and ice cap variations; 5,000 samples are being subject to hydrogen peroxide measurement which will provide information on atmospheric chemistry and snow accumulation and beryllium 10 samples are measured by CNRS in France for studies of accumulation changes associated with climatic variation from the last glacial maximum to the Holocene and investigations of solar variability. Core material is also being measured for past air composition.

During this last season drilling to bedrock was completed at the final depth of 1200 metres. The core is 100 mm in diameter and the last few sections contain rock fragments of up to 5mm and are visibly discoloured by fine silt.

The core from between 391 and 553 metres, which was drilled in the 1991/92 season was too brittle to be handled and has been subject to strain relieving in the drill shelter for a year. Apart from the bottom 6.3 metres of core drilled this season, the brittleness has been a significant characteristic and the scientists experienced considerable difficulty in making thin sections for crystal fabric analysis. No other sampling or analysis was possible and the sections will remain in the drilling shelter for a further year and be retrieved when the drilling gear is removed in the 1993/94 season. They will then be shipped to the new Antarctic Cooperative Research Centre at the University of Tasmania where Antarctic Division scientists will analyse them for evidence of changes in air temperature, the amount of precipitation and atmospheric composition over thousands of years. This is likely to be undertaken by Vin Morgan, Colin Wookey, Melanie Fitzpatrick and scientists from CSIRO. A small quantity of core will also be sent to France for analysis. The Australian scientists who will undertake the next stage of the programme were part of the drilling team this season; others included Alan Elcheikh (electronics/ice drilling); Jo Jacka (ice drilling); Peter De Vries (ice drilling); Russel Brand (PI/station management); Li Jun (core analysis - crystal fabrics); Mark Richardson (computing/ice drilling); Ursula Ryan (core analysis) and David Russell-Head, (core analysis and auto crystal fabric analyser).

Drilling averaged 126 metres a week and was undertaken in three shifts. Significant logistics and communications support was provided by the personnel at Casey Station. *Antarctic thanks Vin Morgan for assistance with this article.*

## Australia moves towards ratification of protocol

Australia's drive for an international regime to protect the Antarctic environment has completed a major step with the passage of key legislation by Federal Parliament.

The legislation, introduced by the Minister for the Arts, Sport, the Environment and Territories, Mrs Ros Kelly, is a major step in the process towards Australia's ratification of the Protocol on Environmental Protection to the Antarctic Treaty, signed in 1991 and known as the Madrid Protocol, which designates Antarctica as "a natural reserve devoted to peace and science." It puts in place a mechanism for prior reevaluation of all activities to ensure minimal impact on the Antarctic environment.

The Protocol will enter into force when all the Antarctic Treaty countries which signed it have taken the steps necessary to make its provisions binding on all their citizens. At this stage only Spain has completed the ratification process.

## Changes to Australian Antarctic Law recommended.

A report tabled in Federal Parliament on 5 November 1992 is the culmination of an inquiry by the House of Representatives Standing Committee on Legal and Constitutional Affairs to examine the laws and legislative structure of Australia's external territories and the Jervis Bay Territory. The second phase of the inquiry, set up in 1988, centred on the Australian Antarctic Territory and the Territory of Heard and McDonald Islands.

The recommendations include:

>defining the legal regime of the Australian Antarctic Territory as including the laws of Tasmania, rather than the laws, (other than

the criminal laws) of the Australian Capital Territory and the criminal laws of the Jervis Bay Territory;

>using the Ordinance making powers under section 11 of the Australian Antarctic Territory Act 1954 to legislate specifically for the Territory;

>declaring the Australian Antarctic Territory a nature reserve under the National Parks and Wildlife Conservation Act 1975;

>incorporating Heard and McDonald Islands within the state of Tasmania; and

>the Australian Government vigorously pursuing the application for World Heritage listing for Heard Island.

The Government has three months in which to respond to the report.

*Wendy Fletcher, Legal Officer, Antarctic Division. ANARE News 71/726*

## Conservation consultants appointed

The Australian Antarctic Foundation has chosen Canberra conservation consultants DAF. McMichael and Associates to undertake a major project in Antarctic environmental planning and management.

The project involves the preparation of a conservation strategy which will describe Australia's long term management intent for the Australian Antarctic Territory (AAT) and address a range of issues relevant to the area. The Protocol on Environmental Protection would be the basis for development of the strategy, which will provide guidance for Australian activity in the AAT. Development of the strategy will involve wide consultation among interest groups, including scientists, conservations and the tourism industry and those contemplating fishing activities in the area. Its development will be guided by a sub-committee of the Antarctic Foundation Board and will include a representative of the Australian Antarctic Division of DASET.

## Station maintenance work

The Antarctic Division's 1993 Antarctic Asset Maintenance Program (AAMP) involves summer and winter operations.

During the summer personnel at Casey, Macquarie Island and Mawson undertook preventative maintenance work and some minor new projects. At Casey a hard stand

was to be built near the main store, the operations building floor re-propped, and new aerials erected for physics research. At Mawson a new more efficient hot water system was installed, the waste treatment plant was overhauled and the incinerator rebricked. The enlarged laboratory at Macquarie Island was fitted out, the surgery re-roofed, reclad, relined and better storage facilities were installed.

## ANARE - feature Ancient forests revealed in Beaver Lake fossils

*Andrew N. Drinnan and David J. Cantrill,  
School of Botany, University of Melbourne.*

Antarctica as we all know it today, is a frozen, ice-covered continent that supports a very sparse terrestrial flora consisting only of mosses and lichens in those rare locations where underlying rocks are exposed. However, this now familiar landscape is only relatively recent in terms of the geological history of the continent, with the formation of the polar ice cap and development of a permanently frozen wilderness occurring only over the last ten or so million years. The earth's climate is strongly influenced by the positions of continents on its surface, for these determine the flow of ocean and atmospheric currents around the globe and the distribution and mixing of warm and cold water and air. Over the past several hundreds of millions of years the continents have drifted over the surface of the earth, creating new and destroying old sea floors, welding together to form massive super continents, and then breaking up again and dispersing

in new configurations, all driven by enormous forces deep within the molten core of the earth.

Antarctica was the central player in one of these supercontinents, the great southern land mass called Gondwana. Gondwana comprised the current continents of the southern hemisphere, Antarctica, Australia, South America and Africa, as well as India. It was in existence about 280 million years ago, and began to break up approximately 160 million years ago. The last Gondwana event was the separation of southern South America from the Antarctic Peninsula leading to the opening of the Drake passage. This resulted in the meteorological phenomenon known as the Antarctic Convergence, which effectively separates the weather pattern of Antarctica from the rest of the world. From this time onward cold air and water were trapped in the polar region, gradually refrigerating the continent to the extent we see it today.

During the existence of Gondwana, however, the situation was very different. Much warmer climates and a correspondingly ice free environment supported a lush vegetation over the area of present day Antarctica, and the evidence of this ancient vegetation is revealed by the occurrence of plant fossils from different geological periods in various parts of the continent.

One of the most spectacular and impor-

tant of the Gondwana floras comes from the geological period known as the Permian era, from about 285 to 245 million years ago, just before the age of dinosaurs. It was dominated by species of a now extinct plant called *Glossopteris*. A great deal remains to be learnt about *Glossopteris* plant and the general vegetation, but clearly some species were trees that formed substantial forests over large swampy areas.

*Glossopteris* has a particularly special place in both geological history of Antarctica and the early exploration of the continent. *Glossopteris* leaves are very distinctive and easily recognised and their fossilised remains are found in all the Gondwana continents. They are the first plants that show a truly southern hemisphere distribution, and were a significant part of the evidence that first led scientists in the early part of this century to hypothesise the existence of Gondwana and the drifting of continents over the earth's surface. In many instances *Glossopteris* floras are now of great economic importance, as their once vast swamps have turned to coal that is commercially exploited in areas such as the Hunter Valley in New South Wales.

*Glossopteris* leaves were the first fossils discovered in Antarctica. The specimens were collected from coal seams in the Beardmore Glacier region, on Scott's ill-fated return journey from the South Pole. Wilson, the expedition doctor and a learned naturalist, recognised their scientific importance and requested that the fossils be retained at all cost. They were amongst the 16kg of geological specimens found alongside the bodies of the polar party, and are now in the collections of the Natural History Museum in London.

The Beaver Lake area, northern Prince Charles Mountains, is one of the few fossil-bearing areas in Antarctica, and the only place in the whole of East Antarctica yield *Glossopteris* fossils.

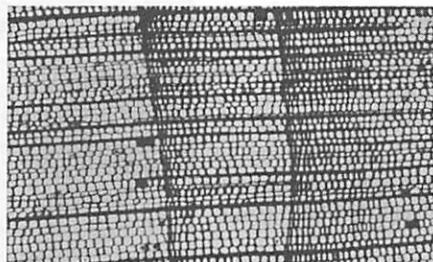
Now a frozen embayment of the massive Amery Ice Shelf, this region was once part of

a river system in vast rift valleys formed early in the separation of India from Gondwana. A fortunate combination of geological processes and an ice-free area have exposed a small sequence of river and flood plain sediments deposited in Permian times. Within the sandstones are numerous minor coal seams, the remains of low lying swamp vegetation dominated by *Glossopteris* trees.

These plant fossils from the Prince Charles Mountains play two vital roles in reconstructing the history of the Earth's vegetation. First they allow information from East Antarctica, by far the largest part of the continent, to be incorporated into the global picture. This is particularly relevant given the central position of Antarctica in the Gondwana super continent. Observations made in the field suggest that the uniformity of vegetation and climate



*Fossil Glossopteris leaf from near Radok Lake, Permian (260 MYA) Photo A Drinnan*



*Thin section through silicified peat (Permian) from Radok Lake, showing cross-section of wood with growth rings. Photo A Drinnan*

deduced from the other Gondwana continents also pertained to the Beaver Lake area, namely a cool temperate climate with rainfall far exceeding evaporation, resulting in extensive swamps and Glossopteris forests in low lying areas. The second important aspect concerns new information about the plants themselves that cannot be gained from fossils found elsewhere in the world. It is this 'unique' aspect that make some of the Beaver Lake fossils of major botanical significance.

Within a narrow seam of coal is a zone 40 cm thick of exceptionally preserved plant fossils. This layer was prevented from being compressed and turned into coal under the pressures and temperatures generated when the sediments were buried. Ground water percolating through the overlying river sands became very rich in silicate, which crystallised out of solution when it came into contact with the buried plant remains. Thus a narrow zone of swampy peat and leaf litter of the forest floor was solidly and permanently entombed in pristine condition, embedded in rock hard, glassy quartz.

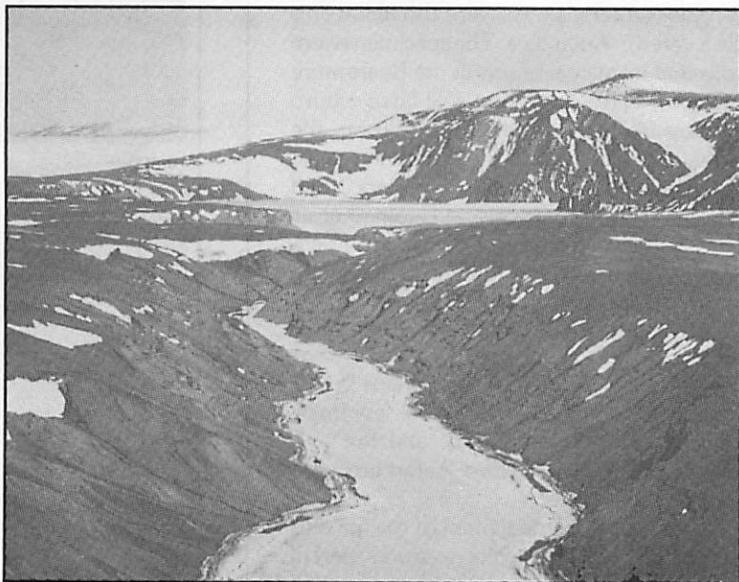
Such an immaculate preservation of plant fossils yields a rare view of the plants unparalleled by other kinds of fossilisation. Details of cell structure are revealed down to the minutest level, growth rings in tree trunks are easily observed, and the absence of any distortion allows the shape of complex plant features to be reconstructed with confidence.

The Beaver Lake fossil layer has encapsulated the leaf litter and other debris of the for-

est floor in its original position - a mass of leaves, twigs, wood, fruits, seeds and pollen, all intertwined with the roots of other plants growing in the swamp. Because forest-floor debris is a faithful representation of the plants of the overstorey above, analysis of the fossil layer will reveal a detailed picture of the immediate vegetation of the swamp. At present little is known of the plants that grew with Glossopteris; indeed there is still much to be learnt about the nature of Glossopteris itself.

During five weeks of fieldwork in the Beaver Lake area we collected about 1000kg of fossil plant samples, which will form the basis of laboratory analyses at the School of Botany, University of Melbourne, over the next several years. When the new information and results from the study have been made available to the general scientific community, the specimens will be lodged in the collections of Australian and overseas museums where they will be available for examination by other interested scientists.

*This feature has been reproduced from ANARE News Spring/Summer 1992-93 pages 10 and 11.*



## Chile

## Eleven bases opened for 1992/93 programmes

Six vessels and 13 C-130 flights are providing the logistic support for the 1992/93 summer and winter operations being undertaken by Chile in the Antarctic. Four stations are scheduled to operation throughout the coming winter while seven smaller stations were used to support 18 summer scientific programmes.

The C-130 flights supporting the 1992/93 Chilean Antarctic activities commenced on 29 July 1993 with one each month until November through to January when there were two. Then there will be one flight again each month until April with none scheduled for May and June 1993. All operated between Punta Arenas and Marsh where air support was supplemented by Twin Otter and DH6 operations. Marsh has a hard rock runway which is 1,292 metres in length and 39 metres wide. (There is also an ice runway at O'Higgins which can support DH6 and Twin Otter operations.)

Six vessels comprise the Chilean Antarctic flotilla and have provided the main logistic support for summer operations which were carried out over a wide area involving a number of islands, the Antarctic and Fildes Peninsula.. The 29th scientific expedition aboard *M/N Quellon* a merchant vessel of 240 tons, carrying ten people undertook two major voyages the first leaving Pto. Montt on 28 December 1992 was scheduled to finish on 1 February. The itinerary from P. Montt included Fildes Peninsula area, Coppermine Island, Covadonga, Shireffe, Point Williams, Cape Potter, Armonia, Almirantazgo and a return journey. On 10 February she was scheduled to depart again on a similar voyage but with a slightly different itinerary and this was scheduled to end on 7 March 1993. Her captain for the season was Sr Eugenio Oliva Bernabe.

*AP Pilato Pardo*, is an ice strengthened cargo vessel with a displacement of 2785

tonnes and able to carry 12 passengers. She was under the command of Capitan de Fragata and left Punta Arenas for Antarctica on 2 December returning to the port on 26 January. The third vessel in the fleet supporting summer operations was the *AGS Yelcho*. She has a displacement of 1544 tonnes and carries 12 passengers and left Punta Arenas on 2 December, returning 15 January. *ATF Galvarino*, an 1,800 tonnes vessel able to carry , 12 passengers left Punta Arenas for Port Williams on 30 November returning to the port on 28 January. The *ATF Lautaro* was at sea from 28 November until mid February 1993

Of the four bases operating throughout the year Capitan Arturo Pratt in Bahia Chile on the Greenwich Island and General Bernardo O'Higgins were relieved in mid-December. The main annual relief at Teniente Rodolfo Marsh was scheduled for 20 November while Fildes was to be relieved on 15 February.

Seven smaller bases were in operation over the summer. They are located on Adelaide Island, on the Munita Peninsula, on the Palmer Archipelago, on King George Island, Robert Island, and two on Livingstone Island.

Seven different nationalities were scheduled to be involved in the programme during the summer. They included Spanish, French, Peruvian, Mexican, New Zealanders, Germans and Jamaicans. (See Antarctic Vol 12. No. 9 page 308.) A number of expeditions from other countries also oper-

ated out of Chile; they were supported by ANI and comprised DC-6; DH-6 and Cessna operations. (See page 30) Yoshiro Shirakawa President of a Japanese Institute of Photography was scheduled to visit Adelaide Island.

## Summer science programmes

Three earth science programmes were planned; one party spent 24 days in the Fildes Peninsula Area mapping the soil types for a cartographic purposes; another visited five different locations during a 21 days stay in Antarctica to study the concentrations and accumulation of radioactive contaminants as part of a world wide study and a third undertook another mapping programme in Fildes Peninsula area over 26 days designed to produce a multi disciplinary map.

Six biological and ecological programmes were to be undertaken; they involved chemical studies of marine organisms in the Fildes Bay area, work on the comparative ecosystems at on Robert Island, coastal ecology and physiology in South Bay, photosynthetic work on microalgae; biosynthetic work including species quantification also on Robert Island. Penguin and fish studies were also undertaken on Livingston and Ardley Islands and in the Fildes Peninsula area. Some work on krill provided the thrust for another programme.

Three atmospheric studies were included in the overall programme, two to be undertaken from Marsh and involve thermospheric irregularities and cosmic ray work. A comparative study of ultraviolet radiation and how it affects the photosynthetic ability of aquatic organisms was part of the programme.

Other projects included paleobotanic work in the South Shetland Islands, satellite observations at O'Higgins and the establishment of a scientific marine at Arturo Prat.

## Italy Summer plans limited by finance

Funding for the full 1992-93 Italian Antarctic Programme was not available because of major restrictions of government expenditure however a late revision allowed some of their scientists to work in the Terra Nova Bay area and with other national antarctic Programmes. The principal logistic support enabling the major part of the programme to proceed by transporting the Italians south was provided by the *Polar Queen*, chartered for the Ganovex VII expedition, by the Federal Institute for Geosciences and Natural Resources, by a US C130 Hercules. A Squirrel AS350B from Helicopters (NZ), based in Nelson, provided support for the scientific and other programmes undertaken by the Italians in the Terra Nova Bay and adjacent areas.

The *Polar Queen* was loaded in Lyttelton by November 26 and sailed the following day, arriving at Terra Nova Bay on December 6. In addition to the participants in the German programme there were six Italians, some of whom were to work with the Germans, and Jim Wilson (pilot) and his engineer from Helicopters New Zealand, a Nelson based company. A further 13 Italians flew south by US C130 Hercules on December 13 and were transported from McMurdo to the base by their chartered aircraft and by two German Squirrel helicopters, one of which was an AS305B2. The entire party returned to New Zealand on board the *Polar Queen*, arriving in Dunedin on January 26, a week later than scheduled

because of bad weather encountered during the deployment of German scientists in the Yule Bay area

Terra Nova Bay station lies at 74deg41'42"S/164deg07'23" East, on the coast of the northern foothills which are north-east of Gerlache Inlet in Victoria Land. It was established during the 1986-87 season a support a variety of scientific programmes being undertaken by the Italians, many of which are operated on an international basis. This summer the expedition leader was A Cucinotta and the station manager D. Voli.

Atmospheric and earth sciences provided the focus of the programme. Massimo Frezotti from ENEA/C.R.E. - Casaccia in Rome continued glaciological observations with the positioning by GPS, of some data points on the Drygalski, David, Strangline, Tarn Flat, Priestley Glaciers and on Browning Pass; the programme involved some 50 to 60 helicopter hours. For much of the time he was accompanied by Guiseppi Zibordi from C.N.R./IMGA at Modena who undertook a telesurvey as part of the operation of the AVHRR (Advanced Very High Resolution Radiometer) for the collection and processing of cloud and ice coverings. This data will be used to provide information for future aircraft operations.

General maintenance of the seismic and geomagnetic observatories was undertaken and Lorenzo De Silvestri, of ENEA/C.R.E. Casaccia in Rome was extensively involved in the work data collection, replacement and repair of on the various automatic weather or "Meteo" stations which have been installed within a range of 150km from Terra Nova Bay. The 12 solar powered stations collect data all the year round and during the summer this information is integrated with that collected from other meteorological stations and radio sounding balloons. A volcanological observatory, comprising five clinometric stations and four seismic stations on Mt. Melbourne was also restored to full

operation. Throughout their stay at the station this season fuel was regularly cached for future operations and empty drums returned to the base.

## Other programmes

In addition to operations in the Terra Nova Bay area two Italian atmospheric physicists M. Cacciani and P. Di Girolomo from the University of La Sapienza in Rome, spent part of the summer at Amundsen-Scott South Pole station where they continued summer observations on stratospheric aerosols by means of the LIDAR installed there during the 1987-88. Annual maintenance of the equipment and training of personnel to operate it for the winter was also undertaken. A similar programme at McMurdo involved A. Adriani and G.P. Gobbi, atmospheric physicists from C.N.R. the Institute of Atmospheric Physics in Rome.

Italian scientists worked at Scott Base with the New Zealand programme where measurements were made by Dr Carlo Valenti from the Institute of Atmospheric Physics in Rome of the column ozone content, using a Brewer spectrophotometer. L. Ciattaglia from the same organisation was at Base Belgrano with the Argentinians where a spectrophotometer in operation and where a sun photometer has been installed to undertake systematic measurements of the optical thickness of the aerosol.

At Esperanza, another Argentinean base F. Fanzutti, a seismologist from the Osservatorio Geofisico, Sperimentale in Trieste optimised the seismic and gravimetric stations put into service last year. The operation of these stations is designed to facilitate a study of the structure and tectonic evolution of the Antarctic margins and of the Scotia Arch.

Dr Bruno Marino (see Antarctic Vol 12 No's 11 and 12 pages 370ff) also worked with New Zealand scientists in a seismic programme originally to be carried out at

in the Wilkes Basin area but rescheduled to the Hut Point Peninsula after an accident with a US Navy Hercules limited the available logistic support for deep field operations.

G. Caneva and A. Colla from the University of Genoa and M. Chiappini from the National Institute of Geophysics in Rome continued airborne magnetic surveys with the scientists from GANOVEX VII. This programme began during the 1991-92 summer.

Three Italians were based either at Dumont D'Urville or operated from the station; F. Vannutelli, an engineer specialising in atmospheric physics from Quanta Sytems S.r.l in Milan operated the LIDAR DIAL (POLE) as part of a cooperative programme to study the ozone vertical profiles, polar stratospheric clouds and tropospheric clouds. This equipment has been operating continuously since 1991. SODAR measurements were undertaken by S. Argenti from C.N.R. Institute at Atmospheric Physics at Frascati in Rome and R. Buccolini participated in a French organised traverse from Cape Prud'homme on the Antarctic plateau towards Dome -C where a base is likely to be established in future. (See Antarctic Vol 12 No 9 page 304ff).

P. Giulani from ENEA -C.R.E./Casaccia in Rome participated in a multi national Antarctic inspection organised by the British (See page 20.).

## Photographer uses base

*M/V Frontier Spirit* called at Terra Nova Bay from 9 to 12 January this year and transferred fuel and a AS350B Squirrel Helicopter also from Helicopters NZ) to the area. The crew comprised. Bob McElhinney and Steve Power. They flew in support of Mr Yoshikazu Shirakawa, a photographer and president of the Shirakawa Institute of Photography who is undertaking a photographic programme covering the Transantarctic

Mountains. His party operated from Terra Nova Bay using one of the huts at the Station and returned to Dunedin on the *Kapitan Khlebnikov*

## Seasonal festivities

The close proximity of the German and Italian programmes this year provided an occasion for the exchange of hospitality. Gondwana was the venue for celebrations on Christmas Eve and the Italians reciprocated on New Year's Eve. The participating nationalities included Germans and Italians of course, but there were also Australians, Dutch, Austrians and Norwegians as well as a small group of New Zealanders.

## The next five years.....

Italian Antarctic activities had previously been funded under a special law passed on 10 June 1985 but which expired in 1991. A new law was approved by the Italian Government in June 1991 but still had to be passed by the two branches of the Italian parliament. This was achieved in November 1991 and is defined in act n 380. Three hundred and ninety billion liras has been allocated. Parliament also reconfirmed the organisational set up of the previous Act 284/85 and gave to the Minister for Universities and for Scientific and Technological Research the task of formulating, with the assistance of a National Scientific Commission for Antarctica, a five year programme and of submitting it to CIPE, a government body for economic planning, for approval with the advice of the Inter ministerial Consultative Committee for Antarctica and of the National Science and Technology Council.

The formulating criteria were that >scientific activities will be improved and renewed on the basis of global problems connected, mainly with global change Programmes, as indicated by SCAR;

> International collaboration will be stimulated and enhanced: part of the budget for scientific research will be devoted specifically to international Programmes;

>it will be possible to carry on research in subantarctic and arctic areas, in connection with Antarctic scientific problems;

>the collection and conservation of Antarctic samples in the National Museums is encouraged, in view of the establishment of a National Antarctic Museum;

>the project of building a winter headquarters, provided with the high technological equipment is foreseen, encouraging collaboration with international parties for its realisation;

>a polar vessel, for oceanographic and cargo purposes, will be chartered on the long term. The main themes for future scientific work are

1 Geological structure and evolution of the Antarctic continent and of the southern ocean.

2. Glaciology and Paleoclimate.

3. Climate: Atmosphere, ocean and their interactions.

4. Sun-earth interactions and astrophysical research.

5. Biology, ecology and environmental contamination.

6. Observation stations, geographic information etc.

7. Advanced technological research.

Some 20 percent of the activities must concern Programmes which are to be conducted at an international level.

Within two years of its entry into force, the Act, 380/91, also provides for the establishment of a National Museum on Antarctica for the conservation, study and enhancement of the finds acquired during the scientific expeditions and of any other evidence of Italy's presence in Anta Antarctica. The decree of 1992 also makes provision for the creation of an ad hoc national study group charged with the formulation of a proposal for the museum as one of the elements that will make up the National

## System of Museums and Scientific Centres. Logistics

The Italian Base at Terra Nova Bay has, since its construction, generally been in operation for two months of the summer season, but this can already be extended to a five month operation. Logistic arrangements can be made for rotation of scientific staff. Currently the base can sleep 60 but it is likely to be expanded to accommodate 80 although some of the service facilities such as fuel storage, labs and recreational rooms and vehicles shelters have still to be completed.

Logistic support is likely in future to be provided by aircraft of the Italian Ministry of defence. A cargo ship may be chartered and a purpose-built or adapted vessel is likely to be acquired on long term lease for oceanographic work. Helicopters will continue to be used for medium to short distances and the acquisition or charter of a light aeroplane is being considered for future scientific and logistical needs.

Operational support on an international basis will be further developed and Italy is likely to join with France in the construction of the proposed base at Dome C as well as maintaining logistical and scientific cooperative Programmes with USA, New Zealand and Germany.

## Agreement with Australians

On 12 August 1992 Italy and Australia signed an "arrangement for Scientific Cooperation in Relation to Antarctica." The arrangement is initially for five years and was made between the Italian National Scientific Commission for Antarctica and the Australian Antarctic Division and comprises joint research projects, information and personnel exchange and logistic and technological cooperation.

Areas identified for initial cooperation include remote sensing of sea ice, LIDAR stratospheric measurements, geological and geophysical investigations aimed at

Gondwana reconstruction, Southern Ocean biology and winter research most particularly in atmospheric physics, limnology and terrestrial botany.

Developments since the signing include discussions on participation of Italian oceanographers in the ANARE marine research

programme, the OGS *Explora* undertaking geoscience studies in the Prydz Bay region and joint investigations into the use of all sky cameras, as well as joint environmental studies, glaciology, logistics and technology and political science.

## U.K.

### Treaty inspection included tourist vessels

A multinational Antarctic Treaty Inspection team involving representatives from Britain, South Korea and Italy, carried out a series of inspections in the Antarctic Peninsula area between 12 January and 14 February 1993. The team travelled aboard the Royal Navy vessel, *HMS Endurance*.

The team led by Mr Munro Sievewright from the British Antarctic Survey in Cambridge, comprised Captain Robert Turner and Lieutenant Commander John Larby from the *HMS Endurance* and Pietro Giuliani from the Italian Antarctic Project and Dr Soon Keun Chang from KORDI in Korea.

They visited the Korean Station King Sejong, the British stations Faraday and Rothera, Juan Carlos Primero and Gabriel de Castilla, established by the Spanish, the Argentinean stations Espiranza and San Martin, the USA's Palmer Station, Arktowski belonging to the Poles, the Brazilian station, Comandante Ferraz and the Chilean base Arturo Prat. Visits were also made to the abandoned American and British bases on Stonington Island and the abandoned British and Argentinean bases on Deception Island. For the time also inspects under the treaty system were made of tourist vessels. These were the *Explorer*, *Akademic Sergei Vavilov* and *Europa*.

A report of the team's findings is currently under preparation and will be submitted to the XVIII Antarctic Treaty Consulta-

tive meeting to be held in Japan in May of 1994.

## US

### Design competitions go a stage further

Environment 2: A new Town for Science was a 1992 design competition for students at US universities, which was administered by the American institute of Architecture Students and partially supported by a grant from the National Science Foundation which stipulated that the winners of the competition, their faculty mentor and the architectural jurors would visit McMurdo refine the design and present it to the residents.

A party of 11 comprising three students from the University of Oregon and their professor and five of the six member jury were at McMurdo from January 1-11. At the end of their stay they produced a cyclostyled booklet which contains a mission statement defining their objectives which were to

>develop a built environmental that pro-

notes a sense of affiliation with the station's research purpose of research and its compatibility with the natural environment;

- >to create a resource management system that maximises human potential, conserves energy and materials and minimises detrimental environmental effects;
- >to renew substandard buildings and systems;
- >to provide a sense of place and community where individuals can seek enrichment;
- >to facilitate and reduce maintenance; and
- >to create environments for quality living.

The proposed a plan that was "evolutionary rather than revolutionary", utilising the majority of the existing facilities, separating traffic and incompatible uses, and grouping related functions in adjacent structures. Community facilities have been grouped to form a town centre, reducing large barren open space to create a sense of place and feeling of identity. A board walk system creates a strong organising element, uniting the town from the housing units to the Science and Engineering Center.

Community facilities in the town centre include a new food service facility, a recreation centre, a dispensary, a reception and information centre,, an education centre - the Peter E. Wilkniss Education Centre - clubs, coffee houses and short-term accommodation. The related facilities would be connected with raised board walks located, in most instances, over utility piping.

Although the NSF is not committed to using the final plan it is trying to develop design expertise for science support in cold regions and to developing McMurdo as a community of the future that supports science efficiently, provides professional and personal fulfilment to residents and has the minimal possible environmental impacts. The results of the study are being considered.

And in the meantime nearly 1,400 km from the eastern coast of Antarctica, Dome A, at an altitude of 4,000 metres, is the

highest point of the east Antarctic plateau. The temperatures there, averages -70deg C and below and the night is five months long. While this secluded and forbidding site may seem an odd location for a research station it has long been a compelling attraction for scientists from many disciplines and now for US college and university students of architecture, engineering and related disciplines, it is also providing a unique challenge- to create a space analog on the highest point of the polar plateau.

These students are competing in Environment 3: An Antarctic high station. The competition is the third that has been jointly sponsored by the American Institute of Architecture Students (AIAS) and the National Science Foundation's Office of Polar Programs. Environment 1 provided students with the opportunity to develop a conceptual design for the U.S. research station at the geographic South Pole, and Environment 2 focused on producing a master design for McMurdo Station that incorporated the needs of the science community while considering community, social, and environmental issues.

The site on the polar plateau was chosen because the dry, cold atmosphere above this region makes it advantageous for astronomical research at infrared and millimetre wavelengths. The region is also magnetically connected to the polar cap and, consequently, gives scientists new opportunities to study the magnetosphere. For geologists the site is of interest because it is above the subglacial Gamburstev Mountains, a rarely studied feature of the east antarctic craton.

The objectives of Environment 3 are to:

- >meet research and living needs of science teams;
- >maximise their working effectiveness and comfort in the most severe climate in the world;
- >minimise the environmental impacts of human presence; and
- >develop and use advanced architectural

concepts and engineering technologies.

The guiding philosophy is that the design decisions should consider science objectives; provide for comfort and safety; be easy to maintain; have internal flexibility and minimum environmental impact; and meet requirements for interpersonal dynamics and quick simple installation with minimum on-site construction.

The students must envision a small, self-contained base that will house 12 researchers along with the necessary support personnel. As in space, the science teams will live in work in the remote enclosure. Because the pressure altitude at this point on

the plateau is equal to an altitude of about 5,000 metres, the students have been encouraged to consider design features that may seem more appropriate for the Moon or Mars.

Full and part-time students, regardless of their major, enrolled at US. institutions are eligible to participate. Teams of three students will be accepted and interdisciplinary groups are encouraged. Registration opened on 8 September 1992 and closes on 21 May, 1993 with submissions due on 28 May to be judged on 5 June in Washington, D.C. Prizes are \$1000, for first, 750 for second and 500 for third.

## Subantarctic

### Macquarie:

The International Union for the Conservation of Nature (IUCN) decided in September 1992 to defer the nomination of Macquarie Island to the World Heritage list pending a review of all Southern Islands for World Heritage status. Macquarie Island had been jointly nominated by the Tasmanian and Federal Governments for World Heritage listing in 1991.

The IUCN has set up a working party of representatives from countries with responsibility for Southern Ocean Islands including Australia, France, New Zealand, Great Britain, Norway and Chile. They will assess and report on the application of the World Heritage Convention to the islands of the Southern Ocean.

### Campbell

The *MVGreenpeace* made a brief call into Campbell Island to pickup the mechanic Steve McAllister and bring him back to Dunedin and Wellington for medical tests. He arrived in Dunedin on about Thursday 11 March and, having finally been declared

fit, returned to Campbell on the *Solander II* a Nelson based fishing vessel which departed New Zealand about March 20.

## 200 teddy bears visit

### Mawson's Hut.

Four men and 200 teddy bears visited Mawson's Hut in Commonwealth Bay in January of this year.

*Buttercup*, a steel yacht was specially constructed for the 1990-91 single handed around the world yacht race. Skipped by her owner Don McIntyre of McIntyre Marine Services in Sydney, the vessel was crewed by Wade Fairley, an adventure photographer, John Miles and Hans Sturzenegger also of Sydney. The teddy bears were entrusted to them by their owners who paid \$60 to Camperdown Children's Hospital in Sydney in return for their passage south. They were photographed in front of the hut and the results will be used in a teddy bear calendar to be produced in 1995.

On their return to Australia the expedition leader called for urgent action to conserve the remaining structures, including the main expedition hut and the many historic artefacts still scattered around the site.

## CCAMLR

# International scheme for scientific observation finalised

The eleventh meeting of the Commission for the Conservation of Antarctic Marine Living Resources was held in Hobart from 26 October to 6 November, 1992. Among the major achievements were the finalisation of the CCAMLR scheme of International Scientific Observation, the setting of a precautionary catch limit on krill in the South Indian Ocean area and the acceptance of significant conservation measures for the protection of selected finfish.

In addition the meeting received a preliminary report from SCAR on the status of Antarctic seals and seabirds, discussed the mortality from longline fishing, net monitor cables and marine debris, agreed to design a survey to facilitate the assessment of krill stock and the fish-by-catch during krill trawling operations, and agreed to further develop guidelines and formats for research cruises. Additional work is also to be undertaken on the development of guidelines for the protection of the organisation's ecosystem monitoring programmes sites and for the development of new fisheries in the CCAMLR area. Whaling and climate change were also discussed briefly during the meeting which concluded with the appointment of a new executive secretary and the next chair for the commission as well as other administrative matters.

CCAMLR XI comprised sessions of the Scientific Committee held between 26 and 30 October, and of the Standing Committee on Observation and Inspection which also met during the first week. General plenary sessions made up the rest of the XIth Meeting of the Commission which was formally opened on 26 October by Penny Wensley, Australia's Ambassador for the Environment.

She emphasised the unique character of the organisation which bases its conservation measures on the ecosystem and has evolved relevant techniques to manage exploitation and monitor developments accordingly. Drawing attention to the United Nations Conference on the Environment and Development held in Rio de Janeiro in June 1992, and the growing appreciation that fisheries and other resource based industries had to take place within the context of sustainable development she suggested that the "rest of the world had finally caught up with CCAMLR".

Delegations attending the meeting came from Argentina, Australia, Belgium, Brazil, Chile, the EEC, France, Germany, India, Italy, Japan, Republic of Korea, Norway, Poland, Russia, South Africa, Spain, Sweden, United Kingdom, United States of America.

Observers came from: Bulgaria, Finland, Greece, Netherlands, Uruguay and the Ukraine. The International Organisations represented included the IUCN, the International Whaling Commission and SCAR. Two non-government representatives from ASOC in New Zealand and the World Wildlife Fund in the UK also attended.

New Zealand's delegation comprised Nigel Fyfe from the Ministry of External Relations and Trade, Dr Don Robertson, Ministry of Agriculture and Fisheries, and Michael Donoghue from the Department of Conservation.

## Observation

During the first week of the meeting the Standing Committee on Observation and Inspection (SCOI) met on several occasions. It was chaired by Jan Arvesen of Norway and their priority was the completion of the CCAMLR scheme of International Scientific Observation as required by article XXIV of the Convention. The Scheme will allow designated observers to be placed on board vessels operating in the Convention Area, by agreement with the flag states concerned. The observers are generally empowered to "observe and report on the operation of fishing activities in the Convention Area with the objectives and principles of the Convention for the Conservation of Antarctic Marine Living Resources in mind".

The specific tasks of the observers are specified in an annex to the Scheme. They include an obligation to record details of the vessel's operation (e.g. partition of time between searching, fishing, transit and details of hauls); taking samples of catches to determine biological characteristics, recording biological data by species caught; recording by-catches, their quantity and other biological data; recording entanglement and incident mortality of birds and mammals; recording the procedure by which each declared weight is measured and collecting data relating to the conversion factor between greenweight and the final product in the event that catch is recorded on the basis of weight of processed product. They are also required to prepare reports on their observations in the special format approved by the Scientific Committee and submit them to CCAMLR through their respective au-

thorities and submit copies of their reports to the captains of the vessels and, if requested, to assist them with recording and report procedures and to undertake other tasks as may be decided by mutual agreement of the parties involved.

Under the scheme as adopted at the meeting each member of the Commission may designate observers in accordance with the relevant Article in the Convention but the activities of the observers are specified by the Commission. Scientific observers are nationals of the member who designates them and are individuals who must be familiar with the harvesting and research activities to be observed, the provisions and the measures of the Convention and adequately trained to carry out their duties. They must also be able to communicate in the language of the Flag of the vessels on which they are observing. On board they have officer status.

## Review of seals and seabirds

CCAMLR had previously requested SCAR, the Scientific Committee on Antarctic Research, to undertake a five yearly review of the status on Antarctic seals and seabirds. Its June 1992 report contained the following conclusions:

**Seals:** For the land-breeding species, censusing is much simpler, and more confidence can be attributed to the estimates. Fur seal populations are continuing to increase throughout the Convention Area. Elephant seal populations are declining in the Indian and Pacific Oceans while the status of the South Georgia stock is uncertain.

The SCAR scientists were unwilling to make any assessments of the status or trends of ice-breeding Antarctic seals, because of the paucity of reliable data. An international programme of research on the behaviour, abundance and distribution of pack-ice seals is currently under preparation and a planning workshop has been scheduled for mid-

1993.

Seabirds: Although there is a lack of long-term monitoring data for many species, the SCAR Bird Biology Subcommittee estimated the status of penguin populations (King, Adelie, chinstrap and macaroni) as all appearing to be increasing or stable. All species of albatrosses and the southern giant petrel were declining, most probably because of incidental mortality in longline fisheries. For other species there was inadequate data to make a reasonable estimation.

### Incidental mortality

Incidental mortality from longline fisheries, net monitor cables and marine debris have been under discussion at recent meetings of the Commission. This year the adoption of a Conservation Measure CM29/X stipulating the use of streamers and other methods to reduce the capture of seabirds by longline vessels was taken a step further and it was recommended that streamers should now be used at all times including night-time deployment. Conservation measure 30/X also adopted at the 10th meeting, at New Zealand's urging, prohibits the use of net monitor cables in trawl fisheries from the 1994/95 season and prescribes modifications to be adopted in the interim. Only Russian vessels continue to use such cables and the meeting was assured that this would be stopped by the time the measure comes into effect. Entanglement in marine debris continues to be a significant problem.

### Fish stock assessment

A working group on fish stock assessment met at CCAMLR headquarters in Hobart prior to the main meeting of the commission. Using the assessments of the working group and scientific committee, a number of new conservation measures relating to finfish have been adopted by the commission and several existing measures

were rolled over. The new measures relate to five species in the South Georgia area for two seasons and limit and define the method of the catch of *C gunnari* for the 1992/93

Catches of lanternfish in South Georgia area have also been limited for the 1992/93 season and a requirement for biological information was set. Limits for the catch of *D eleginoides* in the South Georgia area were established and all commercial fishing in the South Orkney and Antarctic Peninsula regions remains prohibited. Limits were also imposed on the catch of *N squamifrons* in areas of the Southern Indian Ocean for the current and next season.

### Krill and the by-catch

It was noted that there had been a 19 percent decline in the catch of krill in the 1991/92 season and this was attributed largely to reduced trawling during the dissolution of the Soviet Union. Russia however was noted as still being the largest catcher. It was closely followed by the Ukraine, and then Poland and Chile. Australia is also interested in operating a four vessel fleet to catch krill in future seasons.

Generally the krill stock is considered to be healthy but concern was expressed as to the quality of the data available to the working group and at its next session the Scientific Committee will consider the design of a synoptic survey to determine the abundance of krill in a specified statistical area.

The fish by catch problem was during krill trawling was discussed and consideration is likely to be given to measures to reduce this. The time of year and locations at which young fish are most at risk will need to be considered as part of any detailed monitoring of the krill fishery to assess the true magnitude of the problem.

### Research cruises

The Guidelines relating to research cruises were tightened up. A new conserva-

tion measure stipulates that catches taken during research cruises would be counted as part of the overall catch limit. A further resolution outlines the requirements to be observed during planned research cruises in which the catch limit exceeds 50 tonnes. The Scientific Committee has been requested to develop standardised guidelines and formats for such cruises.

## CEMP

Further work is being undertaken on the guidelines for the protection of CEMP (CCAMLR Ecosystem Monitoring Programme) sites.

## New fisheries

The rules relating to proposals for the development of new fisheries were also considered. Such a fishery is defined as being a "fishery on a species using a particular fishing method in a statistical subarea" for which no information on such matters as distribution and potential yield have been supplied or for which data has not been submitted for the two most recent seasons. Any proposed fishery is subject to advance notification and may not be initiated until the Scientific Committee and the Commission have considered the proposal. A precautionary principle is to be embodied in the procedure which is being developed to govern the development of new fisheries during their exploratory stage. This will enable CCAMLR to ensure that a fishery cannot expand before sufficient information is available to enable management decisions to be made.

## Administration

Dr Darryl Powell, the Commission's first Executive Secretary retires at the end of 1993 after 11 years service. Dr Esteban de Sala Ortueta of Spain was selected as his

successor. Dr De Salas is an experienced fisheries administrator. The new Chair of the Commission, replacing Ambassador Jorge Berguno of Chile, will be provided by the delegation from the European Community.

*During 1993 the Working group on Krill will meet in Tokyo from August 4-14' on Cemp in Seoul from 16-23 August; on Fish Stock Assessment in Hobart from 15-21 October. The Scientific Committee will meet next in Hobart from 25 October to 5 November during the same period as the Commission.*

## Whaling sanctuary

In late February the World Wildlife Fund for Nature in New Zealand called on the Government to declare all of New Zealand's 200 mile exclusive economic zone a whale sanctuary. This follows the declaration by Japan in January of its intention to resume catching up to 2,000 minke whales a year in southern waters, an action which encouraged Greenpeace to seek out the fleet and assess the situation. Currently the WWF's proposal is limited to waters under New Zealand jurisdiction, while at a different level the International Whaling Commission is considering an independent proposal submitted by the French at its last meeting to establish a sanctuary south of 40degrees which includes also two thirds of New Zealand and Greenpeace favour a sanctuary.

The question of establishing a sanctuary around the Antarctic from the ice edge to 40deg S latitude was discussed at the last meeting of the International Whaling Commission. (Antarctic Vol 12. No. 9 page 320ff) As usual the meeting was in two parts and the scientific committee discussed the value of sanctuaries as a management tool

and for research and at the main meeting the French Government proposed the establishment of the Sanctuary in accordance with Article VI(l)(c) of the 1946 Convention for the Regulation of Whaling. The adoption of the proposal would call for amendments to the main schedule which are likely to be presented at the next meeting.

For 17 years following the negotiation of the International Whaling Conference in 1938 all southern waters between 160 degrees to 70 degrees west were set aside as a sanctuary to protect part of the Antarctic feeding grounds not yet subject to commercial whaling. In 1955 the Japanese gained support at the IWC to overturn the protection.

On this round the French have chosen the Southern Ocean as being an area where a sanctuary would contribute to a marine ecosystem that has been severely but not irretrievably damaged by human exploitation in less than 100 years. The proposal, they state, integrates with other current international actions towards protection of the entire Antarctic region and given its distance from industrial centres seems to offer the best prospects for securing a satisfactory habitat for cetaceans and other marine life in the long term. Moreover all of the area has the legal status of High Seas and no Southern Hemisphere Nations have declared any interest in resuming commercial whaling and there is no aboriginal subsistence whaling in the region.

Specifically they stated that "The primary purpose of this proposal is to contribute to the rehabilitation of the Antarctic marine ecosystem by reinforcing and complementing other measures for the conservation of whales and regulation of whaling. In particular by the protection of all Southern Hemisphere species and populations of baleen whales and the Sperm whales on their feeding grounds. Other measures referred to, which specifically concern the protection of breeding groups of the migratory species and of the tropical Bryde's

whale are:

- a) the establishment of the Indian Ocean Sanctuary and
- b) the long standing prohibitions of pelagic operations by factory ships north of 40deg south, of the killing of calves and lactating females and, of killing whales smaller than the designated minimum length.

The proposal takes into account the guidelines suggested in 1982 by the Technical Committee Working Group on Whale Sanctuaries by which the Commission took note at its 34th meeting, and subsequently as well as the comments made at that meeting by the delegations on the report of the working group and summaries initiatives made by organisations such as the IUCN and others and principles endorsed by the United Nations. The full document is comprehensive and contains 54 points, many, drawing on current and newly evolved principles, such as sustainable yield and its relation to the trends in environmental management. It then deals with the characteristics and choice of an appropriate sanctuary, further considerations regarding the selection of the Southern Ocean, the boundaries of such a sanctuary, its duration, research and monitoring and inclusion within the sanctuary of certain coastal areas under national jurisdiction (which applies mainly to the Indian Ocean). The document also lists other supportive and supplementary activities and aspects of the guidelines prepared by the Technical Committee Working Group on Sanctuaries.

At the IWC meeting New Zealand welcomed the French initiative in bringing the proposal forward stating that it was consistent with the IWC's mandate and responsibilities to consider such a conservation proposal but stated that thorough discussion at the scientific level and in the light of the Revised Management Procedures, which a sanctuary could enhance. However through discussion was essential. SCAR and CCAMLR are also involved and the item should be on the agenda for the 1993 meeting of the Commission. In the mean-

time the World Wildlife Fund for Nature initiative covers a more limited area but

includes all the waters around New Zealand.

## Greenpeace Three pronged approach to 1992/93 season

Greenpeace used two vessels and undertook three main programmes during the summer. The first comprised the charter of the yacht *Pelagic*, the visiting of bases and monitoring of fishing fleets in the Peninsula and South Shetlands area, the second, a check of the site of its dismantled World Park Base at Cape Evans in the Ross Dependency and visits to other bases in the vicinity and the third, involved the monitoring of the Japanese whaling fleets in the oceans between New Zealand and Antarctic in order to draw attention to the proposed whale sanctuary.

Janet Dalziel of New Zealand was voyage leader on the *Pelagic*, a 16.5 metre long steel hulled yacht (see Antarctic Vol. 12 No. 9 page 326) owned and skippered by American Skip Novak. Julie Crossley, an Australian was first mate and Peter Malcolm, from Tasmania, Hank Haazen from the Netherlands and Jorge Gutman from Argentina made up the rest of the crew with Gutman doubling as medic. All however assisted with the sailing of the vessel. The chief scientist was Ricardo Roura from Argentina who was also assistant campaigner and the photographer; Bruce Adams from New Zealand was the cameraman.

The party departed for Ushuaia on Christmas Day, boarded the *Pelagic* and left

the port early in the afternoon of 31 December.

The vessel then proceeded across the Beagle Channel and Drake Passage to King George Island to visit the bases around Maxwell Bay. They called in at Jubany (Argentina); Artigas (Uruguay); Great Wall (China); King Sejong (Korea); Bellingshausen (Russia); and Ten. Marsh (Chile). At Jubany they briefly encountered the *Canal Beagle*, the Argentinean vessel involved in the removal of the last of the oil aboard the *Bahia Paraiso* (See Antarctic Vol 12. No's 11 and 12 page 400).

About 13 January they arrived in Admiralty Bay on the others side of the island, and visited the Polish station Arctowski, a Czech refuge on Nelson Island and subsequently calling in at Ferrá, a Brazilian Station and Macchu Piccu, the Peruvian Station, abandoned in 1989. They then proceeded to Chile's Arturo Pratt on Greenwich Island. During their stay an small fire occurred in the attic and they were able to assist and they undertook some sampling of the site of an oil spill in the 1970's for the Chilean government. They the visited Moldenado, the Ecuadorian station on the other side of the bay. By now it was January 20 and they proceeded to Juan Carlos, the Spanish station on Livingston Island and then onto Deception Island where bad weather delayed them until January 26. Then it was down the strait called into visit Bernard Stonehouse whose party were working on Colville Island before visit Gonzales Fidea and Almirante Brown. The vessel then proceeded to Faraday, the British base where a two fuel spills last summer has apparently had a noticeable affect on the flora and rocks below the station, and contin-

ued onto Port Lockroy an abandoned British Station. By early February they were back in the Magellan Straits and sheltered briefly at Greenwich Island during another period of bad weather before observing the trawling activities of a Japanese krill fishing fleet. By the 12 February they had proceeded back across the Drake Passage and arrived in Ushuaia. During their travels they encountered a number of the cruise ships chartered by American organisations over the summer (see Antarctic Vol. 12 11 and 12).

*As a general comment Greenpeace expressed their concern about the number of station officers in charge who were unaware of the new environmental protocol, did not have copies or had been told that operational changes were not yet required.*

In the meantime *MV Greenpeace*, under the command of Arne Sorenson, left Hobart on 6 December in search of the Japa-

nese whaling fleet operating in southern waters after announcing their intention in January to take over 2,000 minke during the summer of 1992/93.

During the next 97 days the vessel sailed along the North Victoria Land coast, visited Dumont D'Urville, sailed along the North Victoria Land coast and called in at the Balleney Islands. Extreme weather conditions encountered between the Balleney and Ross Island resulted in extensive damage to the landing gear on their helicopter which would subsequently limit their operations. However they arrived at Cape Evans on 10 February but conditions precluded their going ashore before the following day when they used zodiacs to gain access to the beach.

*Greenpeace scientist Grant Harper taking soil samples at the former site of World Park Base, Cape Evans, Ross Island, in February 1993. Photo: Greenpeace*



The shore component of the expedition comprised scientist Grant Harper, (New Zealand) and Dana Harman (USA); Marc Defourneaux and Chris Robinson who was involved in the establishment and dismantling of the base. Considerable support was also provided by the crew. The site, this season was completely free of snow and ice and there was evidence of the return of skuas, seals, two Adelie penguins and an Emperor. The area was relatively free of debris apart from some nails and wood scrapings left after the withdrawal of the anchors which had secured the buildings. Members of the New Zealand Antarctic Programme had inspected the site in November and marked the area of the fuel rack with a cairn. The Greenpeace team sampled the site finding that the Jet A1 had evaporated with the snow melt and left no residue. They repeated their sampling programme carried out previously over most of the area of the spills and found that the concentration was mostly less the deeper they investigated except for one area where the concentration had increased. Contaminated surfaces were removed and backfilled with material from the beach. Subsequent analysis of the sam-

ples should reveal further information about the behaviour of fuel under these unique conditions. Other soil surface samples were taken for microbiological analysis.

The vessel then proceeded to Scott Base and to McMurdo, staying for two nights in the area and providing open-ship hospitality for some 75 of the personnel at the stations. From there they sailed to Terra Nova Bay, having encountered in the interim the *Kapitan Khlebnikov*, which had put in a cache of supplies for ANI's operations next season. The cache comprises 60, 55 gallon drums of Jet A1, two Yamaha skidoos and associated Mogas and some Avgas for Cessna operations. There are also 15, 25 kg boxes of Australian mutton for use by the Vaughan expedition, (see page 38).

Prior to departure from the Ross Sea the vessel encountered the Japanese catcher *Nissan Maru* and another vessel belonging to the whaling fleet and called in on the German party involved in the GANOVEX expedition in Terra Nova Bay. They finally left the area on 28 February calling in at Campbell Island at the request of the New Zealand government to pick up an ailing member of the current team. (See page 22).

## Seven first footings to south Pole *Fiennes and Stroud* *break two records*

Only two of the seven men and women who walked and skied to the South Pole in January unsupported by dogs or vehicles continued past 90 degrees south.

The two Englishmen, Sir Ranulph Fiennes and Dr Michael Stroud completed their intended crossing of the Antarctic land mass and the longest unsupported journey in polar history - 2172 km in 94 days - but

on February 11 gave up their attempt to reach Scott Base.

Four cross-country skiers of the American Women's Trans-Antarctic Expedition intended to continue past the Pole to McMurdo Sound and join a tourist cruise ship about mid-February. But they were flown out to Chile less than a day after their arrival, because, they were behind schedule, and two members were suffering from the rigours of the journey.

They returned to the United States as the first women to reach the Pole under their own power. The leader Anne Bancroft achieved a personal record. She became the first woman to reach both the North and South Poles by surface transport..

A 29-year-old Norwegian corporate lawyer, Erling Kagge, was the first of the seven to reach the Pole walking alone. The journey of 1310 km took him 50 days, and he returned to Oslo on February 3, with two records - the first solo walk and the fastest trip ever made to the Pole.

All the skiers were flown to their starting points by Adventure Network International, which takes mountaineers, tourists, and private expeditions into Antarctica each summer from Punta Arenas, Chile, using a 1957 DC-6B, two de Havilland Twin Otters, and a 1980 single engined Cessna 185.

The company has a relatively comfortable base camp at Patriot Hills (80 deg 19 min S / 81 deg 20 min W) in the Heritage Range of the Ellsworth Mountains, which is close to a blue ice runway that can be used by wheeled aircraft. It is 1080 km from the South Pole.

## The first away

Fiennes and Stroud were first away on November 10 from Gould Bay (78 deg 00 S / 45 deg 00 W) which is at the junction of the Filchner Ice Shelf with the north-east corner of Berkner Island in the Weddell Sea sector. They did not start from the extreme edge of the shelf but slightly inland.

By November 28 they had reached 80 deg 55 min S / 39 deg 55 min W.

Eighteen days later they were at the Pole, crossing the 90 degree line on January 16.

They did not waste much time there, and headed north into the Ross Dependency on the 81st anniversary of Scott's arrival at the Pole on 17 February, 1912.

When the American women first decided to cross Antarctica in the 1991-92 summer their departure point was named as the Filchner Ice Shelf. In a list of planned itineraries for private expeditions in the 1992-93 summer Hercules Inlet was given as the starting point.

Hercules Inlet (80 deg 05 min S / 78 deg 30 min W) is part of the south-west margin of the Ronne Ice Shelf which is on the western side of Berkner Island. The Filchner to the east between Berkner Island and Coats Land.

## Changes to womens team

Two changes were made in the original team. Anne Dal Vera (37), a ski and wilderness instructor and Sunniva Sorby (31) manager of an outdoor clothing store, and a teacher of navigation, rock climbing and backpacking, replaced Kellie Erwin-Rhoads and Reinette Senum. Sue Giller (44) a computer programmer, whose 20 years of mountaineering included ascents of Mt. Everest and Mt. McKinley completed a team with special skills.

Although the women were in touch with Punta every three days little was heard of their progress after their departure on November 11. They averaged 10 km to 13 km a day at the beginning of the journey. On the last stage the average run was just under 24 kms, when their sledge loads, originally up to 90 kg were much lighter.

Unlike the Englishmen and the Norwegian, the women did have air support. ANI put in supply caches, half way between the Filchner Ice Shelf and the Pole, at the Pole and on the Beardmore Glacier.

Ann Bancroft and her team reached the Pole on January 14. They took 64 days for the shortest distance - 1012 km on a route by way of the Thiel Mountains, which included expanses of sastrugi, and a monotonously bland landscape.

## Kagge

Because Kagge was walking alone and only to the Pole he was more accessible to the media. Some English newspapers did their best to suggest that there was a race between the Englishmen and the Norwegian to reach the Pole first.

ANI flew James Buchan from Punta Arenas to the Pole to report Kagge's arrival for "The Independent." Its readers were told in the Sunday issue of February 14 that the quotation from Tennyson's poem "Ulysses" "To strive, to seek, to find and not to yield" was the epitaph engraved on Scott's monument at Cape Evans.

But Buchan gave a lot more detail about Kagge, who reached the North Pole on foot with a companion Boerge Cusland. A third man, had to be airlifted out.

A most efficient skier, Kagge, planned his route from Berkner Island meticulously, consulting experts, notably the British glaciologist, Dr Charles Swithinbank. With a personal stereo for entertainment he pulled his 125 kg sledge at an average of 26 km a day - faster than his forecast 22km.

## Philosophy

Kagge walked for ten hours a day with four 15 minute rests. Alone in his tent at night he wrote a "philosophical" journal which he intends to publish. To keep his mind occupied while he pushed south into chilling winds he read such books as Oscar Wilde's "The Picture of Dorian Gray" Herman Hesse's "Siddhartha", J.D. Salinger's "The Catcher in the Rye" as well as the bible.

There were some chinks in his armour, however. He left his crampons at home This was his only bad moment and when he realised what he had done he talked to himself for the first and only time on the whole journey.

He decided in advance not to use his radio., His sponsor insisted he should take one but for some reason he left the ice batteries in the Twin Otter which took him to Berkner Island.

His only means of communication was by a Norwegian Army Argos satellite system which could transmit only his position in and a few brief pre-coded messages. Before starting for the Pole he skied north and sent

his first Argos message from 78deg 12min S.

Kagge had aimed to reached the Pole by January 15, his 30th birthday. He was flown to Patriot Hills later than he expected because of bad weather which stopped the Twin Otter flight.

## Delayed departure

When he, the American women, and Mrs Morag Howell, the chief radio operator for Fiennes and Stroud reached Patriot Hills they had to wait almost a fortnight for ANI's leased DC-6 to arrive and fly them to Punta Arenas. Unfortunately the DC-6 had lost an engine.

ANI finally tracked down a spare engine in Laredo, Texas. It was trucked to Miami, Florida, and then made the last transport to Punta Arenas before March. Mechanics worked 30 sleepless hours to fit the engine, and the veteran DC-6, brought back skiers, scientists and tourists to civilisation.

Kagge reached London on February 1, and returned to Oslo a hero's welcome on February 3. He was greeted at the airport by his family and friends and with flowers and musical bands. While children begged for his autograph he did his best to demolish a large slice of cream cake. He needed it, as he was 10 kg lighter than when he set out.

February 3 in Oslo was a day of music, flowers, and cream cake. For Feinnes and Stroud it was just another day of desperation in their progress down the Beardmore Glacier. Eighty-six days of fighting temperatures plunging to minus 25 degrees Celsius or worse, dragging sledges laden with all their food and supplies and battling chilling winds gusting up to 40 knots had pushed their bodies to the edge of human endurance.

There was little indication of their extremely critical situation in earlier press releases to the British Media by a London public relations firm. Most of these were

more concerned with the team's two objectives - breaking an 84 year-old record for the longest unsupported polar journey, and the first crossing of the Antarctic Continent on foot without land or air support plus the expedition's appeal to raise two million sterling for the Multiple Sclerosis Society.

But on the night of February 3 the expedition's chief radio operator, Mrs Morag Howell spoke to the British journalist James Buchan from the ANI Base at Punta Arenas. Mrs Howell was the vital link for the expedition organisers with Fiennes and Stroud who reported their progress to her by short-wave radio. She was based at Patriot Hills and flew to Chile after the summer operations ended. Buchan was on the same aircraft.

## Deteriorating conditions

"The Independent's" readers on February 4 learned that the expedition was in severe difficulties. Fiennes and Stroud were suffering from frostbite and hunger and a breakdown of equipment.

An auxiliary SRSAT radio system which gave satellite positions and pre-coded messages from Fiennes and Stroud to the rear base in Scotland by way of Mrs Howell, was either malfunctioning or had been smashed on the descent of the Beardmore Glacier. Communications with Patriot Hills had evidently been very poor.

Mrs Howell's chief concern was that with Antarctic temperatures falling quickly the question was whether the two Twin Otters at Patriot Hills would find good flying weather and conditions for a rescue mission. The expedition had a rescue insurance policy with ANI.

But Fiennes and Stroud had more serious worries. For 50 days Fiennes had marched with an intensively painful infected frostbitten foot. The infection had not responded to treatment with anti-bodies in the low temperatures, so he had to inject inflam-

mation reducing drugs. Stroud's hands were frostbitten, and both men's body weights had been reduced - Fiennes from 95 kg to 64 kg and Stroud's from 72 to 51 kg. Food rations calculated to last 100 days were low, and did not provide sufficient caloric intake to compensate for the loss of body weight.

By February 6 an expedition spokesman revealed that Fiennes and Stroud had to rely on short-wave radio as they had not been able to repair their damaged satellite beacon. The antenna of the second radio had also been broken when one man fell into a crevasse.

In the first 20 days of the journey Stroud fell into a crevasse, and his sledge had been snapped. It was retrieved and lashed together with rope. Movement down the treacherous glacier ice became more hazardous when Fiennes and Stroud were reduced to one ski pole each, without baskets for support.

When they started their 87th day Fiennes and Stroud had cleared 1931 km. It was a long march across the Ross Ice Shelf to Scott Base and they still had almost four more days on the Beardmore.

## Questions of safety

Although the statement by an expedition spokesman expressed concern for the physical state of the explorers, and how safe it was for them to continue, the emphasis was still on the first world record and the second in sight. At the time the distance covered (2022km) was actually 8 km short of the 1909 recorded (2030km).

Earlier releases credited a record (2004km) to an Australian expedition led by Douglas Mawson. This time, two Australians, Mawson (Yorkshire born) and Edgeworth David (Welsh born) and Alistair Mackay, a Scot, were named. But they were members of Shackleton's 1908-09 expedition. Led by David, they walked 2030 km to fix the position of the South Magnetic

## Pole

By February 7, after 90 days Fiennes and Stroud had passed 2030 km and also completed the first unsupported crossing of Antarctica on foot. Emaciated, exhausted, and close to starvation they reached the base of the Beardmore Glacier. Despite the loss of another ski pole, and still pulling sledge loads of 90 kg, they made better than average progress down the glacier on February 6, covering 29 km.

On February 8, they were camped on the Ross Ice Shelf. They had 563 km more to walk to Scott Base and take advantage of the presence of the *Frontier Spirit* which was in McMurdo Sound until February 17. But time and distance were against them. Food supplies, calculated to last 100 days, were getting low, and Fiennes was still in severe pain with his infected foot.

## Rescue imminent

By this time ANI's two Twin Otters were in position on the Ross Ice Shelf. Fuel depots had been laid to enable the pickup plane and its support to return to Patriot Hills after picking up Fiennes and Stroud and flying them on to Scott Base.

Fiennes and Stroud decided to march on, not so much for the third record but to add distance for the sponsors and the Multiple Sclerosis Society funds. The Twin Otters remained about 100 km north of the route taken by the two men.

Finally, with only five days food remaining, Fiennes ended their journey on February 11, the 94th day. Fiennes called one of the Twin Otters and told the pilot of the decision.

Since February 8, the two men had moved on over the ice to a position just over 69 Km north of the Beardmore Glacier. The aircraft were in position about 9 km from the last camp.

Fiennes called Scott Base at 7 a.m. the next morning to pass on a message to his

wife Virginia. Arrangements had been made with the New Zealand Antarctic Programme for Lady Fiennes to call Scott Base at 8 a.m. on Friday.

Soon after 11 a.m., two exhausted men "more dead than alive" as Fiennes told Patriot Hills from the aircraft, were on the way home. Scott Base heard from them last at 11.15 a.m.

After 94 days of acute hardship Fiennes and Stroud were able to relax and eat properly again. When they reached the Patriot Hills camp on the evening of February 13 they had eggs for breakfast the next morning, and were able to enjoy their food and the pleasure of clean clothing left by Mrs Morag Howell when she flew to Punta Arenas late in January.

Because the weather closed in on February 14, the Twin Otters could not make the last flight out to Punta Arenas until Monday February 15. Fiennes and Stroud were able to avoid waiting journalists as they did not arrive until midnight.

After a good nights' sleep they were on a KLM flight to Amsterdam where they stopped off to fill up on some of the comforts of life they had not seen for more than three months - duty free goods.

## Return to London

Early on February 17, they arrived at London's Heathrow airport. Sir Ranulphs wife Virginia, and Dr Stroud's wife, Thea, and his two children were there to greet them. It was day 100, the crossing of Antarctica from the Filchner Ice Shelf to Scott Base had been planned to take the same time.

After a press conference at which Sir Ranulph said the months it took to make the trip were "the nastiest of my life", the pair were taken to meet the Prime Minister at 10 Downing Street. Dr Stroud had some of his frostbitten fingers strapped; Sir Ranulph wore padded ski boots to protect his feet and carried his ice axe.

Mr Major congratulated the pair on their exploits and asked them immediately to back Manchester's bid to host the Olympics in 2000. "Manchester certainly deserves it", replied Sir Ranulph.

From No. 10, the two men went to

Army Personnel Research Establishment at Farmborough in Hampshire, where Dr Stroud is head of applied physiology, to undergo the days of medical tests to determine how their bodies have reacted to the extreme conditions of their journey.

## Ice-biking on the Polar Plateau

Trevor Chinn

Picture two figures on skis, methodically plodding up a glacier slope leading to the plateau of the Antarctic ice sheet, bulkily dressed against the - 20 deg C temperatures, with the majestic vista of miles and miles of huge glaciers sweeping between the peaks below them. Incongruously a third figure appears bumping along beside them - and this figure is casually pedalling along on a bright red bicycle.

There is nothing new about bicycles in Antarctica. There was one on Ross Island on Scott's expedition and currently there are some at Scott Base for both private and general use. What is new is the concept that a bicycle might be an asset for fieldwork on the gentle slopes of the polar plateau. The idea was impractical until the advent of mountain bikes with their very low gears on a sturdy frame, wide tyres and a seat that does not seem to be designed to cut one in half.

No doubt many have considered the possibilities of biking in the Dry Valleys, and one season a party even fitted bicycle wheels to a banana sled to save on helo hours. The heavily laden contraption was met with mixed success. Nowadays we have sensibly decreed that any form of vehicle in the Dry Valleys shall be prohibited on environmental grounds, and in addition the majority of the valley floors are either too bouldery or too

dry and loose for wheels.

But what of bicycles on glaciers? There should be no environmental problems here as any tracks must be ephemeral and most Antarctic glaciers are agreeably smooth and gently sloping. It is perhaps not until one has seen and travelled some of the huge, smooth bare blue-ice slopes of the polar plateau that one realises the enormous extent of gentle sloping country that lies at the ice sheet margins. On close inspection, one immediately discovers that this ice is super slick, but also that just a few grains of sand are enough for boots to get a grip, while the sastrugi surrounding these areas is normally so hard and wind-packed that one barely leaves any footprints. Consequently a bicycle tyre that mimicked a handful of sand would be bound to get a grip.

In the 1992-93 season, the geological mapping programme of the Geological Survey was continued by its replacement organisation, the Institute of Geological and Nuclear Sciences, with an expedition planned to work along the western margins of the dry Valleys, up to heights which include much of the margin of the ice sheet. Because of associated logistics problems and the high demand by other parties, no motor toboggans were to be used on this expedition. I was not enthusiastic about the prospect of walking huge distances to see yet another plain rock as I have attained sufficient maturity to be content to cover as much country as possible with as little agony as possible. So I declared that I would take an ice-bike for travelling the big shiny areas of flat ice!

In preparation a bike had to be fitted out with tyres that would grip on those very slick

surfaces. Spikes, like crampons, seemed to be technically difficult, while sand a proven success, had much better potential. So two of the roughest, toughest industrial sanding belts in town were purchased. Fortunately the stock belt size was just under two inches wide with a perimeter that exceeded the circumference of a bicycle wheel. This 'sandpaper' strip was glued to a strip of 'cordura', with pop rivets added in case the glue objected to the cold. The material was cut into a series of flaps extending from each side of the sandpaper, and the composite strip was stretched along the tread of the tyre. The tyre was deflected and the flaps tucked firmly between rim and tyre which once reinflated ensured no escape for the sand paper.

## Backup systems

Backup systems were arranged in case the sandpaper wheels' did not work, since there would be little hope of any modifications or repairs being able to be carried out in the Antarctic environment. The first backup system was to fit the bike with studded tyres as used in Canada and other places where icy roads are common, although it was considered that the few studs in these tyres would have little grip on the very hard Antarctic ice. The second backup continued the sand philosophy with, "why not glue the sand directly on to the tyre?". So a pair of smooth treadless tyres called 'road slicks' were bought for the purpose. These were pasted with one of those very tenacious shoe repair rubberised preparations, then, while the glue was still tacky, the tyre was rolled through loose sandy roof grit - as used on metal roofing tiles. The final tread had a very aggressive grip, but the tyre itself was much narrower than the studded counterpart..

The bicycle, complete with its two sets of tyres, two rolls of sandpaper 'overtreads', carrier and pannier bags, was left packed at Scott Base when the expedition left for the first of the Dry Valleys camps in early No-

vember 1992, and it was not until work moved high up onto the edge of the ice sheet near the Mackay Glacier that the bike was flown out on resupply. After being hatched from its crate and assembled, the bike performed well on the rock pavements around the camp. When all was ready to run biking trials on the adjacent glacier, the camp was hit for three days by a vicious katabatic gale. During this time the tent was turned into a workshop while a carrier and pannier bags were fitted, to carry the attendant equipment like spare clothing, coffee thermos, geology hammer and rock samples. Handling tools at -20deg C can be a bit clumsy. During this interlude it was found that the sandpaper tread could not be persuaded to fit through the calliper of the back brakes, so the trials were carried out with sandpaper on the front only and a studded back tyre.

Out on the glacier, the bike was wheeled out while the remainder of the party attached skins to their skis. It was immediately a great success, easily pedalling up the hard snow beside the skiers. On the blue ice of the plateau, the driving wheel still had traction but would accommodate no sudden movements. Despite their sparse distribution, the studs did actually grip on the brittle ice although it did take a little more than the usual bicycling care and courage. It should be noted that this was on "cold" brittle ice with temperatures from -15deg C to -25deg C, where snow has a sandy consistency under skis. During the day it was found that the bike was three to four times faster than the skiers on this terrain, and was only stopped by soft snow patches. Once the wheels sank to two to three centimetres into the snow, cycling became too arduous to continue.

An attempt was made to reach the outermost nunatak across a strange hummocky blue ice field. It was found that the hummocks were the result of wind ablation over crevasses, and it was also found that the loading of a bike wheel is quite high so that



it smartly breaks into small crevasse lids. After the crevasses increased from the harmless 10cm wide to the 20 to 30 cm widths, and obviously got bigger further on, the attempt to reach the nunatak was abandoned. The downhill cruise back to camp was a high speed, rough and bouncing descent of unforgiving sastrugi where control was actually better than on skis. One unforeseen aspect of ice-biking was that your feet get cold, despite wearing good boots, because they are not being worked by walking movement.

The next camp had an area of bare ice some 5 x 15 km across, coalescing glaciers where it was planned to use the bike to map the unusual moraine patterns in detail. Unfortunately 15 cm of new snow fell as t this camp, and although the bike was ridden 300 m down to the bare ice areas, it was found absolutely impossible to ride on any thickness of new snow. The snow is packed over the ice surface and everything fell heavily onto the frictionless surface.

*Extreme glacier biking - ski biking trials undertaken by Trevor Chinn on the upper Victoria Glacier. Photo - Mike Issac*

About two centimetres of new snow remained over the hard snow of the Victoria Upper Glacier neve of the last camp, and this proved ideal for travel by ski, but was just too soft to make any headway on the bike. As a compromise, trials were made of riding the bike while wearing skis, and this combination had very mixed results. The limited steerage meant a smooth launch was required, but at any stage and at any speed, the bike could be safely abandoned in the case of trouble.

Finally the bike was tried out on lake ice during a stopover on the Upper Victoria Lake. Here the warmer lake ice around -deg C was almost too slick for the studded rear tyre, so it was changed for the true-grit tyre. It was then found that in addition to the rough terraced multi-year ice, the bike could easily handle the smooth new ice in top gear

and at top speed without any real danger of falling (well, at least we didn't fall off!). However it was found that a dusting of snow on the tyres under these 'warm' conditions was immediately fatal to equilibrium.

What of the future of ice-biking? I would

unhesitatingly recommend taking a mountain bike for any prospective work in bare ice areas of the plateau, lower glaciers and the lakes. Steel studded tyres are a minimum requisite, and if it can be arranged "sandpaper tyres" are the ideal modification.

## The Mount Vaughan Antarctic Expedition

Colonel Norman Vaughan, the 88 year old veteran of the 1928-29 Byrd Antarctic Expedition is planning his third trip to Antarctica during the summer of 1993/93. Vaughan, first travelled south as a dog handler responsible for the teams used by the geological expedition undertaken as part of the Byrd Expedition of 1928 29 which created Little America, pioneered aerial mapping and made the first flight to the South Pole. He has returned to the Antarctic once in the interim and that was to join in the celebrations making the 50th Anniversary of the historical flight on the 19 November 1979.

The original geological party was led by Dr Laurence E. Gould, a geologist who also navigated, and comprised Frederick E. Crockett, dog driver and radio operator, Edward E. Goodale, dog driver; George A. Thorne dog driver and topographer; Norman D. Vaughan, dog driver and in general charge of all the dogs; and Jack O'Brien who supported much of the survey work.

Departing Little America early in November they made fast pace across the first 100 miles to depot No. 4, the last outpost of the party supporting the Pole flight and depot laying for the geological party. From the following day they headed south and by 4 p.m. November 25 they could distinguish Mt. Nansen and steered towards a gap in the solid rock of wall which was Liv's Glacier, and camped in the shadow of the mountain. They were trying to chart as much of the

Queen Maud Mountains as they could and the mapping was undertaken largely by Thorne and O'Brien. Three days were spent exploring the lower part of Liv's Glacier before they found it inaccessible and moved to the western portion of the Axel Heiberg where they established Strom Camp.

On December 6 half the party left the camp to climb a saddle between two spurs on the southern slope of the mountain. discovering that it comprises a great series of sandstones containing toward their top, seams of impure coal-like material and that it was part of a great uplifted fault block system of mountains. On December 8 the party moved further westward and Vaughan, Goodale, Thomson and Gould climbed another spur of the mountain. Another day was spent in the area and they returned to Strom camp after climbing what they assumed to be Mt. Betty, both to search for a cache left by Amundsen and to look at the eastern part of the Axel Heiberg Glacier. The discovery of the cache is not mentioned in Little America, the book by Byrd, but Reader's Digest "Antarctica" states they found it on a lower ridge. It contained a tin of kerosene, a waterproof packet containing boxes of matches and a can with its lid tightly in place. "It was a climax wrote Gould, "the high spot of the summer for all of us" when I pried off the lid of this tiny can and took out the two little pieces of paper. One was just a piece crudely torn from a book and contained the names and addresses of

Wisting and Johanssen who had helped Amundsen build the cairn and the other was a page carefully torn from the notebook of Amundsen himself.....

On 12 December Gould and Goodale recovered a cache laid by Byrd to support the polar flight and brought the food back to camp giving the party a greater margin of safety in terms of supplies. On 13th, a Friday, they began their eastern trip; the barrier was blanketed in clouds, ahead and toward the east lay a great range of mountains and 15 miles to their right was Mt. Nansen. Part way up the Axel Heiberg Glacier they camped with Mt. Ruth Gade towering above but for the next three days they were tent bound in deteriorating weather. On the 7th they were underway again and proceed eastward towards the Barrier before coming across a great ice field and turning sharply to their right to go into the mountains.

### Their achievement

On 21 December, 1929 they summarised their route and mapping, as being "east from Mt. Alice W. the mountains were lower and continue as far west as we could see. The highest peaks in Marie Byrd Land do not exceed 5,000 feet while Mt. Ruth Gade beside Axel Heiberg is 15,000 feet. The eastern part of the area is characterised by greater glaciers than Axel Heiberg or Livs." They charted three great valley or outlet glaciers that could be classed with the Beardmore. While Thornton completed the mapping the others climbed the nearest peak which they called Supporting Party Mountain; it was their farthest point from little America and lay at 85deg,25min,17" S/147deg55'W. They built a cairn and left a note "This note the farthest east point reached by the Geological Party of the Byrd Antarctic Expedition. We are beyond or east of the 150 meridian and therefore in the name of Commander Richard Evelyn Byrd

claim this land as a part of Marie Byrd Land, a dependency or possession of the United States of America. We are not only the first Americans but the first individuals of any nationality to set foot on American soil in the Antarctic. This extended sledge journey from little America has been made possible by the cooperative work of the Supporting Party composed of Arthur Walden, leader; Christopher Braathen; Jack Bursey and Joe de Ganahl. They then gave the composition of their party. In all had mapped 175 miles of the front ranges of the Queen Maud Mountains and demonstrated that the great fault block mountain system continued almost due eastward from Axel Heiberg Glacier for more than a 100 miles, that there was no such highland as Amundsen thought he saw called Carmen Land and they had helped to push the known limits of the Ross Ice Shelf more than a 100 miles further east than they had been known to exist by the base laying flight made by Commander Byrd. They retraced their steps, deviating to avoid obstacles and were slightly delayed by weather but arrived back at Little America on 19 January.

### And next summer

This coming season Vaughan and his party plan to retrace the steps of the geological party and climb Mt. Vaughan named for him. The expedition comprises a party of seven with his wife Carolyn Muegg Vaughan as co-leader with the Colonel. Other members are Dr Peter Goth, a mountaineer and physician widely known for wilderness medicine skills. Vern Tejas, who made a successful solo winter ascent of Mt McKinley and Brian Horner, a skier, climber and cold weather survivalist. Two of the following: Beverly Johnson, Dolly LeFavor and Paul Marcolini, will also be involved and are likely to remain at base camp, one to operate the radio.

ANI will support the expedition by flying

them from Punta Arenas to Patriot Hills on 25 October and subsequently across the continent by DC3. Twenty two northern polar huskies will be taken south as part of the expedition. Some will be provided by Earl and Natalie Norris of Willow, Alaska.

Navigation will be by GPS and a suitcase telephone and Collins' state-of-the-art telephone will be taken for communication. A limited meteorological science program will be undertaken during the course of the expedition which has been estimated to cost US \$1,500,000 and is scheduled to return

to the States on December 31, 1993. The high point of the expedition will be the ascent of Mt. Vaughan on December 19, Colonel Vaughan's 88th birthday.

Dog food and fuel has been cached at Marble Point this season by the *Kapitan Khlebnikov* in preparation for the expedition. The skidoos in the cache will be used by National Geographic film team which will be filming the expedition. The remaining caches are scheduled to be laid next season along the route of the 1929 geological party whose footsteps they will be retracing.

## Display grant for museum

The Australian Antarctic Foundation recently pledged grant funds of \$A111,300 to the Tasmanian Museum and Art Gallery in Hobart, to design and develop a new exhibition on Antarctica's geophysical nature and its role as the "Climate engine of the world". It is scheduled to open in early December 1993.

The exhibition, "Antarctica", *Secrets of the Frozen World*", will use computers, satellite communications, photographic murals and other special effects in tactile and participatory displays.

The Tasmanian Government has also provided \$50,000 towards development of the exhibition, but to fully realise its plans the Museum needs local and national sponsors. It will draw on local scientific, engineering and computer expertise to develop the exhibition.

## Highest award

Monica Kristensen was, last year, awarded the Explorers' Club's highest level of endorsement for the Aurora Programme which was undertaken in 1991/92 and 1992/93. The programme has two parts,

the first comprising the Filchner Project, an investigation into the mass balance of the Filchner Ice Shelf and its interaction with a changing global climate and the second, involving the location and retrieval of the tent left by Roald Amundsen at the South Pole in 1911. (See Antarctic Vol 12. No. 7)

## Schedule for Antarctic:

This issue of Antarctic is the fourth to appear in the last six months and represents the end of a catchup phase implemented by the Council of the New Zealand Antarctic Society. From June 1993 issues will be available to branches for dispatch by the 21st of the last month in each quarter with the exception of the December issue which should be available by 10th of the month. This means that copy deadlines have been brought forward to the 20th of the second month of each quarter - e.g. 20 May for the June issue - with the exception of the December issue for which the deadline will be November 10.

**Caption error:** The caption for the cover of Antarctic Vol 12 No's 11 and 12 appeared as the *Frontier Spirit* in the Beagle Channel, however the photograph was of the *Society Explorer* in the Neumeyer Channel - a minor "change to the advertised programme". The photograph, was still however, taken by Colin Monteath.

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