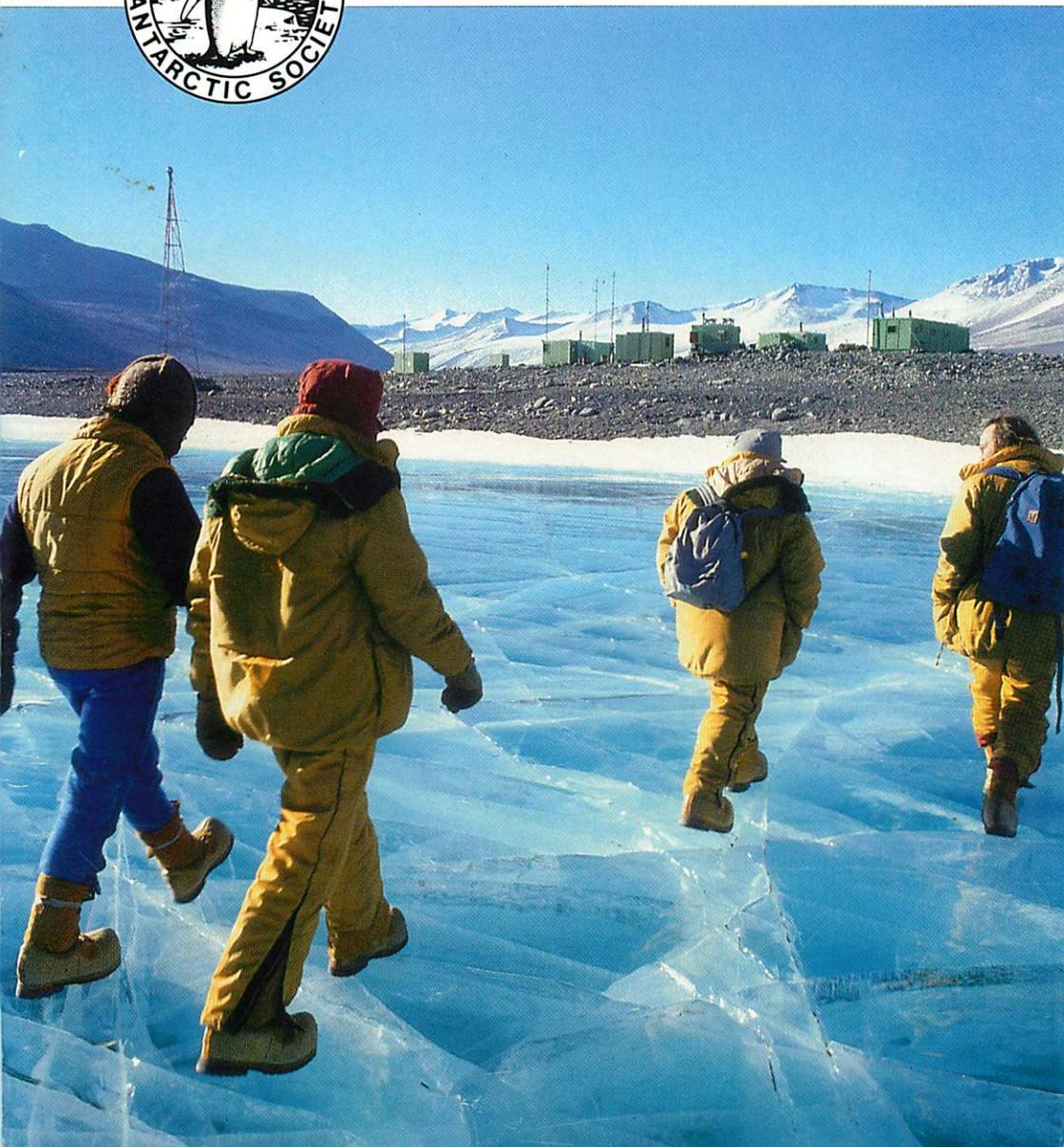


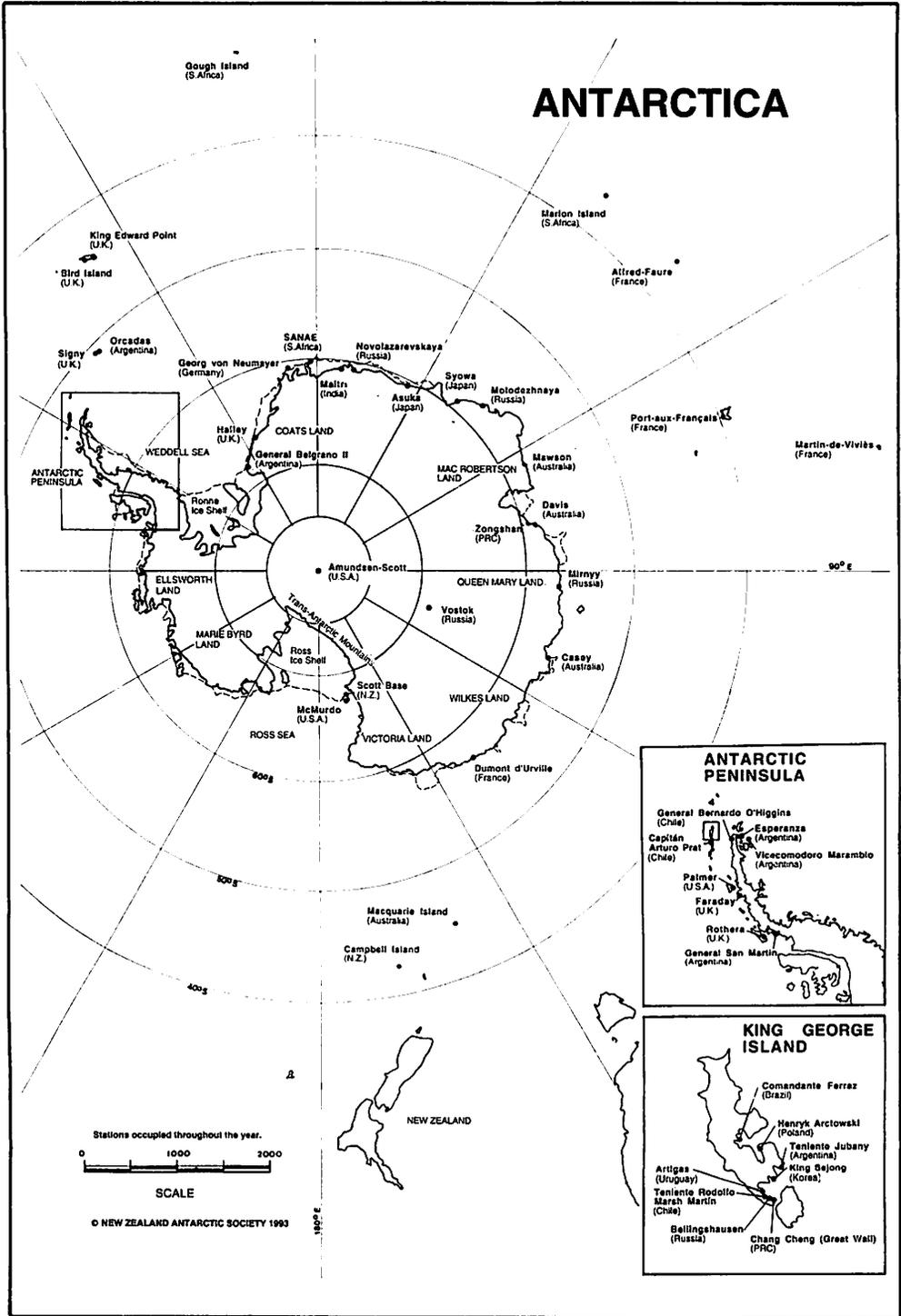
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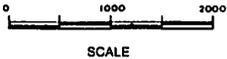
Bulletin Vol. 13 No. 3, September, 1993.



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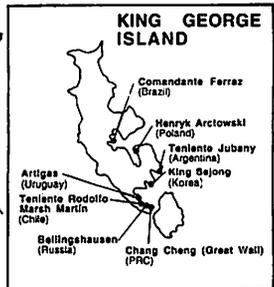
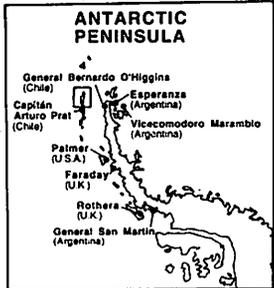


Stations occupied throughout the year.



SCALE

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Editor: Robin Ormerod
Please address all editorial inquiries,
contributions etc to the
Editor, P.O. Box 2110, Wellington,

New Zealand

Telephone: (04) 4791.226

International: +64 + 4+ 4791.226

Fax: (04) 4791.185

International : +64 + 4 + 4791.185

All administrative inquiries should go to
the Secretary, P.O. Box 2110, Wellington
New Zealand.

Inquiries regarding back issues should go
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New Zealand.

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Cover: Scientists walk across Lake
Vanda towards the New Zealand sta-
tion. Photo: Chris Rudge

NZAP

Ozone studies, seismological investigation and aerial mapping included in 1993-94 programme

The first scientists involved in the 1993/94 New Zealand Antarctic Programme flew south this season on Winfly (August 23-27) to make springtime ozone measurements. Administrative personnel from programme headquarters in Christchurch were also among the early season party travelling south to help with the groundwork involved in the changeover in base staff for the coming year and preparation for the summer season. The main body flights, scheduled to commence on October 5, were delayed by one day because of poor local weather conditions in the McMurdo area. Some 80 scientists, as well as other specialists and support staff are involved in the New Zealand Antarctic programme this season. They are undertaking projects as diverse as aerial mapping, a seismic investigation of the Wilkes Basin, wind profiling and environmental studies in the dry valleys and biological work on the sea ice and on Ross Island.

Ozone measurements have been made at Arrival Heights, some five kilometres from Scott Base, with a Dobson spectrophotometer since January 1988, and at Scott Base with a Brewer spectrophotometer since February 1989. Both instruments measure UV levels at particular wavelengths, and the amount of ozone overhead is deduced from these measurements.

The instruments operate virtually year round using sunlight from September to March and moonlight during the winter. The data is archived with the

world ozone data centre and the springtime ozone data is supplied to the World Meteorological Organisation (WMO) for inclusion in their special bulletins, on the current state of the ozone hole, which are distributed internationally

This season Ross Martin from NIWAR in Wellington flew south on Winfly to supplement the regular programme undertaken during the winter by Mike Mahon with springtime measurements and is scheduled to return on October 22 while Dr's Carlo Valenti and Luigi Ciattaglia from the Istituto Di

Fisica Dell'Atmosfera are due south on October 13 for nearly three weeks to continue their part of the programme. This year's ozone hole, which began to form in mid-August, developed slightly faster than in previous years; and ozone levels measured at Arrival Heights have been lower than ever measured there before. For six days during the period September 27 and October 10 the total ozone values were between 130 and 140 Dobson Units (DU) which is lower than the previous record low ozone value of 143 DU measured on 11 October 1991. If there was not an "ozone hole", ozone levels over Arrival Heights in October would be about 300 DU. The low ozone values are expected to be maintained until the breakup of the "hole" which should occur at the end of November or early December.

Another branch of NIWA, based at Lauder in Central Otago, is also concerned with ozone but is focussing on the analysis of the Arrival Heights/Scott Base/Campbell Island data base for stratospheric trace gases. This is achieved by ground-based remote sensing of: nitrogen dioxide, using visible spectrum techniques at Arrival Heights and Campbell Island; ozone, using the Dobson spectrophotometer at Arrival Heights and the use of ultra violet techniques to collect data relating to chlorine dioxide. Responsibility for data acquisition is shared between visiting NIWA personnel and the resident Scott Base technician, and data reduction is carried out at Lauder and at Gracefield. This season Karin Kreher and Alan Thomas from Lauder flew south at Winfly to oversee springtime data collection; Alan Thomas is scheduled to return on November 8 with Steve Wood from the same organisation and remain at Scott Base until November 23. In January Gordon Keys and Steve Wood will again fly south, with Steve Wood remaining for the win-

ter to maintain the programme. He will co-operate with US scientists in flying a series of large balloons during the 1994 autumn and winter to measure the vertical profiles of nitric acid.

Measurement of selected trace gases in the Antarctic using samples of air collected from aircraft between New Zealand and Antarctica is also being undertaken by NIWA in Lower Hutt. Paul Roberts from the organisation flew south at Winfly and is due to collect further data on two flights before the end of October. He will be accompanied by Gordon Brailsford from the same organisation on the first to these. This will be the first of three flights for Gordon, the second being in November and the third in February. Measurements of isotopes in carbon monoxide and methane are being used to validate models of global atmospheric chemistry and budgets of greenhouse gases.

Mapping

Although mapping of the Ross Dependency has continued regularly since the inception of the New Zealand Antarctic Programme there are still vast regions for which adequate mapping/digital topographic information does not exist. The relative ruggedness and inaccessibility of much of this country and vastly enhanced technology now means that high altitude aerial photography is the most economic, speedy and convenient method.

This season the Department of Survey and Land Information, New Zealand, Aerial Mapping, a Napier based company, and the US Geological Survey are combining staff and resources in a joint project that will enable aerial photographs to be taken of the Convoy Range, the Keottlitz Glacier to Minna Bluff, Brown Peninsula, Black Island, White Island, Ross and Beaufort Islands. Reconnaissance imagery will

also be obtained through some areas of the Transantarctic Mountains specifically the Skelton, Hatherton and Leverett Glaciers. The US National Science Foundation is contributing funds.

New Zealand Aerial Mapping will fly a Rockwell Commander 690B Turbo-prop aircraft to Antarctica in October. The aircraft has been specially adapted to provide endurance for the flight from New Zealand to McMurdo. It is a dedicated aerial mapping platform equipped with twin camera bays, Global Positioning System (GPS) Navigation equipment and dual Ashtech GPS antennae and receivers similar to others which will be operating as base stations on Ross Island during all flights to provide precise positioning of the airborne camera at the time of exposure.

The aircraft will be piloted by Colin Harris with David Napier as navigator. Both are from Aerial Mapping as is the engineer Les Appleford. The Department of Survey and Land Information in Wellington will provide a surveyor, Kelvin Tait and the US Geological Survey are sending Larry Hoptem, a Geodetic Scientist and two surveyors, Dale Benson and Gordon Shupe.

During their six weeks in Antarctica they will operate from the ice runway and photograph an area of 40,000 square kilometres. The results will be used by the Department of Survey and Land Information NZS and the US Geological Survey to produce 1:50,000 scale topographical maps.

Seismic investigation

Travelling furthest from Scott Base this season will be a team led by Dr Steven Bannister from the Institute of Geological and Nuclear Sciences Ltd (IGNS) in Wellington, working together with scientists from US Geological Survey/Stanford University. They will undertake a 370 km long traverse on

the East Antarctic ice cap, acquiring multi channel seismic and radar data to determine the stratigraphy and thickness of Ferrar dolerite and Cenozoic sediments beneath the ice cap in the Wilkes sub-glacial basin. The profile crosses the hypothesised location of an old inland-sea. It is important to determine the nature of the sediments beneath the East Antarctic ice cap because it is likely that they contain information about advances and retreats of the Antarctic ice sheet. The data should also give information about the flexure of the East Antarctic lithosphere, associated with the uplift of the Transantarctic Mountains.

The party comprises David King and Ron Hackney, also from Wellington, Uri Ten Brink and Rafi Katzman from the USGS and Itzik Makovski from Stanford University. They will travel south between November 15 and 22 and return to Christchurch in January 1994 and will be supported in the field by Bill King and Mike Collins from Christchurch and Jon de Vries from Wellington.

The put-in at McMurdo Dome (77deg 47'S 158 deg 18'44" E) by LC-130 is scheduled for December 1-6 and will comprise the expedition personnel, a Hagglands, two Tuckers, four toboggans and five sledges as well as a field camp, supplies and a portable wannigan. The seismic line will commence at 77deg47'01"S/158deg18'41"E and finish at 78deg01'40" S/144deg58'38"E. During the exercise the team will be using techniques similar to those employed last summer in the Ross Island area (see *Antarctic* Vol 12 No 11 and 12 p.370ff). This season however they will be using a high resolution 60-channel over-snow "streamer" instead of traditional geophones. This streamer, loaned by Norsk-Hydro A/C and the University of Bergen in Norway will be towed along behind the

Hagglunds.

Dry valleys

The existence of valleys virtually devoid of ice is of special interest in the Antarctic. The barriers of rock stopping glaciers enter from the tops of the valleys is only part of the explanation. Sunlight heating exposed rock leads to a moist cool sea-breeze offsetting the drying effect of the down-valley flow. From mid-November to mid-December a team from the Physics Department at the University of Auckland, led by Dr Stuart Bradley and comprising Kevin George and Paul Martin, will continue an examination begun two years ago of the influence of that wind in the Wright Valley.

Crucial to their project is understanding whether other present glaciated areas are climatically stable or whether moderate global warming can lead to a proliferation of dry valleys in the Antarctic and elsewhere. This summer they hope to extend the number of fixed sites, include radiation and pressure sensors, install fully developed remote wind profilers to obtain continuous 3D information on development, penetration and interaction of wind systems. Results from model valley meteorology using a 3D meso-scale model

The lake levels are checked annually in the Dry Valley area by a surveyor for the NIWA. Photo K. Westerskov, 1982/83



will be compared with field measurements and will help them elucidate these questions.

Lake Vanda

Two projects are being undertaken by the Freshwater Division of NIWA, the National Institute of Water and Atmosphere in the Wright Valley this season. Dr Clive Howard Williams from Christchurch and Julie Hall from Hamilton will be studying the sources of nutrients in the Onyx River system and the processes whereby nutrient concentrations are modified within. The river, which is some 30 km in length, is of particular interest because it is the only major external source of water, nutrients and suspended sediment to ultraligotrophic (nutrient poor) Lake Vanda and in recent years the discharge has been increasing steadily. By quantifying nutrient sources and sinks the scientists hope to better understand the dynamics of nutrients in this cold desert river and to assess the nutrient and sediment loading to Lake Vanda. Knowledge of these processes will enable them to better predict the consequences of any developments in the Wright Valley or the effects of changes in discharge brought about by local climatic warming. The scientists will be in Antarctica from late December for about a month, in this, the first part of a three year project.

Tackling the problem from a different perspective will be Dr Ian Hawes, and Anne-Maree Schwarz from Christchurch, who will be at Lake Vanda from mid November to approximately December 20. Because of the complex vertical structure of the Lake the input from the Onyx is likely to remain in the upper 10 metres of the water column. Nutrients derived from this source are therefore likely to be all that is available to phytoplankton in this layer.

The annual loading of phosphorus

(the most limiting nutrient) via the Onyx River is roughly equivalent to the septic tank output of three people and so, small perturbations are likely to have proportionally high impacts on the phytoplankton. Investigations will be made of the impact of water, nutrients and suspended sediments entering the lake via the Onyx River on the phytoplankton populations of the surface layer. Abundance, species composition and activity of phytoplankton, will be monitored before the first flows, immediately after flow begins and during maximum flow during this part of the three year project.

Glacial studies

Dr Wendy Lawson and Christopher Nelson from the Department of Geography at the University of Auckland will continue an investigation, begun by the same team last year, into the behaviour of the debris-laden ice found at the base of the Taylor Glacier in the Dry Valleys. This research ultimately aims to examine the implications of the observed behaviour of debris-laden ice, a type of ice found at the base of many glaciers and ice sheets, on overall ice dynamics and hence on the response of ice masses to changes in climate.

The pair will be in Antarctica from approximately November 25 until January 11. Most of this time will be spent working at the snout of the at the Taylor Glacier, where they will be testing the strength of debris-laden ice at the margin of the glacier and within a tunnel constructed into the ice. They also hope to be able to install instrumentation aimed at exploring the relativities of the thermal regimes of debris-laden and clean ice.

Sedimentary studies

The origin of the 1000 metre thick

sequence of the lower Beacon Supergroup (Devonian), in southern Victoria Land in Antarctica remains controversial as to whether it is marine or non marine. The debate centres on the presence of trace fossils frequently used by geologists to interpret the origin of paleoenvironments. The trace fossils in the lower Beacon Supergroup are considered by some to be consistent with non marine deposition and many of the scientists working in the area now tend towards this view. Of the previous studies however most have been conducted on a regional scale and insufficient data collected for scientists to confidently establish the sedimentary processes and the depositional environment.

Working in Antarctica from early December to between early and mid-January, Michael Wizevich, and Stephen Thornley from the Antarctic Research Centre at Victoria University and Ken Woolfe from the Geology Department at the University of Townsville, will study the lower Beacon Supergroup in detail, collecting data from a relatively limited area and stratigraphic interval around Table Mountain in South Victoria Land. The three-dimensional exposures at Table Mountain will be used for lateral profiling which take into account the changes in the lateral as well as vertical facies to provide a refined depositional model. Improved understanding of the depositional system will contribute not only to resolving the trace fossils problem, but also to southern Victoria Land palaeogeographic and tectonic reconstructions.

Retreat of ice sheet

Alex Pyne, Les Singh, Rowan Leslie and Alan Rennie from the Antarctic Research Centre at Victoria University will, subject to ice conditions being safe

for travel and use their equipment, spend five weeks from early November in the Cape Roberts area this season.

Their objective is to determine the timing of retreat of the edge of the Antarctic ice sheet in the Granite Harbour and McMurdo Sound area (South Western Ross Sea) and of the Mackay Glacier (fed from the East Antarctic ice sheet) since the last glacial maximum 20,000 years ago. A specially designed and built corer will be used to obtain a series of cores of up to six metres of both soft mud and stiff diamictite in depths of water as great as 1000 metres. Radio carbon dating of shell debris above the diamictite in the core will indicate the time at which the grounding line retreated past each site.

Geology

The Wilson Terrane is a deeply eroded portion of a 400-500 million year old belt of mountains formed during subduction of the oceanic crust beneath the East Antarctic Shield. This project will examine the structural, magmatic and fluid process which occurred in the middle crust at about 15 km depth during subduction. Attempts will then be made to determine the nature of the rock prior to these processes and compare them to rocks thought to be similar in western North America but which rifted apart from East Antarctica about 500 million years ago. The party led by Dr David Craw are from the University of Otago's Department of Geology and comprise Yvonne Cook, and Sarah Jones. They will be assisted in the field by Stuart Drake from Franz Josef and Simon Cox from Dunedin. Both are employed by the New Zealand Antarctic Programme. Members of the party will be in the field for up to six weeks from early November.

Biological studies.....

Fish

This season a team of six from four different organisations will combine to continue the study of the Antarctic notothenoid fishes which have radiated to fill a range of ecological niches in the polar seas. There are now over a hundred closely related species some of which have developed extreme specialisations while others have remained generalised. The team are assessing the metabolic consequences of this process by comparing specialists with generalists both between and within families. This involves quantifying substrate dependencies, metabolite levels, establishing nucleotide ratios and studying heat-stress proteins. Incubation and sampling will be carried out at Scott Base and Terra Nova Bay station and analyses will be completed in New Zealand using spectrophotometry, high-performance chromatography and radioimmunoassay. Nucleotide sequences of mitochondrial DNA will be determined from which a molecular-based phylogeny may be derived to clarify the evolutionary origins of the notothenioids.

Led by Dr John Macdonald, the team will comprise Tim Lowe and Dave Todd all from the Department of Experimental Biology Research Group at the School of Biological Science, at University of Auckland, Bill Davison from the Zoology Department at the University of Canterbury, Guido di Prisco and Maurizio Tamburrini from ENEA in Italy.

Craig Thorburn from Kelly Tarlton's Underwater World in Auckland will also join them to collect samples of live fish for display within the "Antarctic Experience", scheduled to open in late December. (See *Antarctic* Vol 13.No. 2 page 86).

Michael Williams, one of the recipi-

ents of the RDRC science award will be working with the party for his study of the internal wave structure under the shore fast ice of McMurdo Sound. (See *Antarctic* Vol. 13 No. 2 page)

Work being undertaken by the party will begin early in November and continue until early February when the last of them will return to New Zealand.

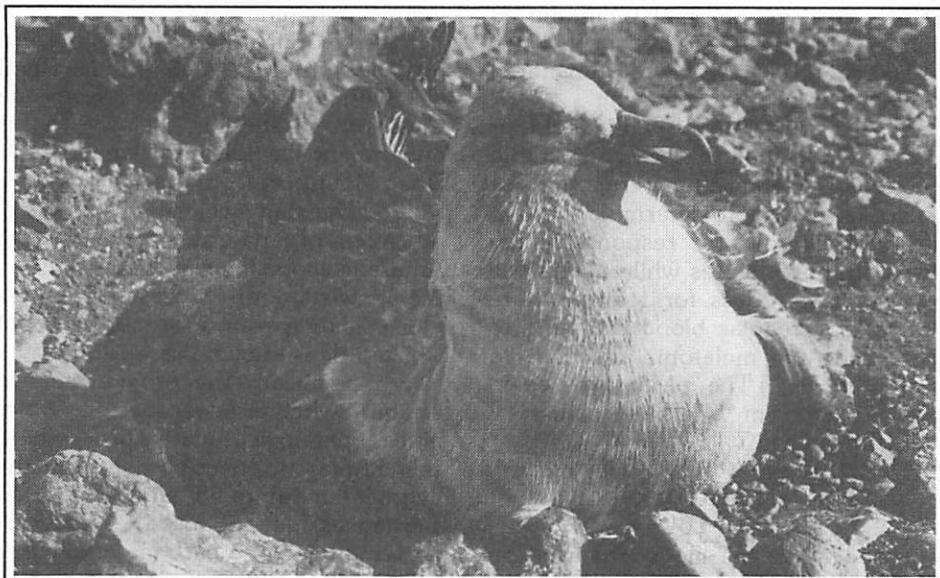
Skuas

Observations of the populations of Antarctic South Polar skuas have shown when two chicks are hatched the older chases the younger one from the nest and invariably survives. Theory indicates that the cause of this behaviour is competition for parental food but it may also be attributable to failure of the parents to feed them intensively enough.

Professor Euan Young and Dr Craig Miller from the School of Biological Sciences at the University of Auckland will travel south on December 20 to spend five weeks at Cape Crozier in a study designed to determine whether the birds can obtain enough food to satisfy chick hunger, whether there is food rationing or whether aggression is genetically determined. In a separate experiment the ability of parents to raise both chicks will be tested.

Penguins

Gary Miller from the Department of Zoology, University of Otago will be returning to Antarctica to continue studies of the Adelie penguins in the project led by Dr Lloyd Davis. Working at Cape Bird from approximately October 20 to December 22 with Dr Fiona M. Hunter from the University of Cambridge the team will be seeking to establish whether in cases of cuckoldry - where more than one male copulates with a female - there is any mechanism for the sperm from one bird to take precedence over the other. This may be an important factor



in breeding success. The other part of the programme, tracking the winter migration by satellite telemetry has been deferred for this season.

The annual aerial photographic survey and assessment of population dynamics of penguin rookeries in the Ross Dependency will be continued. This season two parties, the first comprising Bruce Thomas, Brian Karl and Kerry Barton and the second Dr Peter Wilson and Kerry Barton all from Landcare Research in Nelson will undertake a "two visit" programme in late November and early December and in mid-to-late January.

Their aim is to provide basic data against which future population levels can be compared in order to monitor environmental change, induced naturally or by man, in the Antarctic ecosystem. It is part of New Zealand's contribution to the International Survey of Antarctic Seabirds (ISAS) and the results are being achieved by aerial photographic census, and ground truth counts at the rookeries at Cape's Royds and Barnes in early December and late Janu-

An Antarctic South Pole skua sits on her nest. They are being studied this season at Cape Crozier Photo Kim Westerskov

ry to assess breeding success for the season. The party will overfly Capes' Royds, Barnes, Bird and Crozier in helicopters but use a C-130 to cover the other rookeries in the Dependency.

Once the photographs are printed, the birds are counted and the data analysed so that changes in the numbers can be related to environmental variables. A sample of 100 chicks at Capes Royds and Crozier are also to be weighed and measured in order to index chick condition.

Seals

A party from Lincoln University near Christchurch led by Dr Graham Barrell and comprising Ian Corson, Peter Isherwood and Tessa Williams will be continuing earlier studies of the physiology of lactating Weddell Seals. Previous work has shown an absence of diurnal patterns of secretion of the hor-

mones cortisol and melatonin during the continuous exposure to daylight. Blood samples revealed an unaltered metabolism in spite of fasting.

This season four lactating and four non lactating adults in the vicinity of Big Razorback Island will undergo glucose tolerance testing to determine sensitivity of insulin-glucose response in the two lactational states while others will be placed in darkness for four or more hours for regular blood sampling to determine the melatonin response to this stimulus. The party will be in Antarctica from about November 12 until December 7.

Pondwork

Aspects of the biogeochemical cycling of sulphur and iodine will be examined on the McMurdo Ice Shelf near Bratina Island this season by Dr Steve de Mora, Alan Grout and Peter Lee from the University of Auckland and Christian Schall from the University of Regensburg in Germany.

Sulphur gases particularly $(\text{CH}_3)_2\text{S}$ and CS_2 and the volatile iodine compounds, CH_3I and CHI_3 , will be investigated by the party who will be in Antarctica for three weeks from the end of December. These gases are derived ultimately from biological process sources and the glacial ponds represent an unusual source of biogenic gas emissions. The concentrations of the gases both in glacial meltwater ponds and in the atmosphere will be determined as there is much speculation as to their role in modifying the composition of the atmosphere. Dimethylsulphide is an important precursor to the formation of atmospheric aerosols, a process that might be hindered by the presence of iodine compounds. Their objective is therefore to evaluate the role of the glacial meltwater ponds on the Ice shelf as a biogenic source of sulphur and

iodine containing gases.

Also working among the pond and tidal lagoons of the McMurdo Ice Shelf will be Dr Henry Kasper from the Cawthron Institute in Nelson who is undertaking the field programme for Dr Doug Mountfort from the same organisation. The study will establish the significance of anaerobic processes in Antarctic ecosystems and contribute to the knowledge of processes which exploit cold temperature organisms about which little is known.

Specifically the project aims to establish whether anaerobes play a significant part in degradative processes in saline Antarctic ponds by measuring the degradation of radio labelled marker substances, quantifying the end products, methane and carbon dioxide and isolating the anaerobic organisms which carry out the degradation or low temperature transformations.

In another project led by Dr Kasper, Carol Hulse also from the Institute and Kip Powell from the Department of Chemistry at the University of Canterbury will be studying the dynamics of metal pollutants in Antarctic soils. The residues of historic pollution events at Marble Point will be described and small scale pollution experiments undertaken near Scott Base. From the results they hope to be able to predict the fate of metal pollutants in areas where levels of human activity may be high in the future. The results of this multi-disciplinary study will be applicable in the prevention and management of pollution in the Antarctic.

Environmental

New Zealand's pending ratification of the Protocol on the Protection of the Antarctic (See *Antarctic* Vol. 13 No. 2 page 56) requires that the Programme undertake more careful assessments of the impacts of activities past and present.

For the second year Dr Doug Sheppard from the Institute of Geological and Nuclear Sciences Ltd in Lower Hutt near Wellington and Dr Iain Campbell from Land & Soil Consultancy in Nelson will sample the soils and meltwaters from Ross Island, Marble Point and the Wright Valley to delineate and characterise chemical contamination due to New Zealand activities.

In the three weeks from early January further sampling will be undertaken at established sites in order to understand the mobility of contaminants and more data will be collected to better define baseline levels and the variability's of heavy metals in the Antarctic surface environments in different ecological and climatic regimes. The information gathered last year is being considered and cleanups will be undertaken where necessary. Data from both seasons work will be used in future environmental management.

Lichens and bryophytes

Granite Harbour is known to have an exceptionally diverse and abundant lichen and bryophyte vegetation but the algae have not yet been investigated. This season, a party led by Dr Paul Broady and comprising Monique Baars and Melanie Davidson all from the Department of Plant and Microbial Sciences at the University of Canterbury, will undertake a taxonomic and ecological survey to reveal whether the algal flora is equally diverse. Mapping and microscopy will be performed and cultures established for later detailed examination in New Zealand to enable a thorough description of the taxonomy and distribution of the algae to be made. In addition a broad ranging ecological survey of terrestrial invertebrates will be conducted.

The party, which will be in Antarctic from mid-December to late January,

will also survey an area close to Scott Base for its suitability as a possible study site in the International Programme Biological Investigations of Terrestrial Antarctic Systems (BIOTAS). For a time they will be joined the Lucette Dijkstra, a RDRC Science Award recipient and Ph.D student from Lincoln University who is undertaking DNA fingerprinting to determine the genetic base of an Antarctic green algae. (See *Antarctic* Vol. 13 No. 2 page 59)

Permafrost

A group from Land and Soil Consultancy led by Dr Iain Campbell from Land and Soil Consultancy in Nelson and comprising Dr Graeme Claridge from the same organisation in Wellington will be joined this year by Megan Balks and Dave Campbell from the Earth Sciences Department at Waikato University in the continued study of permafrost. Their objective is to determine the properties of permafrost, their relationship to environmental parameters and the changes that occur when it is disturbed by human activities.

During previous work around McMurdo Sound the team established the general characteristics of the permafrost in the moist zone regions adjacent to the coast and found that substantial changes in the physical properties occur when the upper permafrost is disturbed. This season they will continue observations in an area adjacent to Scott Base and study permafrost at New Mountain and in the Beacon Valley where the properties are significantly different because of the relatively shallow depths in various places.

Other activities.....

Field Training programmes will again be undertaken. This year the team, led by Andy Thompson, will comprise

two other instructors Sea Brooks and John de Vries. As usual they will also make up the primary search and rescue team and be responsible for the training of other SAR personnel, including those who will winter over.

RNZAF personnel

Thirty-two RNZAF personnel are scheduled to go south. These include a helicopter detachment of 19, five involved in survival training for RNZAF C-130 crews in the Antarctic environment and eight who, in two parties, will assist programme personnel in various maintenance and environmental tasks.

Survey assistance and Telecom maintainance

Survey assistance to NZAP and USAP projects will again be provided. This year the surveyor is John West from Nelson whose activities will include the collection of data from the tide gauge at Cape Roberts and the annual Lake levelling trip to the Dry Valleys.. Doug Rose and Bryan Wilson from Telecom will carry out the annual inspection, maintenance and installation of equipment at Scott Base.

Media coverage

Media personnel will include George Murahidy and Raewyn Rash from TV 3 who will obtain library footage and news material; Linda Bercusson and Yvonne Martin who will provide regular news coverage for the programme and Craig Potton, a photographer who will be obtaining a photographic record of Antarctica and New Zealand activities at Scott Base, the Dry Valleys, Capes Evans and Royds.

Two of the ICAIR team are also scheduled to go south as part of their

work programme. (See *Antarctic December 1993*, Vol 13 No. 4.) Two staff from Canterbury Museum, Garry Bagot and Harvey Courtman also plan to spend five days in Antarctica from November 1 to reacquaint Museum staff with work on the historic huts and with Antarctic operations.

Works programme

Eleven personnel from Serco Services, Works Consultancy, Drew NZ Ltd., and Protection Plus as well as one painter will be involved in the Scott Base works programme for the season (see *Antarctic March 1994*).

Regular programmes and distinguished visitors

Most of the regular programmes are scheduled to continue. These will be summarised in our March issue. A number of distinguished visitors will travel south this season; their visits will also be covered in our March issue.

Antarctic Heritage Trust

David Woodings, Lawrence Smith, Lynn Campbell and Rose Evans are contracted by the Antarctic Heritage Trust to continue the programme of restoration, preservation and presentation of the historic sites on Ross Island as programmed for the fourth year of the Conservation Plan. During their four to six weeks in Antarctica they will work at Scott Base, Cape Evans and Cape Royds where they will complete the environmental monitoring of the huts, including visitor numbers; complete the inventory/condition reporting of artefacts at Cape's Royds and Evans and at Hut Point, complete curatorial work at each of the huts and begin the repository of historical items stored at Scott Base.

Scott Base personnel 1993/94

Operations group

Neville JONES 34, Wanganui,
Operations Support Manager
Grant AVERY*, 34, Lower Hutt,
Science Technician (1991-92
winter)
Belinda BENNETT*, 34, Auckland
Science Technican/Base Assistant
Andrew THOMPSON, 28, Welling-
ton, Leader, Antarctic Field
Training
Sean BROOKS, 25, Timaru, Instruc-
tor, Antarctic Field Training
Jon de VRIES, 39, Wellington,
Instructor Antarctic Field Training
(1991-92)
Simon COX, 29, Dunedin, Field
leader (1986-87, 1989-90)
Stuart DRAKE, 32, Franz Josef, Field
leader
Bill KING, 40, Christchurch, Field
leader (1974-75, 1978-79, 1992-
93)
Mike COLLINS, 25, Christchurch,
Mechanic (1991-92 winter, 1992-
93)
Bruce JANES*, 31, Napier, Field
Support Officer
Robert CLARK, 25, Auckland, Senior
Communications Operator
Maree ALLEN, 29, Palmerston North,
Communications Operator
Glenn COOKSLEY, 24, Auckland,
Communications Operator

Base Group

Ross COOK, 46, Auckland, Base
Services Manager
Eric TRIP*, 28 Christchurch, Senior
Telecom Technician
Sue WALLACE, 46, Auckland,

Canteen Manager
Art BOSMAN*, 40, Hamilton, Chef
Robin BURGESS, 23, Invercargill,
Chef
Angela BOCOCK*, 28, Oxford,
Domestic
Anna HOBBS, 30, Mt.Cook, Domes-
tic
Tori EDWARDS, 26, Christchurch,
Domestic
Tracey JAMIESON, 25, Auckland,
Postal Admin. Clerk
Bronwyn JOULE, 33, Waihi, Supply
Officer
Helen SIMPSON, 26 Auckland, Cargo
Handler

Engineering Group

David Lucas*, 46, New Plymouth,
Engineering Services Manager
Dominic McCARTHY*, 28,
Christchurch, Base Engineer
Mike BUTLER, 22, Linton, Plant
Operator
Rik MORGAN, 21, Linton, Plant
Operator
Jeremy RIDGEN*, 26, Christchurch,
Mechanic
Gus MCALLISTER, 27, Wairora,
Mechanic
Grant WEST*, 28, Palmerston North,
Electrician
Russell SCARLETT, 31, Christchurch,
Carpenter (Winfly)
Kevin DUIGNAN, 36, Christchurch,
Carpenter (Main body).

*Winter over. This team will be joined
by Steve Wood, a technician from
NIWA-Lauder for the winter, bringing
the total party to 11.

ANARE

Last Australian dogs to leave Antarctica

Australia's last five husky dogs will leave the ice this season. Ursa, Morrie, Welf, Bonza and Elwood remained at Mawson Station after the 19 working huskies and three pups left last summer for their new home in Minnesota.

The departure of the dogs is required under Clause 2 of Article 4, Annex II of the Madrid Protocol, an international agreement which designates the continent a natural reserve and states that "Dogs shall not be introduced onto land or ice shelves and dogs currently in those areas shall be removed by 1 April 1994." The five dogs are well past their working age and will live out the rest of their lives in Australia with former expeditioners experienced in handling them and who have an understanding of their nature and needs. Two will be in south Victoria and three will remain in Tasmania.

Before leaving Mawson on December 15 for the 13 day voyage to Hobart, each of the huskies will be examined by two veterinarians and by the station doctor who has been responsible for their welfare during the last year. The three men, and their current handler Rob Nash, from the Bureau of Meteorology, will accompany them on their 5,500km sea journey back to Hobart aboard the *Aurora Australis*. Although the dogs will have been inoculated to meet quarantine requirements they will have to remain in a specially-built compound at Antarctic Division for a month

before going to their final destinations. Rob Nash will be responsible for their welfare during this period.

The Australian Government first obtained 12 Labrador and Greenland huskies from a 1948-50 French expedition for use at Heard Island prior to the eventual establishment of an Antarctic Station. On 15 January 1950, 16 huskies, including seven pups loaded at Melbourne arriving at Heard Island on February 5.

On 21 January 1954, 27 huskies left Heard Island by ship, arriving at the site of the new Mawson station in Antarctica on February 11. Between 1957-70 dog teams were established at Wilkes and Davis Stations but eventually, with changes in local activities, all were sent to Mawson. On 4 November 1992, 19 working dogs and the three pups were taken aboard *Aurora Australis* bound for Hobart and then by air via Melbourne and Los Angeles to Minnesota USA. Of the 22 relocated at Minnesota, five journeyed across the Arctic sea ice to the North Pole which they reached on 13 May this year.

At the time of the signing of the Protocol only Australia, Britain and Argentina still had dogs on the continent. Details are currently being confirmed by *Antarctic* but it is believed that the Argentineans removed their teams last summer and that the British will remove their dogs in late January 1994. An unspecified number of the

23 or 24 British dogs are also going to Minnesota in January, having been used earlier this coming season to support a scientific programme on the Peninsula. The possible relocation of the Argentinean teams was still uncertain at press time.

Footnote: A number of dogs are ex-

pected to travel south this season as part of the Mt. Vaughan Antarctic Expedition led by Colonel Norman Vaughan who had hoped to be the last person to drive teams on the Antarctic continent but it appears that his objective will be usurped by the British.

19 projects make up the 30th Chilean Antarctic Scientific expedition

The 30th Chilean Antarctic scientific expedition "Expedicion Cientifico Antartica", organised by the Instituto Antartico Chileno INACH, comprises 19 projects as diverse as a cartographic survey, an archaeological programme and observations of whales. The main logistic support will be provided by the *M/N Capitan Luis Alcazar* which will remain in Antarctica from 8 January to 15 February 1994. The expedition leader, Mr Gergio Lizasoain, will be on board for the duration of the ship's time in Antarctica. Most of the investigators involved in the programme will be flown to President Frej Base (Ex-Marsh) by C-130 aircraft of the Chilean Airforce and from there they will be dispersed to their research locations by the *Alcazar* and helicopters carried aboard the *AP Piloto Pardo*, a Chilean Naval vessel which will provide supplementary logistic support.

Three projects are being undertaken jointly between organisations. The cartographic survey of the Fildes Peninsula is part of a project to build up a 1:10,000 digital data base in order to create a Geographic Information System for multi disciplinary scientific purposes. Victor Villanueva Lopez is the main

investigator. INACH and IGM are the key organisations.

Personnel from INACH, ACH and the National University of Chile UCN are working together to create an infrastructure for a scientific marine station at Base Prat. In charge of this project is Armando Mujica Retamal.

Ruben Stehberg from INACH and Martin Bueno from the National Museum of Natural History and National Plan for I & D in Spain are joint leaders of an archaeological-historical project being undertaken in the Shetland Islands but this year will work on Livingston Island in their search for the location of the *San Telmo* and evidence of the activities of the survivors. They will also continue their collection of plastic and other superficial material to determine its origin.

Four monitoring projects are to be continued; Daniel Torres Navarro from the Chilean Antarctic Institute will study further the population and breeding dynamics of *Arctephalus gazella* at Cabo Sherriff and the small island of San Telmo. Further biological information will be collected on krill in fishing area 48 by Armando Mujica Retamal from the Department of Aquaculture in

the Marine Faculty of the Northern Catholic University. Ecological monitoring of the three species of penguins on Ardley Island in the Shetland group will be continued by Jose Valencia Diaz from the Faculty of Sciences at the University of Chile.

Neutrones, MN-64, in Chilean Antarctic Territory will be monitored further by Enrique Cordaro Cardenas from the Cosmic Radiation Laboratory in the Faculty of Science, Physics and Mathematics at the University of Chile. This work will be undertaken at the Base Presidente Frei.

The short term projects

The short term periodical projects include a study of the ecology and physiology of fish in the sub littoral rocky areas of South Bay being undertaken by Patricio Ojeda Rossi from the Faculty of Biological Sciences at the Catholic University of Chile. This team will focus on aspects of the diets of the *Notothenia neglecta* and *N. gibberifrons*.

Mario M. Vergara from the Faculty of Physical Sciences and Mathematics at the University of Chile will continue his study of volcanic and metamorphic rock sequences in the Byers Fildes Peninsula areas as well as Brabant Island and Anvers Peninsula. The study focuses on the volcanic sequences in the Jurassic, Cretaceous and Tertiary periods at different locations on the Antarctic Peninsula. He is endeavouring to construct profiles and much of his work this season will be laboratory based.

Quantifying antarctic plant species and establishing their metabolic and biosynthetic characteristics will be continued at the scientific station Risopatron on Robert Island by Luis Corcuera Perez from the Science Faculty at the University of Chile.

The migration of vertical Cs-137

and Sr-90 in Antarctic soils is the purpose of a study being undertaken by Paulina Schuller from the Institute of Physics at the University of Southern Chile. She is determining the magnitude of their accumulation in Antarctic soils and contributing to the knowledge of the world-wide distribution of radioactive contaminants by this study at Base Presidente Frei.

Among the projects that are continuing for more than three years are a study of the Paleobotanics in the South Shetlands being undertaken by Teresa Torres Gonzales from the Faculty of Agriculture and Forestry Sciences at the University of Chile. She is interested in the morphology, anatomy and taxonomy of the fossils and other leaf impressions in the Jurassic, Cretaceous and tertiary strata and is comparing and linking them to the fossils in other regions of the southern hemisphere. This season she will work at Byers Point on Livingston Island and on Snow Island.

The geology and geochronology of the South Shetland Islands will be further studied by Francisco Herve from the Faculty of Sciences, Physics and Mathematics Department at the University of Chile. His work will focus on the rock sequences in the Margarite Bay area and aims to establish their relationship to the other rocks in the basement of the Antarctic Peninsula and Gondwanaland.

Aurelio San Martin Barrientos from the Department of Chemistry at the Faculty of Sciences at the University of Chile is working on the chemicals in Antarctic marine organisms in Fildes Bay. He is concerned with the metabolites present in the organisms, characterising the primary and secondary structures which make up the isolated reproductive chemicals and other factors relating to biological generation.

A comparative study of Antarctic

terrestrial ecosystems in relation to the structure and circulation of nutrients will be undertaken by Italo Serey Estay from the Department of Biological Sciences in the Science Faculty of the University of Chile. He aims to establish the various seasonal factors controlling the nutrients available to populations of important species of lichens and mosses in the substratum of soils on Robert Island.

The utilisation of the orange pigment in Antarctic krill is being analysed by Claudio Romo from CECTA, at the University of Santiago. He will examine the components such as proteins, pigments, soluble lipids and determining how the resources can be made suitable for human consumption and use in the animal and industrial markets of Chile and elsewhere.

Working at President Frei Base and using Yelcho as a sub-base, Margarita

Prendez from the Faculty of Sciences at the University of Chile will study the contribution that aerosols make in the troposphere and their interaction and influence on the ozone layer.

Onboard ship in the Gerlache Straits and adjacent waters will be Anelio Aguayo who is studying the feeding behaviour of the baleen whales *Megaptera novaeangliae* and *Eubalaena australis* and testing the hypothesis that the population recovery is more rapid than suggested and sustained principally because of a different and more successful feeding strategy.

At Presidente Frei, Marija Eliana Ramirez from the National Museum of Natural History will continue the systematic study of the taxonomic relationship and the morphology of the Antarctic *Gigartinaceae* and *Phyllophoraceae* - *Rhodophyta*, *Gigartinales*.

Strong international element in Italian programme

Operations at Terra Nova Bay Station this season are expected to begin on October 12-13. Two ships, and a C-130 Hercules will provide logistic support for the programme which will include work in the Scotia Arc, a land-sea geotraverse and two inland traverses to Dome Concorde in conjunction with the French Antarctic Programme as well as operations in the Ross Dependency. A number of Italians scientists are also working at other national bases or aboard other vessels.

A C-130 Hercules from the Italian Air Force will make seven flights from Christchurch to McMurdo Sound between October 11 and November 29. Flying variously under the command of

Major's Vittorio Maccabruni, Luciano Ciccione and Paolo Martini, the aircraft will carry a total of 88 scientific and logistics personnel south. Four helicopters (three AS 350 B Squirrels and one Bell 212) have been chartered from Helicopter Resources Pty Ltd, at Tyabb in Victoria, Australia. Flown by civilian pilots, Leigh Hornsby, Ward Bremmers, Andrew Baker, Rob McPhail, Dave Pullinger and Colin Hardiman, they will undertake ship-shore operations and ice reconnaissance, support scientific activities in the field and provide transport for personnel to and from McMurdo Station.

The cargo ship M/V *Italica*, a 130 metre, 4,000 metric ton vessel with a

draft of 6.8 metres and normal speed of 13.5 knots will sail from Ravenna on October 10 under the command of N. Fevola. She is scheduled to arrive in Hobart on November 19 and Lyttelton on November 21. By December 10 she should have reached Terra Nova Bay, with 72 passengers aboard, and from where she will depart on January 15 for Dunedin returning to Terra Nova Bay on February 2 to continue to support operations until February 21. By March 3 she will have returned to Lyttelton and will then proceed to Hobart before going back to Ravenna, where she is scheduled to arrive on March 16.

Until December 12 Mr Mario Zuchelli will lead the expedition handing over to Roberto Cervellati, on his arrival at TNB aboard *Italica* until the closing of the station at the expedition's end early in March 1994.

OGS Explora, a seismic vessel, will operate in both the Scotia Arc and the Ross Sea areas where she will support a land-sea geotraverse Antarctic Crustal Profile 1 (ACRUP 1) which will involve the installation of a temporary field camp in the Drygalski area. This vessel has an overall length of 72.63 metres and draught of 14 metres. She is 978 tons dead weight, has a speed of 14 knots, carries 20 passengers and belongs to the Osservatorio Geofisico Sperimentale (OGS) at Trieste in Italy. *OGS Explora* is scheduled to leave Italy on November 8 and arrive at Ushuaia on December 7 and operate in the Scotia Arc area until December 25 when she will return to Ushuaia for two days prior to leaving for Dunedin where is expected to arrive on January 21. From then until March 3 she will operate in the Ross Sea area before returning to Lyttelton on January 28 and Italy on 17 March 1994. This vessel will sail under the command of S. Valles and M Vranicich. D. Nieto will be the party leader.

Icebird, chartered by the Australian

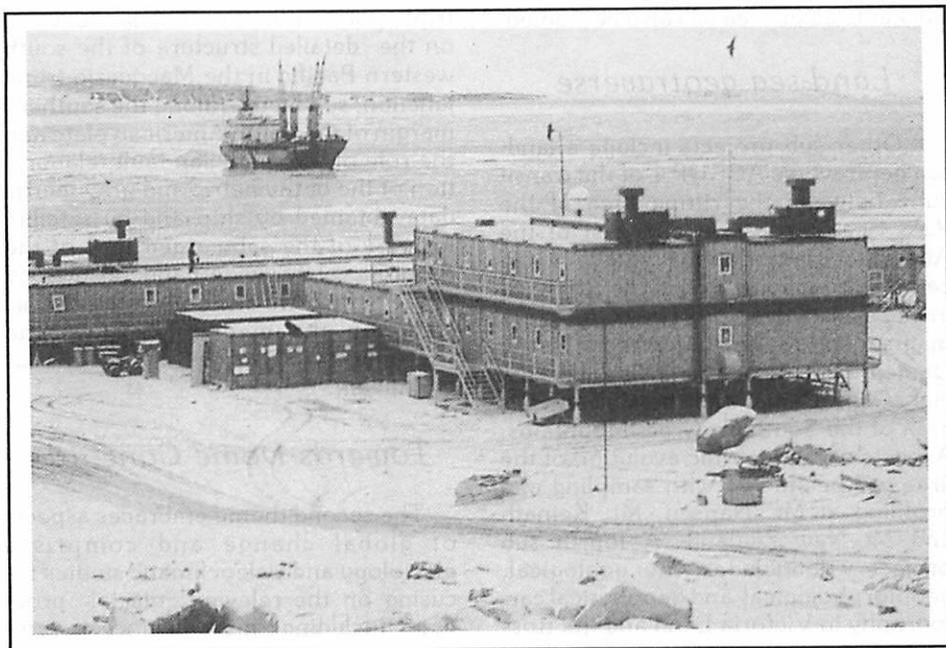
Antarctic programme will deploy Italian personnel to Dumont d'Urville on her third voyage of the season during November. They will participate in joint Italian-French antarctic research programmes.

Terra Nova Bay Station lies at 74deg41',42"S/ 164deg07'23" E along the coast of the Northern Foothills of Victoria Land, north east of Gerlache Inlet. It was established during 1986-87 to support summer operations which, at the base this season, will consist of improvements and maintenance of technical and scientific plants in addition to the scientific programme.

A third hangar (20 X 24 metres) will be assembled for logistics and scientific needs; a cryogenic plant for nitrogen production will be completed and the power plant housing enlarged, adding to the two previous prefabricated modules. Two new antenna towers will be installed, an oceanographic buoy moored at sea and a shore based station for reception of data established. The metallic housing of the sea water intake and the pier damaged last summer will also be restored.

The science programme

Operating out of Terra Nova Bay Station, the scientific programme is focussed on a number of themes. The first of these covers the geological structure and evolution of the Antarctic continent and of the southern ocean. Overall the project is being co-ordinated by C. Ghezzi and C.A. Ricci from the University of Sienna. Within this major research project are a number of sub-projects, which for this season include a number of studies relating to the evolution of the lithosphere in the Ross Sea Region, the Proterozoic-Paleozoic evolution of the Pacific margin of Antarctica, on the evolution of the Pacific border of the east Antarctic craton and



Terra Nova Bay Station at the end of the fifth Italian Antarctic Expedition

the Lower Proterozoic-Paleozoic with field work on the geology, petrology, geochemistry and geochronology of the granulitic rocks of the Wilson Terrane, the regional progressive metamorphism in the Terrane and work on the granitoids and include characterisation of selected complexes, studies of the structural relationships between them in terms of space and time, surveying, sampling and geological and petrographic mapping.

Among the specific areas to be visited for these projects are the Campbell Glacier, Mills Peak-Mt. Emison, Capsize Glacier, Mt. Dikason, Black Ridge and boomerang Glacier; the southern Wilson Terrane focussing on Terra Nova Bay, the Eisenhower Range, Deep Freeze Range, and southern Cross Mountains; the central Wilson Terrane focussing on the Lanterman Range, Morozumi and Daniels ranges and the Wilson Terrane in the Terra Nova Bay area. Work on the granitoids of the

Wilson Terrane is to focus on the area north west of the Browning Pass, principally at Mt. Kienath and Boomerang Glacier, Tinker Glacier and Mt. Murchison, the Campbell and David Glacier areas and the sector between the David Glacier and Cape Ross. Work will also be undertaken in the Lanterman area and around the Mt. Abbott complex.

As part of the studies on the crust accretion of the Antarctic Pacific paleomargin in the Phanerozoic, the suture zone between Wilson, Bowers and Robertson Bay Terranes in the area of the Lanterman Range will be studied during visits to the Carnes Crag, Clove Spurs, Index Spurs, the area north-east of Mt. Bernstein and surrounding Husky Pass and Mt. Edixon. Visits to the Admiralty intrusives in the Mariner and

Tucker Glacier area will also be studied.

Land-sea geotraverse

Other sub projects include a land-sea geotraverse ACRUP 1 of the transit zone between the rifting area of the Ross Sea Depression and east of the Antarctic craton and a study of the cenozoic geodynamics in the Ross Sea area and work on the Cenozoic magmatism to be undertaken in the Daniell Peninsula, the Whitehall Glacier, Cape Daniel and the Vulcan Hills area of the Southern Cross Mountains. Aspects of the tectonic evolution of the area will be studied with sampling and profiling at Mt. Nansen, Mt. Keinath and Mt New Zealand. A fourth sub project will include the geological, geomorphological and geophysical cartography in Victoria Land and the Ross Sea areas.

The peri-Antarctic basins and margins of the Antarctic plate are being studied in a range of nine projects several of which involve work with other nations. The co-ordinators for this series of projects are E. Bonatti from the Institute of Marine Geology at Bologna and A Praturlon from the Committee of Geology at CNR in Rome. Although field work is not planned for all projects this season the key focii of this broad ranging topic include geophysical exploration of the north-western border of the Antarctic Peninsula to study the crustal conditions and the geodynamical evolution of the area; the structure and evolution of the southern border of the Scotia Plate (Elephant Island/South Orkney Island) during the Oligocene/Miocene; the structural evolution of the Pacific Margin of the Antarctic Peninsula where there is a progressive collision between the trench and the oceanic rise; the geology of the Antarctic plate margin in the region of the Bouvet

triple point in the South Atlantic, work on the detailed structure of the south western Pacific in the Macquarie triple junction; subduction along the southern margin of the South American plate and the role of the Magellan fault; elaboration of the bathymetric and gravimetric data obtained by ship and by satellite imagery of the submerged part of the Antarctic plate; wide band seismology in the Scotia Arc and a morphotectonic study on the medium Atlantic and Circumantarctic rises by means of multibeam.

Towards Dome Concorde

The second theme embraces aspects of global change and comprises glaciology and paleoclimatic studies focusing on the relevant glacial processes including mass balance parameters and their space distribution and involving direct measurements on the Strandline, Tarn Flat, Drygalsky, Priestly and Reeves Glaciers and a superficial drilling programme in northern Victoria Land at intervals up to the Talos Dome. Ice shelves and floating ice tongues are be studied on the Hells Gate and Nansen ice shelves and further work on the dynamical behaviour of ice streams begun during the last two summers will be undertaken. The possibility of a traverse from Terra Nova Bay to Dome Concorde will be verified within the framework of ITASE and EPICA-Dome Concorde projects and a study of the David ice-stream will be carried out. During this phase of the operation the party plan to use caterpillar vehicles to cover the first 200 km of the Antarctic plateau, already undertaken during the last two summer expeditions. Observations of snow cover; drilling of snow and firn will be undertaken as part of the project which will also include a atlimetrical survey with

GPS measurements. The collection of paleoenvironmental data contained in land and sea ice and in land and sea sediments will be continued. Work on ice physics and geophysical prospections will be undertaken as part of the Dome Concorde Project (EPICA) and collection, sampling and studying of the meteorites in the Antarctic ice will be continued as part of the EUROMET programme. Field controls may also be established to aid thematic cartography from telesurveys.

Atmospheric studies this season will focus the physics of the plant planetary boundary layer to be undertaken on the Nansen Ice Shelf, at Terra Nova Bay and Dumont d'Urville; solar radiation and clouds at Terra Nova Bay and at Dumont d'Urville where the LIDAR will continue to operate. The Greenhouse gases and minor atmospheric components are being studied at Jubany and Scott Base and other LIDAR work is being undertaken at Amundsen-Scott South Pole Station, and at McMurdo.

Climatic system

Work on the climatic system and sea-ice atmosphere relationships focus on sea-atmosphere interactions and meteoroclimatic forcing of open sea and sea ice. An ice formation - polynya experiment will be conducted on the Hells Gate Ice shelf using radar, gravimetric and electromagnetic techniques. Sun-earth relationships, with a focus on the chromospheric structures and their dynamics, will be studied at Terra Nova Bay where instruments are to be installed and tested. Solar wind - magnetosphere interactions and the ionosphere will also be studied at Terra Nova Bay where a riometer will be installed and tested this season. An all-sky camera is to be installed at Belgrano base to detect auroral visible phenomena.

Three sub projects are being undertaken as part of an astrophysical research programme. They include the location of a site suitable for a remotely operated telescope able to operate in the near, medial infrared; observations of low energy cosmic rays observations will be continued at the South Pole where cosmic background radiation will be measured with different instruments, the results from which will determine the choice of detectors to be installed on Dome C.

Adaptation

In a separate series of projects the physiological, biochemical and molecular mechanisms of adaptation are to be studied. These range from organismic to molecular, of the adaptation in the basic physiological mechanisms developed by the ecosystem in response to environmental cooling. Many of the projects include or envisage international collaboration and, in some, this element is well established.

Work on aspects of evolutionary adaptations of fish has been undertaken for some years in conjunction with Dr John MacDonald from the University of Auckland in New Zealand. This year the party is to include Dr Bill Davison from the University of Canterbury (see *Antarctic Vol. 13 No. 3 page96*) Work on the haematological characteristics of the Emperor and Adelie Penguins during growth will be investigated in conjunction with the Americans and, in another project, a study will be made of the respiratory physiology in invertebrates. Enzymes and metabolism, transport proteins, cell membranes and stress proteins in fish will be studied along with factors influencing development and growth. The adaptive and non-adaptive characteristics and morphofunctional features in different species characterised by different eco-

logical and trophic specialisations will also be carried out in collaboration with scientists from the UK and Argentina.

Ecophysiology and ecotoxicology

Sub-projects being investigated under the broad title ecophysiology and ecotoxicology include the UV-B radiation effect on the photosynthetic apparatus and adaptation to the Antarctic environment which will involve widespread collection of mosses, lichens and algae for investigation; the ecological-functional characterisation of earth Antarctic ecosystems and study of the flows of essential and toxic elements in the trophic chains will involve sampling of vegetation at a range of different sites where the microclimatic parameters will also be investigated. Collection sites will be widespread and include Crater Cirque and Cape Hickey for the landbased samples while specimens of plankton, echinoderms, molluscs and fish will be collected in the Gerlache Inlet for blood and organ sampling.

The development of bio-indicators and bio markers will be studied in relation to the presence of physical and chemical agents of natural and anthropogenic origin. This project involves the periodic collection of organisms that will be used as bio indicators or on which various biomarkers will be studied. Sites for collection include Cape Bird on Ross Island in conjunction with the New Zealand programme; Cape Washington and Terra Nova Bay. Some diving will be involved to observe and to assess the distribution and composition of some populations as well as sampling to study particulate contamination. Some work will be carried out in conjunction with the Australians.

Another sub-project will focus on the adaptation mechanisms in Antarctic

organisms in relation to trace metal metabolism. Fish, molluscs and sea urchins will be sampled and experiments carried out to evaluate heavy metal effects. In two other sub-projects, waters and soils will be sampled to determine the existence of photosynthetic or extremophilic micro organisms as part of a chemical microbiology and biochemistry study and the chemistry and biochemistry of molecules of biological interest in Antarctic marine organisms, algae and marine plants will also be conducted.

The ecological and genetic aspects of differentiation processes in populations of organisms such as amphipods, crustacea, molluscs and fish, nematodes, marine and freshwater microfauna and ciliate protozoa will be conducted as part of another study on ecogenetics and speciation. Picoplankton ecology involving sampling, culture preparation and chlorophyll measurements will also be undertaken.

Southern ocean studies

Aspects of the ecology and bio geochemistry of the Southern Ocean are the focus of a two part project comprising coastal work and ship board studies in 1994-95. The dynamics of the biological processes related to the upper oceanic layer, as a function of the physical and chemical environmental factors and of the ice melting processes is one aspect while the bio geochemical processes in the water column and in marine sediments completes this study. Most of this season's work will be in Terra Nova Bay where secondary production, particularly silica and carbon turnover and short-term variations in population structures of selected populations in the benthic communities will be among the foci.

Environmental contamination will be studied in a project coordinated by P Cescon from the University of Venice. A systematic analysis of elements of environmental interest; their distribution and variation in time in different matrices. are the key components of this study. They include diffusion and transport of pollutants at a planetary level; pollutant distribution in sea and lake matrices, and the sampling to collect standard reference materials. Many sites will be visited as part of this project. They include Deception Plateau, the Styx and Aviator Glaciers and Mt. Melbourne.

Work on human biology and medicine will concentrate on circulatory mechanisms and their adaptation to short and long term stays in Antarctica; dermatophytes will be collected and studied and work undertaken on the stress relationship with the biochemical hormonal system as well as some psychological and behavioural testing on programme participants.

Solid earth geophysics

The solid earth geophysics programme will involve maintenance and data acquisition from geodesy, geomagnetics and seismological observatories. Solar radiation measurements will be made and the micro climatological network restored to automatic data functioning during the summer and winter. Cloud covering will also be measured continuously and ozone studies continued at Scott Base and Belgrano. Ionospheric and meteorological programmes are to focus on ionospheric radio propagation; equipment for acquiring meteorological data will be maintained and improved and data acquisition from the NOAA satellite will continue.

A permanent mareographic station

is to be built at Terra Nova Bay. It will be included in the Global Sea-level Observing System (GLOSS). The station will represent the geodetic reference point for future terrestrial and hydrographic surveys in the area. In another project, wave motion will be quantified using a wave metric system on a buoy connected to a receiving station at the base camp.

Activities included in the project Telesurvey, GIS and Database are a remote sensing programme, data acquisition, storing, coding and analysis for GIS. Echo sounders will be used on the cargo vessel and small scientific boat to record the bathymetry in Terra Nova Bay to enable a 1:240.000 chart to be prepared.

Robots and telescience

Plans are underway for experimentation work of projects involving robots and telescience. The co-ordinators are B. Palaia and A. Marino both from ENEA in Rome. Tasks this season include an inspection of typical ground and environmental features in order to implement and modify Mission Analysis results from tests with a ground mobile robot. Experiments are also planned with an autonomous underwater vehicle and will focus on critical aspects of environmental conditions, constraints and collection of data for project activities and parameters as well as the operation of ROBY 2, a tethered ROPV in support of scientific research. Parameters for Telescience will be investigated in another project. Field tests will be made of an aerosol sensor and a marine corrosion sensor.

Further experiments will be undertaken on the teletransmission of medical images from the Italian Antarctic station to some hospitals in Rome as well as in Pisa. The capability of send-

ing and receiving, storing and forwarding data via polar orbiting micro-satellites will also be investigated.

Work at other stations

Four guests from other nations will visit the station at Terra Nova Bay and nine others will be worker visitors. In all approximately 150 Italians will be either participating in the science programmes of other nations this season or providing logistic support.

Other stations

Two Italian researchers will be working at Amundsen-Scott South Pole Station where a Cerenkov light telescope and data acquisition systems will be installed and investigation of stratospheric aerosols by LIDAR continued. Two

other researchers will maintain the Brewer observatories at Belgrano and continue making measurements of ozone. A seismic station installed at Base Esperanza in 1992-93 will be maintained and improved. Two Italians will collect air samples in flasks for CO₂ analysis at Jubany. LIDAR and SODAR measurements will be made by Italians at Dumont d'Urville and further LIDAR work is being undertaken by Italians at McMurdo Station.

A joint US/Italian programme will enable two Italian researchers to participate in the cruise of the *Nathaniel B. Palmer* to the Ross Sea (see *Antarctic* Vol 13, No 4) and two others will aboard the *R/V Polar Sea* working in the joint project Ecology and Biogeochemistry of the Southern Ocean

Joint logistics agreement between Nordic countries sustained

Under the joint agreement by which the three Nordic Countries undertake their Antarctic Research, Sweden is responsible for the logistics arrangements for the 1993-94 summer season. *MV Polar Queen* will be used to transport 35 people associated with the main body of Swedish activities, the 11 Finnish scientists and support staff and 12 Norwegians to Queen Maud Land the principal area of operations. Cargo is scheduled to be loaded at the beginning of November in Gothenburg and the ship is expected to depart for arrival in Cape Town in South Africa about two weeks later. The expedition personnel should join the ship on November 29 and leave the following day for Antarctica arriving at the ice edge on December 10.

In 1992/93 Norway was responsible for the logistic arrangements.

Last year the Swedish scientists used the Norwegian ships *Polarbjorn* and *Lance* to accomplish a terrestrial programme in Queen Maud Land as well as a marine programme in the Weddell Sea. Another part of the Swedish programme was carried out on the antarctic Peninsula. In conjunction with Argentina five Swedish scientists visited James Ross Island and Vega Island to undertake programmes of glacial geology and paleoclimatology. The third part of the Swedish programme was undertaken in cooperation with BAS on South Georgia where research into zoology, limnology and plant ecology was undertaken. Swedish scientists also joined with other nations for a separate marine expedition to the Weddell Sea.

This season the Swedish programme comprises five different

projects, three of which are being undertaken in cooperation with scientists from other countries. Their station Wasa at 73deg03minS/13deg25'W in Vestfjella will support a party of 15 including leader Olle Melander from the Swedish Polar Secretariat, a technician, base commander and research fellow, two glaciologists, two geodeticists, and an environmental officer.

Helicopters carried aboard the vessel will be used to support field activities. The pilots are Jan Sundberg from SAAB Helicopters in Nykoping and Ulf Brink from Heliflyg AB in Ostersund. Technical support is being provided by Yngve Pettersson also from Heliflyg AB. All three will operate out of Wasa. Some work will also be undertaken in the vicinity of Svea, a smaller Swedish base, which is located at 764deg35minS/11deg13'W in Heimefrontfjella.

Glaciology, geodesy and medicine will be studied at the Swedish stations and their surroundings. The glaciological research project is based on mass balance of the ice sheet and a survey of the subglacial landscape in the Maudheim-vidda area. The two facet geodesy programme complements work begun in 1991-92 when a geodetical base network was established in the area. This work is coordinated with scientists from Norway, Germany and South Africa. The second aspect deals with altitude measurements of Antarctica's ice-stretches using data from the European remote sensing satellite ERS-1. Medical work this season is focussed on the D-vitamin group.

In addition the Swedish Polar Research Secretariat runs a programme aimed at investigating the environment and impact of research and other activities in the station area. This season sampling will continue along with biological investigations.

ITASE, the International Trans-Antarctic Scientific Expedition, is studying changes in temperature, precipitation and atmospheric contamination during the last 100-200 years. A network of traverses over the whole Antarctic continent is planned. Measurements will be carried out every 100km when 20 metre of ice cores will be drilled and analysed to determine their oxygen isotope level, electrical conductivity and soluble and insoluble impurities. Radio echo studies will be conducted and GPS measurements taken to establish movements. The Swedish contribution in 1993/94 involves a traverse from the Swedish stations in eastern Queen Maud Land (at approx 73deg s) to the South Pole and back again but concluding at the Germany's George von Neumeyer Stations. Hagglund ATC sledges and a living module will be used as logistic support and accommodation. In all eleven scientists and support staff will be involved in this expedition which will be led by Jack Berg who is based in Stockholm. The deputy leader is Ulf Hedman from NOAB Nordoptik AB. Three Swedish and one American geologists are participating. A Swiss scientist, Katrine Fuhrer from the Physics Institute at the University of Bern and the Dutch meteorologists, Louk Conrads from the Institute for Marine and Atmospheric Research at the University Utrecht and Dr Raymond Schorno from the Netherlands Marine Research Foundation are included in the party along with two Swedish technicians.

In conjunction with the US Swedish scientists are involved in the Antarctic Muon and Neutrino Detector Array (AMANDA) project in which the high-energetic neutrino particles from the universe are detected by an array of equipment placed 1200 metres below the surface of the continental glacier at the Amundsen-Scott South Pole Sta-

tion.

Swedish scientists will also be on South Georgia again this season. This year will be the third of the four planned seasons of study of the reproductive strategies of the southern elephant seal (*Mirounga leonina*) in conjunction with BAS scientists. Further work on King Penguins will also be undertaken. Most of this programme is focussed on a king penguin colony of approximately 160 birds, situated at the Olsen Valley some 3.5km from the field station in Husvik but some complementary work is also undertaken in the larger colony at Fortuna Bay some 20 km from Husvik.

An inspection tour, in accordance with the Antarctic Treaty, is being made by Swedish scientists and others this season. The party of nine will be led by Dr Anders Karlqvist from the Swedish Polar Secretariat and includes three personnel from the Ministry of Foreign, one from the Ministry of Environmental Affairs, one from the National Environment Protection Board and one from the Ministry of Education. They will be accompanied by journalists from Swedish Radio and the Swedish Central News Agency.

Finland

The Finnish Antarctic Station Aboa was established in 1988-89 at the same time as Wasa. Both stations are often referred to as the Nordenskjold Base. The location of Aboa is on Basen, the northernmost nunatak of the Vestfjella Mountains in Western Dronning Maud Land.

This season the Finnish expedition comprises 11 persons, four hardrock geologists, two quaternary geologists, two geophysicists, one solid earth geophysicist, one technician and one civil engineer. The projects to be undertaken represent a continuation of work begun in previous years.

At Aboa the expedition leader is Professor Jaakko Siivola, who also leads the team of hardrock geologists. Henrik Grind is responsible for the logistics and is also a member of the geological team together with Arto Luttinen, Maika Raisanen and Siivola. Petri Lintinen is responsible for the quaternary geology and Jari Nenonen is the other member of the group. Tapio Ruotoistenmaki takes care of the geophysics together with Jukka Lehtimaki. Jaakko Makinen is responsible for the geodetics programme. Ebbe Nyfors is in charge of communications and the station and Pertti Vilkmán is responsible for the generators and machinery for the expedition.

The groups will spend about six weeks in Antarctica during which they will use two terrain carriers one Finnish built Sisu NA - 140 and one Swedish built Hagglund BV 206 to travel to their research sites. Six to eight Lynx snowmobiles are also available to the expedition. Six of these are equipped with emergency boxes and sledges. Together with the Swedes, two MD 500 E helicopters will be available for a up to a month at the beginning of the expedition and also towards its end.

During the 1991-92 austral summer the Finnish Antarctic Research Station Aboa was the centre for a major helicopter - supported programme of geoscience in western Dronning Maud Land. The objectives were to fulfil the studies already begun during the FINNARP 89 expedition. Primary geological investigations were made at the south end of Vestfjella at Utpostane, in the middle section of the same mountain range at Muren/Kjakebeinet area and at the isolated nunatak group Mannefallknausance. Reconnaissance bedrock mapping and sampling was done along the entire Heimefrontfjella. Brief studies of Sembberget and the southern part of Kirwanveggen were

also made. This season a more detailed study of the gabbro intrusion at Utpostane and at Muren will be undertaken. Also some complementary studies of the geology in the northern part of Vestfjella are scheduled. Geological mapping, sampling and structural geological investigations are planned in Heimefrontfjella, mainly on both sides of Bibergdalen (between Sivorgfjella and Tottanfjella).

In the 1989-90 season Petri Lintinen focussed on "The quaternary studies of the northernmost Vestfjella nunataks, Western Dronning Maud Land" and together with Nenonen he will do more quaternary geological work in the whole of Vestfjella and in some parts of Heimefrontfjella. Their aim this season is to make detailed glacial and geological observations by digging test pits on till surface and studying striations.

During the FINNARP -91 expedition a concrete pillar for an absolute gravimeter was built close to Aboa. This season the team will construct a hut around the pillar and Jaakko Makinen will measure absolute gravity, thought to have been measured previously at only two stations in Antarctica. The determination at Aboa will therefore improve the global coverage of the International Absolute Gravity Base station Network (IAGBN).

Geophysical investigations in the nearby area are also to be undertaken in order to interpret the thickness of ice cover and the geology below the ice surface. The geophysicists are Jukka Lehtimäki and Tapio Ruotoistenmäki. Their methods include gravity, magnetic and electromagnetic measurements. The petrophysical characteristics of the rock types will be evaluated by taking samples for petrophysical measurements to be made in profiles between the nunataks Basen, Plogen and Fossilryggen. The interpretation programmes from the GSF (Geological

Survey of Finland) will be used to analyse the data.

An automatic MILOS 200 weather station is located at Aboa and it has operated since January 1989. Meteorological data is measured every third hour. The parameters are 10min mean wind speed, maximum wind speed over the last three hours, air temperature, dew point, pressure and pressure tendency and relative humidity. Data is being sent through the ARGOS satellite transmittance system. The research group comprises Kari Karlsson, Petteri Taalas, Jouko Launiainen and Timo Vihma.

Data has also been transferred to the Finnish Meteorological Institute by the French Argos satellite communication system and submitted to the GTS distribution since early in 1993. It is processed each month and the results have been used in sea-atmosphere interaction studies. So far, the data, which is also available for other studies, has been archived at the Finnish Meteorological Institute.

Microbial ecology.,

The biologists, Jorma Kuparinen and Ann Heenanen are going on the JGOFS cruise *Antares 2* from 26 January to 25 March 1994 onboard the ship *Marian Dufresne*. They will study the contribution of bacterioplankton in the secondary carbon production of Antarctic waters. Due to the patchy environment of Antarctic waters they will make high resolution measurements of bacterioplankton from the wind mixed layer and expect to obtain high resolution estimates of bacterioplankton biomass and secondary carbon production in the upper wind mixed layer.

The Finnish Meteorological Institute carries out ozone sounding in cooperation with the Argentine Servicio Meteorológico Nacional at the Argentine station Vicecomodoro Marambio. The total ozone has been measured by a

Dobson spectrophotometer since 1987. The ozone soundings are measured by Vaisala DigiCora and ECC sonds, from November 1988 - May 1989 continuously, twice a week during August to December and every second week for the rest of the year. The research group comprises Petteri Taalas, Tapani Koskela, Juhani Damski, Esko Kyro and Markku Rummukainen from the Finnish Meteorological Institute and Gustavo Talamoni, Maximo Ginzburg and Victoria Tafuri from the Servicio Meteorological National in Argentina.

The joint activity will continue through 1993-96. Basic analysis has involved three dimensional trajectories, potential vorticity and temperature fields based on the global data of the European Centre for Medium Range Weather Forecasts.

The ozone soundings and total ozone measurements have been submitted to the WMO in real-time and to the World Ozone Data Centre in Canada every second month. Marambio is one of the four stations used for the annual monitoring of Antarctic ozone loss.

Future interests include continuous ozone sounding and total ozone measurements, a comparative study of the exchange processes related to the Arctic and Antarctic polar vortexes and participation in international campaigns and projects to study Antarctic ozone and the comparative modelling study of uvb absorption atmospheric ozone and aerosols in the Arctic and Antarctic.

Norway

Information on the Norwegian programme was sketchy at time of publication but it appears that the major field activities are two glaciology programmes each comprising three persons. The first will be working in the Jutulgryta area and the second in Jutulstraumen. Both will access their research areas via

Troll. A four person biology programme is to be undertaken at Svarthammaren where a small steel hut will be erected to support activities. This new summer station will be called Tor. Two other Norwegian scientists will undertake topographic work in the Heimefront-Vestfjella area.

Logistic support

Logistic support for the Nordic expeditions is, as stated primarily being provided by the *MV Polar Queen*. Having arrived at the ice edge on December 10 she will unload Norwegian expedition members and equipment at SANAE, and from December 13 will support a helicopter reconnaissance to be undertaken along the ice edge near the Swedish station Wasa. From December 14 until 23 she will be unloading at Wasa and supporting the departure of the ITASE group on their traverse towards the South Pole. On December 23 she is scheduled to sail for Cape Town arriving there on January 2 and leaving the following day with the inspection group on board. By January 12 she will have arrived at Georg von Neumayer station to unload German scientists and equipment and two days later she will depart. The inspection tour, the itinerary of which was not confirmed at publication time, is expected to last until January 28 when the vessel returns to Wasa to evacuate personnel. On February 3 she will depart for Cape Town arriving there on February 12 and departing the following day for Neumayer to collect members of the ITASE expedition and their equipment. On March 1 she will depart arriving in Cape Town on March 10 at the conclusion of the expedition.

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Non-government expeditions

Two non-government expeditions have been advised but logistic detail is not available. A group of 12 mountaineers-climbers will operate in the Fenriss area of Dronning Maud Land between January and February of 1994 and the Filchner Ice Shelf Project is to continue. Known as the Aurora Programme, it

will again be led by Dr Monica Kristensen. Captain Jostein Helgestad is second in command and in charge of logistics. Field activities are being supported by two Twin Otters and skidoos. They will be working on the Filchner Ice Shelf, Bailey, Recovery and Support Force Glaciers, the Polar Plateau above these glaciers and at the South Pole. Their study, designed to cover three years, focuses on climate related glaciology, meteorology and oceanography and will be completed this year. A further search will also be made for Roald Amundsen's tent at the South Pole.

Half United States programme to be undertaken in McMurdo and continental area

The United States 1993/94 Antarctic Program comprises 120 programmes 61, of which will be undertaken in the McMurdo Sound, Dry Valleys, continental areas including Vostok. Fourteen involve personnel, often undertaking maintenance and training for winter operations at McMurdo Station and for the 18 programmes scheduled to be installed, or continued, at Amundsen-Scott South Pole Station. The remaining projects are to be undertaken in the Peninsula area and aboard the ships *R/V Polar Duke* and *R/V Nathaniel B. Palmer* and include two in the Ross Sea area. (Approximately 640 scientists and field staff are involved; numbers of base and logistics support personnel were not available.)

For the purpose of programme coverage Antarctic has chosen to include the McMurdo Sound and Dry Valley programmes in this issue and scheduled details of the Peninsula programmes for the December issue.

The remaining continental, McMurdo and South Pole programmes, many of which will continue over the winter, will be detailed in the March issue.

During last winter McMurdo Station supported 237 science, United States Navy and Antarctic Support Associates personnel. On August 23 the first of eight flights, using three aircraft, to make up the 1993 WINFLY took south scientists who were involved in ozone depletion and biological studies. Some 272 hours of flying were involved in this series of flights. Since then, and for a few weeks before, base operations have been geared largely towards preparing facilities for the summer science programme during which approximately the number of personnel using the station is expected to peak at 1,250.

Food services and McMurdo aviation terminal operations were transferred to civilian contractor in 1992 and all other logistical support functions except for LC-130 flight opera-

tions and services related to flight safety are currently being reviewed for possible future transfer from the Navy to the USAP civilian contractor. During the next two years, public works, terminal operations and supply will gradually also be transferred to the contractor. USAP will begin studying the viability of commercialising on-ice aviation support, first through helicopter operations and maintenance. The earliest date, however, for implementation of commercial helicopter support would be the 1995/96 season.

At the station this summer the Crary Laboratory is expected to be completed with all three phases coming into full operation. Dedicated in 5 November, 1991 to the memory Albert P. Crary, the laboratory comprises five pods yielding a total of 46,500 square feet of working area.

The first phase accommodates the Core Pod which contains a telescience room and includes a GIS facility and the initial development of the Antarctic Meteorological Research Centre (AMRC) with a computer system which includes Terra Scan satellite overpass data processing software and colour-dye sublimation printer. Management offices, special equipment rooms, storage rooms and a receiving and staging area are located on the first floor. There are also computer and conference rooms, multipurpose space, reading and coffee lounges. The Biology Pod contains two Environmental Monitoring and Enforcement Laboratories (EMEL), one Snow and Ice Mechanics Laboratory (SIML), five general use and two microbiological laboratories and one radioisotope laboratory, four walk-in-freezers, four walk-in environmental rooms, a chemical storage room, storage and preparation areas, a field party staging area and ten offices including that of the NSF Science Representative in Antarctica.

In addition there is an Atmospheric Sciences Pod which was completed at WINFLY 1992 and contains an assembly and test area, two environmental laboratories, an electronics workshop, a Faraday cage, a photographic darkroom, a receiving and recording area. Penetrations through the roof will accommodate instrumentation such as Lidars and there are six offices. One of the environmental laboratories contains the Italian Lidar system, installed at Winfly 1992, and which measures particles in polar stratospheric clouds throughout the year. Two offices in this pod accommodate further development of AMRC, installed last season and a computer system with man-computer interface data acquisition system (McIDAS)-X meteorological processing software. The Earth Sciences Pod, completed in October 1992, contains a sorting and storage room, rough cut and thin sectioning rooms, an instrument room/laboratory, an electronics shop, a common work area, three freezers for processing ice and snow specimens and six offices. The electronic shop accommodates the Mt. Erebus Volcano Observatory (MEVO) which was installed last season.

The third phase of the development is scheduled for completion in October 1993 and contains an aquarium, holding tank, two laboratories and a storage room.

The laboratory supports primary NSF/OPP funded and international antarctic programme investigators, four research centers/labs (two EMEL, SIML, AMRC and MEVO) GIS and local area network (LAN), with connection to Internet. The laboratory will also support a biology training course during January 1994 (see page.....) designed to address adaptations of organisms to the antarctic environment. Discussions continue on the installation of a very long base-line interferometry telescope

long base-line interferometry telescope (VLBI) and a synthetic-aperture-radar (SAR) ground station.

This season also USAP is to relocate the explosive storage yard in order to prepare the existing site for construction of a ground station to receive data from a planned joint US Canadian satellite carrying a synthetic aperture radar. The data will be used to make maps. The ground station will be installed during the 1994/95 summer.

Depending on funding levels, work will continue on a mobile runway facility for Williams Field, the renovation and replacement of substandard housing. NSF, with the assistance of NASA., has installed a satellite communications earth station at Black Island. It provides modern TCP/IP computer network, linkage to global Internet as well as multiple simultaneous telephone channels, facsimile transmission and reception and compressed video. NSF will go on line in January 1995 with an even higher capability earth station, designed and engineered with the assistance of the US Naval Electronics Centers.

Logistic support

USAP plans to use 1866 hours of helicopter operations during this season. Funding to US\$49.36 million was provided last year for a new LC-130 scheduled for delivery in December 1995. Three of the existing LC-130's F Models have gone through the Gross Weight Improvement Programme which significantly increases their weight-bearing capacity and flight endurance. Three have also have improved navigational and other equipment installed as part of the Avionic Systems Improvement Program. Improvements to the other four of the seven owned by NSF will be completed during June 1996. All standard Depot Level Maintenance and ski repairs are to continue at Air New Zealand in Christchurch. In addition, LC-130 BUNO 148320 went into Air

New Zealand hangar for extensive repairs after suffering a significant accident in McMurdo last December.

The Air National Guard's 109 Tactical Airlift Group will return again this season with two crews and two aircraft planned for a four week period in November and again in January. These efforts will be further supplemented by a number of RNZAF LC-130 flights and helicopter operations.

The first wheeled C-130 operations commenced on the Pegasus blue-ice runway last February. Plans are to use this runway again during the season as wheeled operations increase the carrying load of the LC-130's. USAP has also contracted successfully for Utility Twin Otter Support.

A US Coastguard icebreaker will open up a channel into McMurdo Station in January 1994. A resupply tanker and a supply ship will deliver fuel and supplies to McMurdo, the supply ship performing a double shuttle by returning to Lyttelton between the McMurdo calls. The *Nathaniel B. Palmer* will operate in the Ross Sea between December 1993 and March 1994 and make two port calls at McMurdo.

Scientific programmes

Among the first scientists to go south were two parties of scientists undertaking aspects of ozone depletion. One of these parties comprised four personnel working the Department of Atmospheric Science at the University of Wyoming and who continued their programme of balloon-borne measurements of the ozone, polar stratospheric cloud particles, and condensation nuclei above M c M u r d o Station. The second party, also of three, but led by Dr Robert L. DeZafra, from the Physics Department at the State

University of New York based at Stony Brook, has been making millimeter-wavelength radio measurements of stratospheric gases (ozone, nitrous oxide and chlorine monoxide) to provide ground truth for similar spectrometer measurements made by the Upper Atmospheric Research Satellite launched by the National Aeronautics and Space Administration during the late summer of 1991. The data are being supplemented by the spectrometer installed last summer for the year at Amundsen-Scott South Pole Station. It is recording abundances and cycles of atmospheric trace gases-measurements that are important to the scientific understanding of the annual "ozone hole". by measuring chlorine monoxide, ozone and ni-

trous oxide. Chlorine monoxide is a unique product resulting from the destruction of ozone by chlorine and nitrous oxide is valuable as a tracer of the dynamics of the atmosphere. Overall measurements of the gases will be useful for determining the degree of stratospheric subsidence during the polar winter and are also important to understanding how man-made chemicals, such as chlorofluorocarbons, can cause global change. A member of this party will repoly at South Pole for the winter of 1994 to continue these observations.

Scientists and other support personnel deploying at Winfly to McMurdo were involved in early season preparations for other projects.

Scientists working in the McMurdo Sound area.....

Dr J. Ward Testa, and Lorrie D. Rea from the Institute of Marine Science at the University of Alaska-Fairbanks, will lead a team of eight scientists who are attempting to elucidate aspects of the physiology, behaviour and survival of **Weddell seals** during their first year of life.

In a three part project they will use satellite telemetry, to record physical and physiological changes related to the amount of maternal care, weaning and development of diving abilities. They will also track the development of diving behaviour and dispersal of pups. The data will be used to compare diving and movements by one or two year old juveniles. In a related project they will examine the maternal, physical, physiological and behavioural factors that affect the movements of pups during their first year and possibly condition them for survival. As part of a long term study of population dynamics they will continue to measure the population

size, survival rates and productivity of Weddell seals in McMurdo Sound. These data will provide a context for interpreting yearly variations in the condition or behaviour of juveniles. The team will work in the Hutton Cliffs area and at the Laboratory at McMurdo Station but are likely to use helicopter and fixed wing aircraft support to deploy and recover radio transmitter packs affixed to seals and for their survey work.

The annual sea-ice near Strand Moraine will serve as the primary research location for a party of six researchers studying the Weddell seal. The team leader is Dr Warren M. Zapol from the Department of Anesthesia at the Harvard Medical School in Boston. The seals are of particular interest as they have important adaptations that enable them to dive to depths as great as 500 meters for more than one hour. To concentrate on mechanisms of gas transport in free-diving seals the team will

use non invasive ultrasonography to evaluate the oxygen-storage capacity of the spleen and continuous laser spectrophotometry to study how oxymyoglobin stores oxygen in their skeletal muscles during free diving. They will also examine how oxyhaemoglobin is diverted to the heart and brain rather than to peripheral circulation. The metabolic demands will be estimated using a velocity meter. In parallel studies, the heart rate of fetal seals will be monitored to examine how it is altered during the mother's diving so that they can tolerate long periods of limited oxygen.

Further work on **freezing avoidance in Antarctic fishes** will be undertaken by Dr Art DeVries and a team from the Physiology Department of the University of Illinois. During the summer they will examine the physiology and mechanistic processes involved in freezing tolerance to better understand how antifreeze's evolved. They will focus on the synthesis of antifreezes and the factors that control this, the secretion, fluid tissue transport and conservation. In addition to helping scientists gain a better understanding of how creatures adapt to extreme environments this project will also provide data that may have implications for human pathologies, nucleation theory and crystallography. The work will be undertaken from mobile fish huts to be placed on the annual sea ice up to 15 miles from McMurdo Sound between October and December.

A study of **chemical ecology of shallow-water Antarctic marine invertebrates** in McMurdo Sound will be undertaken by Drs William J. Baker and James B. McClintock from the Florida Institute of Technology and University of Alabama at Birmingham and a team of five scientists. Researchers have documented that biological chemicals do have a moderate influence on ecological relationships in polar communities contradicting the theory that suggests that

as latitude increases the number of marine organisms using chemical defences decreases. Extending the scope of earlier study they will investigate the chemical nature of defensive agents, by isolating and characterising biologically active chemicals from invertebrates that previously were found to use chemical defence mechanisms. With this data they will be able to evaluate the roles that such chemicals play as feeding deterrents, antifouling agents or overgrowth inhibitory chemicals; and determine biological origin of the excretions or metabolites as they are called, and examine the storage of defensive agents in specific tissues or mucus. The research will enhance understanding of the significance of defence metabolites in the ecology of antarctic marine benthos. The team, which will operate from three mobile dive huts within a ten mile radius of McMurdo station and spend a short time at a temporary camp to be established in New Harbour will use SCUBA to collect specimens.

Also diving in McMurdo Sound this season is a group undertaking a project for which Dr John S. Oliver from Moss Landing Marine Laboratories is the Principal Investigator. One member deployed at Winfly to establish research locations and to collect baseline data. The rest of the party will be continuing **benthic monitoring**. Primary research sites, involving the drilling of some 40 holes through the sea ice for sampling, include Winter Quarters Bay and McMurdo Station land/sea transition areas. Day trips to locations near Cape Royds and Marble Point have also been proposed.

Some types of **foraminiferan protozoa** produce shells composed to mineral grains tightly bound by a chemically resistant, biological cement. During shell development these single-celled animals collect mineral grains from the sediment and secrete them as cement in the proper amount and location to sculpt

architecturally elegant structures. The high abundance of certain giant species at a site in McMurdo Sound makes the foraminiferan community uniquely suitable for the study of specific aspects of their shell construction and related questions concerning their evolution.

Focussing on a giant one-celled species allows the study of the creation of cement in a cold-adapted marine organisms without the complications of cell-to-cell and cell-to-tissue interactions common to multicellular animals. Using time-lapse video microscopy, light and electron microscopic cell chemistry, and gel electrophoresis will provide information on this kind of test construction at the cellular and biochemical levels of analysis. Materials testing, combined with structural modelling will enable the team to characterise the mechanical properties of the cement. From a practical standpoint, this environmentally safe cement binds immunoglobulins and has useful material properties that may have applied biotechnological or biomedical applications. Molecular genetic analyses of selected species will provide a much-needed framework for determining the evolution of this important protozoan group. This highly interdisciplinary project is made possible by new advances in biotechnology and has both basic and applied implications for fields such as medicine, molecular pharmacology, protozoan development and evolution, palaeontology, engineering and marine products chemistry. Dr Samuel S. Bowser from the Wadsworth Center for Laboratories and Research in Albany and his team of five will use the semi-permanent camp at Explorer's Cove in New Harbour from mid-October to mid-December and use SCUBA to collect samples many of which will be analysed in the Crary Laboratory facilities.

Dr Donal T. Manahan and two colleagues from the Department of Biological Sciences at the University of Southern California is offering a four-

week course based at the Crary Science Engineering Center but undertaking field work in McMurdo Sound for eight to ten students from major international research institutions. The course comprises three modules: cold adaptation, energy metabolism and molecular genetics of antarctic organisms. Its themes are temperature adaptations in fish, energy metabolism during larval development of marine invertebrates, osmo-regulation and the molecular genetics of algae. A fourth module will consist of student projects. Course members will be graduate students, post doctoral fellows or other scientists looking for an introduction to antarctic biology prior to undertaking research of their own or investigators seeking to develop new approaches and techniques. Field collections and laboratory experiments together will lectures from the course faculty and guest speakers will make up the programme. Both VXE-6 and USGC helicopters will be used for the field work. The party will be in Antarctica from early January to early February.

A field team of four led by Dr Ross Powell from the Department of Geology at Northern Illinois University, will be working on the sea ice in the Granite Harbour, Cape Mackay and the Blue Glacier area. Their objective is to evaluate the **processes occurring at the grounding line of polar glaciers** in order to develop constraints for both glaciological and oceanographic models. A remotely operated submersible vehicle (ROV) will be used to help obtain data. The physical processes involved in the release of debris from the glacier and its dispersal in the ice proximal marine environment will be examined. Sedimentary processes, surface sedimentary facies, and biological communities will also be studied and the information used to improve interpretation of older glacial sedimentary facies.

Dr Gerald L. Kooyman and four researchers from the University of Cali-

fornia at San Diego, Scripps Institution of Oceanography, the Center for Marine Biotechnology and Physical Research Laboratory at La Jolla in California have selected **emperor penguins** as natural indicators of environmental change. During visits to the three main colonies in the Ross Sea area at Coulman Island, Cape Roget and Cape Washington they will compare foraging and distribution patterns, study hunting tactics, compare food habits and predation pressure and determine if the birds have traditional foraging areas and depths, study predator avoidance and determine chick and egg losses. Also of interest is why some colonies are larger than others and why those with more than 20 chicks are within 150 km of each other in the Ross Sea. These penguins inhabit one of the richest marine environments surrounding Antarctica and appear to be affected by even minor

changes. If the variables affecting them can be determined, scientists will have an early warning system of changes in the marine environment.

A newly designed instrument able to take quantitative measurements of **snow accumulation, mixing and erosion** will be installed at a site near Williams Field in mid-January. Dr David A. Braaten from the Department of Physics and Astronomy at the University of Kansas is the principal investigator. The instrument disperses inert time markers at the snow surface at intervals of time that allow a quantitative measure of snow accumulation and its spatial uniformity. The project has important applications to the interpretation of paleoclimatic records from snow pits and ice cores. A second instrument may be deployed close to the Automatic Weather Station at Minna Bluff.

Dry Valley Programmes

The Dry Valley deserts are among the most extreme in the world. They are subject to low temperatures, very limited precipitation and salt accumulation. The two distinct seasonal cycles, their closed ecosystems and their natural quietness make them ideal for a range of diverse research projects.

The biological systems in the valleys are relatively simple, with no vascular plants or vertebrates and very few insects. Trophic interactions and biogeochemical nutrient cycles are largely limited to microbial populations and micro-invertebrates. Species diversity and abundance are low. However complex interactions among species and between the biological and physiochemical environments exist in the lakes, streams and soils and such interactions between the components of the ecosystem, enhance the overall productivity.

All ecosystems are shaped to varying degrees by climate and material transport, but nowhere is this more

important than in the Dry Valleys. The obvious effects of an extreme environment coupled with the general simplicity of ecosystem structure makes them an ideal location to study the basic relationships in the ecosystem. As part of the Long Term Ecological Research (LTER) project, this season, Dr's Robert Wharton, Diana W. Freckman, Diane McKnight and John Priscu from the Desert Research Institute at the University of California at Riverside, the U.S. Geological Survey and Montana State University and 12 other associates will be in the **Lake Hoare** area from early October until late January during which time they will also make trips to other lakes and glaciers in the **Taylor Valley**.

The focus of their research are the hypotheses that the structure and function of the dry valley ecosystems are primarily controlled by physical constraints and that they are modified by material transport. Systematic data

collection, long-term experiments, and model development will help them integrate the biological processes within and material transport between the lakes, streams, and terrestrial ecosystems of the dry valley landscape.

Lake Bonney: Working at Lake Bonney from late October through to late January will be Dr John C. Priscu from the Montana State University's Department of Biological Sciences, (also involved with the previous project) and six associates. The lake, which is permanently ice-covered and divided into two lobes by a narrow, shallow channel, presents a special situation in which turbulence and upper trophic levels are virtually nonexistent and microbially mediated processes dominate biogeochemical reactions. Data on the nitrogen dynamics show that phytoplankton are generally nitrogen deficient and that nitrous oxide concentration on the east lobe is the highest recorded in nature. Bulk denitrification does not exist in the east lobe and the natural abundance of nitrogen in the west lobe is the highest ever recorded in an aquatic system. From their earlier research the team have come to believe that both ammonium and oxidised nitrogen are significant regenerated nutrients in the upper trophogenic zone and that nitrous oxide is a product of nitrification and, that, in the west lobe bulk nitrification acts as a sink for nitrous oxide and regulates its accumulation. Microbial generation will be measured, the use of ammonium, nitrite, nitrate and nitrous oxide assessed and the distribution of nitrifying and denitrifying bacteria will be determined. The study is one of the first to examine nitrogen dynamics in a system lacking top-down regulation and should provide important clues regarding global microbial nitrous oxide production and consumption.

Cryoendolithic micro organisms, which colonise the upper few millimeters of limestone rocks in the ice-free re-

gions of Antarctica, live in an extreme environment near the absolute limit of their physiological potential. Consequently even minor changes in the environmental can trigger death of the communities. Although light and melt water from snow penetrate the rocks, the extremely low ambient temperatures appear to limit growth in these communities. Another group of researchers has found that a climatic gradient spans a range of sites in the Dry Valleys of Southern Victoria Land. By using automatic data loggers to monitor the microscale climate inside the rocks, a team of five investigators, led by Dr E. Imre Friedman from the Biological Science Section of Florida State University will quantify the environmental conditions. Computer models based on the measurements will help them identify the exact threshold - between life and extinction - for these organisms. To document how the dead communities degrade and form trace fossils, they will collect living and fossilised samples, and use transmission electron microscopy to analyse them. Because the cryptoendolith microbial ecosystem in the Dry valleys is thought to parallel the last stages of life on early Mars, their investigation will help other researchers to reconstruct the process of extinction of life on Mars and may suggest what form such traces of life might currently take on that planet. The five member party will operate at from six field camps in the **northern Dry Valley** region, locate new research sites. They will be joined by a mountaineer who will help with sample collection and be in the area for a month from late December.

Commuting to the Dry Valleys from McMurdo Station but extending their time at **Lake Hoare** in mid-December and early January Dr Diana W. Freckman from the Department of Nematology at the University of California and five other scientists will continue the extensive ecological investiga-

tion of nematodes in the dry valley ecosystems of Antarctica.

During the summers of 1990 and 1991, nematodes were found over a wide range of dry valley soil properties. By sampling them in various habitats with different soil formations, and elevations the team hope to further understanding of their abundance and trophic role. It is known that nematodes assume a cryptobiotic state in which their metabolism becomes undetectable and physiological and morphological changes occur. Studies of cryptobiosis will determine their potential duration of activity and field experiments will be conducted to examine their response to levels of temperature, moisture and energy in the soil. Molecular biology techniques will also be used to establish the genetic diversity.

The six months of light and six months of dark with ice cover in Antarctica simplify the seasonal cycle for scientists and make the lakes of the Dry valleys uniquely suitable for studying the internal production and degradation of organic material. During the summer, sufficient light penetrates the ice cover to support algal and bacterial photosynthesis. This sustains a microflora population similar to temperate lakes without plant nutrients but with plentiful amounts of oxygen. Working at **Lake Fryxell** in the Taylor Valley, from mid October until the third week in December, Dr Brian Howes from the Woods Hole Oceanographic Institution and a team of six other scientists will be collecting data which will enable them to develop an ecosystem understanding of the rates and pathways of carbon, nitrogen, sulfur and water cycling. This information will be used to produce a model of the lake's carbon cycling for comparison with similar ecosystems. Specifically they will determine the relative importance of the physical versus biological processes in controlling the composition and distribution of bioactive and nonbioactive

gases in the Dry Valley Lakes. Understanding the processes controlling elemental cycling should enhance their knowledge of other aquatic systems.

Working at **Lake Hoare** in the **Taylor Valley** and on the **sea ice of McMurdo Sound**, a team of five led by Dr Carol Stoker from the Ames Research Center at the National Aeronautics and Space Administration in California will demonstrate the potential uses of a basic telepresence system - TROV - a system that can see but not move. It will be attached to a submersible remotely operated vehicle and used to map the biological, chemical and physical characteristics of the ice-covered lake. From the data the team will develop three dimensional profiles of temperature, light, currents, dissolved oxygen and microbial distribution and morphology. The system will also be deployed through the sea ice at McMurdo Sound to collect data and video images which will be transmitted via a telecommunications network to the Ames Research Center in California. The field team members all experts in telecommunications and electronic engineering will coordinate with scientists in order to meet the research objectives.

Geological programmes:

Since the beginnings of igneous petrology, geologists have concluded that magmas with distinctly different compositions can occupy the same magma chamber simultaneously. The close associations of certain igneous rocks (granophyre and plagiogranite) with basalt and the scarcity of rocks of intermediate compositions have led petrologists to propose varying processes to explain the phenomenon. Isolated observations made by other investigators suggest that possibly the inward spreading, partially crystalline meshwork or solidification front along the roof of sheet-like basaltic intrusions

thicken to the point of gravitational instability and begin to tear internally. Gashes and lenses open, and nearby late stage intervening melt is forced in to fill the potential void. The process is called solidification front instability (SFI). This season three members of the Department of Earth and Planetary Sciences at John Hopkins University led by Dr Bruce D. Marsh will study the diabase sills of Antarctica which offer some of the best examples of SFI. Their field work will be augmented with experimental and analytical investigation to delineate the physics and chemistry of SFI. Similar complimentary studies are also being undertaken at Stott Mountain, in Oregon and Zor in Pennsylvania. They will be in Antarctica for all of January and select two field sites in the Dry Valleys after a preliminary helicopter reconnaissance. Dr Mark D. Kurz and two colleagues from the Chemistry Department at the Woods Hole Oceanographic Institute will spend about six weeks from early December working at four different remote camps in the **Dry Valleys** measuring cosmic-ray produced nuclides to obtain surface-exposure ages of glacial moraines. Their goal is to use the technique to define the chronology of Antarctic glaciations. One of their priorities however is to obtain new dates for the Late Wisconsin Ross Sea drift. Whenever possible, they will try to measure helium-3, beryllium 10 and aluminium 26, but in younger rocks their measurements will emphasise detecting helium-3.

Seismic stations

The seismic stations at **Mt. Newall** and **Bull Pass** will be replaced by a party of three from the Albuquerque Seismological Laboratory at the U. S Geological Survey. The three-component broadband and short-period vertical instruments are to be placed in shallow bore-holes, and the data telemetered via a relay on Mt Newall to Scott Base as

part of the world-wide accumulation of data by the Global Data Center.

Abrasion studies

Antarctic abrasion is the focus of a long term study being undertaken by Dr Michael C. Malin and an associate from the Malin Space Science Systems in San Diego who are using information about physical and chemical weathering rates to help describe past environmental conditions in the Dry Valleys. They will visit 11 sites through the **Asgard and Olympus Ranges**, the **Taylor, Wright and Victoria Valleys** and the blue ice next to Allan Hills to collect rock samples, which have been exposed for ten years and to document information about site conditions. This accumulation of data will result in ten years of average weathering rates for different standard materials as a function of environmental conditions at each site. The rates will be important for interpreting exposure-age data that are used to estimate the history of ice and snow cover.

Dr David M. Harwood, from the Department of Geology at the University of Nebraska will lead a party of seven researchers to various locations in **Southern Victoria Land** and **Minna Bluff**. Their objective is to map, collect and describe fossiliferous glacial erratics from low-elevation moraines in the area. They will focus on recovering erratics from near-shore depositions of Eocene age that contain a wealth of terrestrial and marine fossils of flora and fauna. Miocene and Pliocene marine deposits are also a key target so that they can increase the palaeontologic and paleobiographic record of the Cenozoic. Most of the party will be in Antarctica for two months from November 20.

Through high-energy nuclear reactions, cosmic rays can produce radioactive forms of certain elements in quartz on exposed bedrock surfaces. Using

accelerator mass spectrometry, researchers can determine the concentrations of these radioactive species. Such information can provide valuable data on exposure times and rates of erosion for exposed bedrock surfaces. The method has been used to establish exposure ages ranging from 10,000 to 50,000 years for a variety of surfaces. The oldest times that have been found are in bedrock samples in Antarctica.

Ice sheet mechanisms

Dr George H. Denton from the Quaternary Institute at the University of Maine and a party of seven other investigators will be assessing the mechanisms of antarctic ice sheet and paleoclimatic evolution through the last glacial cycle in this region. The purpose of their research is to test the accepted hypothesis that during the glacial maximum the ice sheet expanded as sea level fell and thinned in the interior of Antarctica due to decreased accumulation and that, as the ice sheet receded the sea level rose and thickened in the interior, producing the current interglacial configuration. Data, however, from recent studies has already challenged this theory and suggests that only minor areal expansion occurred in the Ross embayment region during the last glacial maximum. At carefully selected sites the party will examine in detail the glacial geology and isotope chronology. By integrating this record with glaciochemistry data from the **McMurdo Dome** core, they will be able to produce the first isotopically dated paleoclimatic curve for this region of Antarctica. Such information will allow them to disentangle important paleoclimatic forcings of ice-sheet evolution, evaluate hypotheses of ice-age climate dynamics that require rapid, synchronous global change and test the sensitivity of the west antarctic ice sheet to climate change. They will establish ten different remote camps in

the **Dry Valleys** during their stay in Antarctica extending from mid-October to late January.

From mid-November, a two person field team from the Geophysics Department at the University of Washington led by Gary D. Clow will log temperature profiles in several existing holes in the **Taylor** and **Wright Valleys** before joining the rest of their team at **McMurdo Dome**.

Dr Edward Waddington is the principal investigator of the party whose purpose is gather to data which will provide a direct thermal measurement of any climate warming in the Ross Sea sector of Antarctica. When combined with existing climate records and indicators, the data should provide information about past relationships in the region among such climate factors as cloudiness, air temperature and wind patterns. Paleotemperature will be derived by applying formal inverse methods to the data to be collected in a transect from the **Taylor Dome**, through the **Dry Valleys** to the Ross Sea. The oxygen-isotope proxy record from the Dome ice core will be compared with the true thermal record in order to calibrate the data. Vertical strain rates will be measured in an existing 130 meter dry hole to allow correction for firn compaction and ice advection.

The **McMurdo Dome** Field Camp lies at 77deg47minS/158deg49minE. This season it will be supporting 19 investigators, including ten drillers from the Polar Ice Coring Office (PICO). Planned activities include installing a deep coring drill rig and drilling approximately 600 metres of ice core to derive paleoclimate information from the records. Ice dynamic observations will also be made on the Dome and on the Taylor Glacier and temperatures will be recorded. The field camp is also being used as the initial staging area for a seismic traverse from the Transantarctic Mountains to the Wilkes subglacial basin.

Long duration balloon program

Between 7 December 1993 and approximately 5 January 1994 two 81,000 cubic meter high altitude helium research balloons will be launched to obtain data for cosmic ray experiments. Operational support for the launch of both balloons will be provided by the National Scientific Balloon Facility (NSBF,) part of the Physical Science Laboratory of New Mexico State University of the National Aeronautics and Space Administration - Wallops Flight Facility/Long Duration Balloon Program (NASA/LBD) and the flights are being undertaken for the Japanese-American Cosmic-Ray Emulsion-Chamber Experiment (JACEE). Working in collaboration, the University of Washington will fly one scientific payload per balloon.

As each balloon completes one circumnavigation of the antarctic continent, the mission will be terminated by radio from an LC-130 aircraft and the payload recovered if possible. Based on past missions, it is anticipated that each balloon will circumnavigate Antarctica in a period of 7-10 days at approximately 78 degrees latitude and at an altitude of 38+ km (3.5MB).

The Japanese-American Cosmic-Ray Emulsion Chamber Experiment is a collaborative group known as JACEE which includes some 35 senior scientists working at 11 institutions in the United States, Japan and Poland. JACEE field team members will deploy in late November to integrate the scientific instrument payloads at Williams Field. The payloads will consist mainly of emulsion chamber boxes. Their goals are to measure the cosmic-ray energy spectrum and composition in the ultra-high energy range (approaching 1,015 electron volts) and to study nuclear interactions at these energies, which are beyond the capabilities of any accelerator. Analyses of the data will be conducted by the JACEE

group which is expected to launch 20 such balloon flights over the next ten years.

Environmental protocol

The Antarctic Environmental Protocol will have a major impact on USAP activities. NSF has requested US\$6 million for related safety, environmental, and health activities this season. Cleanup at McMurdo will continue, as it has since the closing of the Fortress Rock dumpsite in 1991. A cradle-to-grave life cycle waste management programme is under study for McMurdo Station. NSF is reviewing possible remediation of the shore around Winter Quarters Bay, as well as the seabed in front of McMurdo Station. The incinerator has been shut down and food waste will be retrograded. The support contractor is developing a comprehensive plan for management and disposal of all hazardous and non hazardous waste (including low-level radioactive waste) produced at all US facilities in Antarctica. The U.S. Navy will continue to be responsible for the transport of waste out of Antarctica.

Oak Ridge National Laboratory (ORNL) field-team members will make four trips to McMurdo Station at different times during the season to assess environmental impacts of the United States Antarctic Program activities. Visits will be made to the South Pole Station and most of the larger field camps and extended facilities in the McMurdo vicinity (e.g. Pegasus, Black Island and Williams Field) for similar assessments. In addition, field team members will visit Palmer Station twice to assess environmental impacts and to gather further information for the preparation of documents on the Peninsula System operations and activities. J.T. Ensminger from the ORNL is the principal investigator and field leader of four person team.

The NSF is working with the U.S.

Congress to strengthen the U.S. Antarctic Conservation Act (ACA) by add-

ing regulations regarding waste management and disposal in Antarctica.

Sub-Antarctic

Auckland, Campbell and Snares to be visited this season

The new team of five destined to spend the next 12 months at Campbell Island comprises, for the first time, a married couple*. They are scheduled to travel south in late September aboard the *Geomarine*, a Dunedin based vessel, owned and operated by Mark Hansen, formally operator of the sailing vessel *Tradewind*.

Mike Bourke of Invercargill, and formerly of the New Zealand Meteorological Service, will lead the 1993/94 party on the Island. Wendy Taylor, also formerly of the Service is the Meteorological Officer and her husband Steve Taylor is the mechanic. The couple are from Five Rivers, near Lumsden. The technician is Bill Burman from Auckland. Jim Henderson from Dunedin is the maintenance officer. The outgoing party will return to Dunedin aboard the *Geomarine*.

The party can expect a number of visitors throughout the summer season with four tourist vessels making a total of nine voyages. The vessels are the *Kapitan Khlebninkov*, *Evohe*, *Pacific Ruby* and the *Geomarine*. (As at publication time schedules had not been fully confirmed details will appear in our December or March issues.)

From November 1-11 the New Zealand Navy vessel *HMNZS Tui* will be visiting Campbell and Auckland Islands as part of a joint expedition organised in conjunction with the Navy and the

Department of Conservation in Invercargill.

Lead by Ron Peacock from DOC in Te Anau the party of ten will comprise navy personnel, DOC staff and representatives from the Museum of New Zealand, the Southland Museum and the National Institute of Geological and Nuclear Sciences. Their programme will include maintenance of facilities, some preservation of historic sites particularly at the cemetery of the Hardwick Colony near Port Ross in the Auckland Islands where a boardwalk will be laid. Weed control, aimed particularly at preventing the spread of the *Oleria* tree daisy which is growing over the island's trees, will be undertaken as well as miscellaneous monitoring which will include the regeneration of vegetation on Enderby Island after last summer's rabbit eradication programme. The Southland Museum team will bring back the remains of the World War II coast watching station and gather further information for a new sub-Antarctic display at the Museum. The Museum of New Zealand Staff will undertake research on the falcon on Adams Island where there is a colony of 30 or 40 of the birds. In all five of the days the party are in the sub-Antarctic will be spent at the Auckland Islands and three days at Campbell Island.

From 27 December until 20 January, Nick Gales from the Department of

Conservation Science and Research Section in Wellington will lead a five person team to the Auckland Islands to undertake further research and monitoring of the Hooker's sealion.

Between January 20 and February 20 a five person team led by Andy Cox from DOC in Invercargill will be on Adams Island in the Auckland group to undertake a census of the Wandering Albatross and further work on pig eradication. At the same time a two person team, led by Nick Tor from DOC in Invercargill will n be following up the

rabbit eradication programme undertaken earlier this year. (See *Antarctic* Vol 13. No. 2 page 80). They will also be undertaking further work on pig control.

During March a group, led by Pete McClelland also from DOC will spend five days monitoring and undertaking census work on Bullers Mollymawk on Snares Island. The specific dates for this expedition also have yet to be confirmed.

**Some couples are however known to have married after their return from the island!.*

Growth in membership of the Antarctic Treaty and Scientific Committee on Antarctic Re- search

By R.K. Headland, Scott Polar Research Institute,
Cambridge, U.K.

The two histograms following give indications of annual growth in membership of the Scientific Committee for Antarctic Research and numbers of adherents to the Antarctic Treaty. The Committee (SCAR), a non-governmental scientific organisation which is part of the International Council of Scientific Unions, was established in Den Haag in 1958 by scientific institutes from 12 countries participating in the Antarctic programmes of the International Geophysical Year. Subsequently others were admitted to full membership directly until 1986 when provision for associate membership was made. Original members, other full members, and associate members are distinguished graphically. Presently there are 25 full members and five associate members. There will be no admissions until the next meeting in 1994.

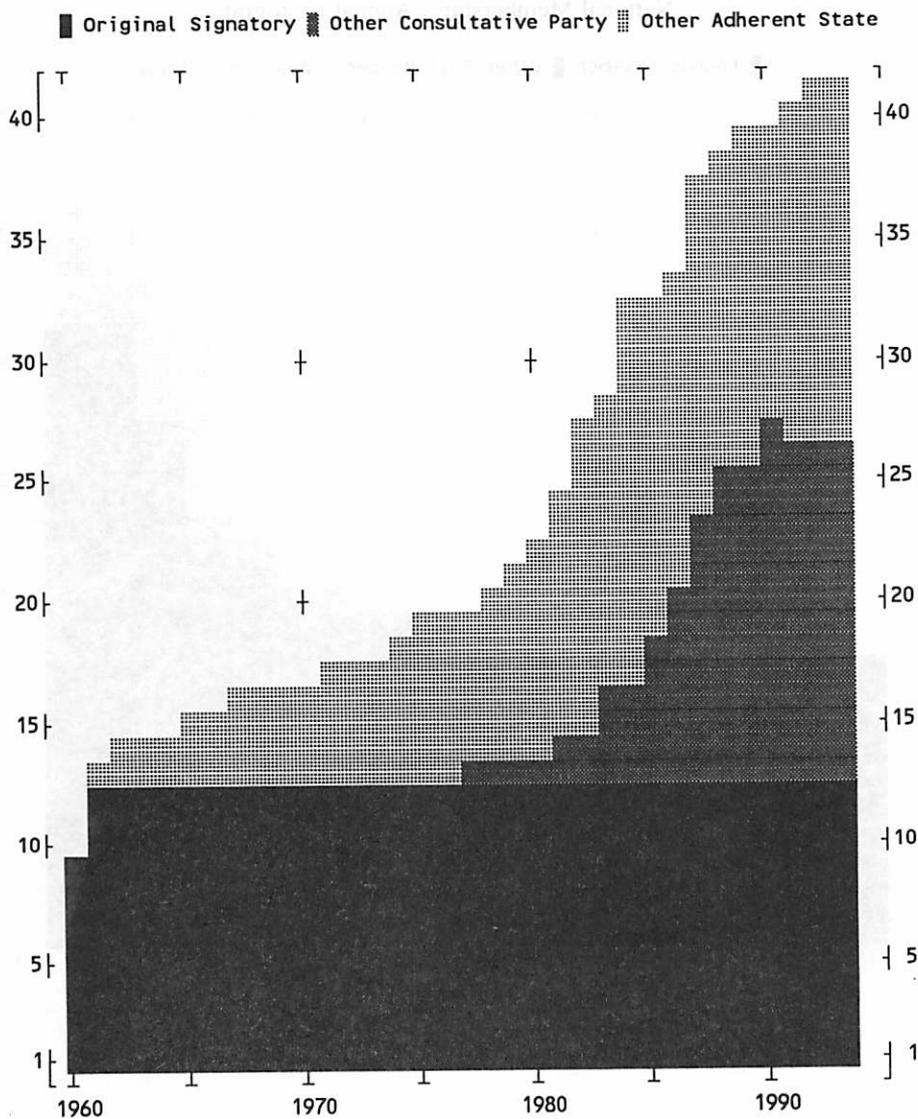
The Treaty, essentially a legal and political instrument, was made in Washington in 1959, by the governments of the same 12 countries which established SCAR. These original signatories completed their ratification requirements during 1960 and 1961. Subsequently 29 other countries have acceded to the Treaty and 14 of these became Consultative Parties following their activities in the Treaty region. Again there are three categories of association, which are indicated graphically. A country may accede to the Treaty at any time - although only two (Estonia and Pakistan) may be expected to do so by 1994. The proportion of the populations of countries adherent to the Treaty is approximately 76 percent of that of the Earth.

The unification of the DDR and BRD in 1990 reduced membership by one in

Scott Polar Research Institute

Antarctic Treaty

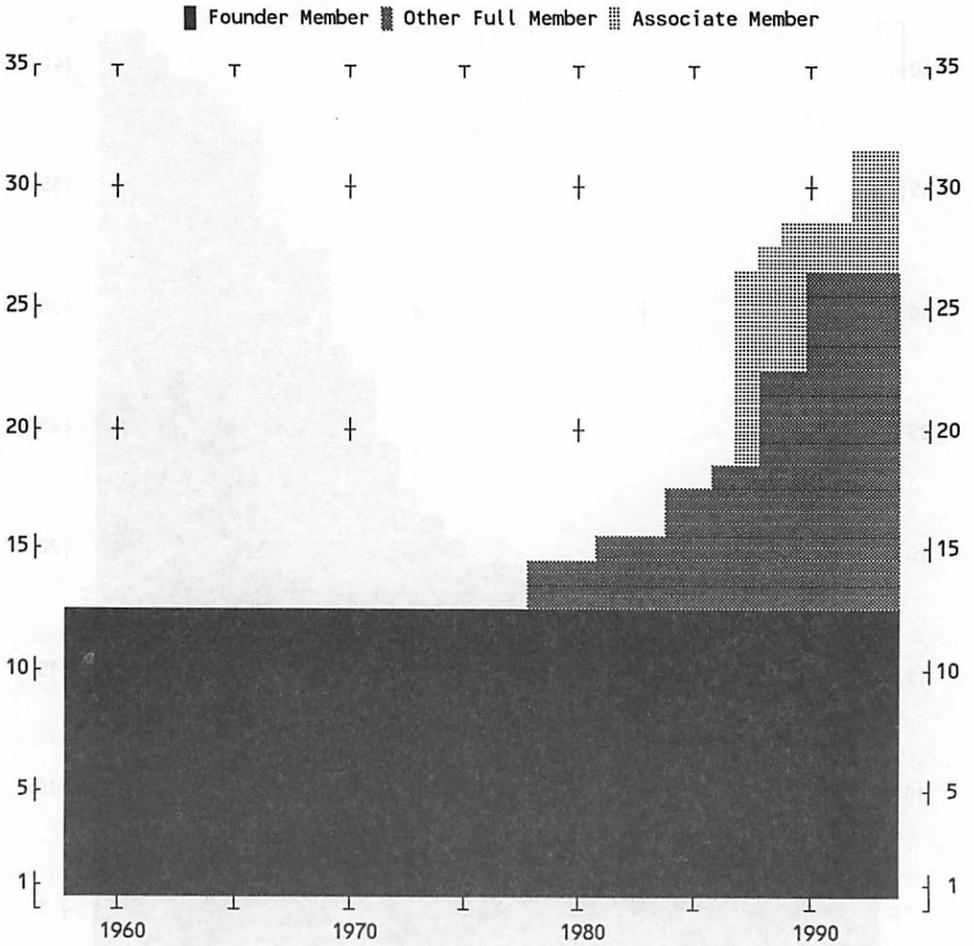
Annual histogram of adherents (from dates of ratification etc)



Scott Polar Research Institute

Scientific Committee on Antarctic Research

National Membership : Annual Histogram



both histograms as both German states had equivalent membership status at that time.

Several trends may be revealed in the histograms; one is the enormous increase in interest in Antarctic affairs indicated between 1980 and 1990. This corresponds to a period where the significance of 1991 became perceived (with a review of the Treaty possible), and to the wide misinterpretation of 1991 necessarily bringing major changes to the Treaty and the governance of Antarctica. This was at a time when concern about Antarctic mineral wealth was strong. Much popularisation of the Antarctic, by several environmental activist groups with powerful propaganda capabilities, also occurred during this period. A subsequent trend, decline of the rate of growth, may represent a lessening of interest following the passing of 1991 and development of the Environmental Protocol. Analogous indications are provided by the histogram of station numbers in the previous edition of *Antarctic* (see Volume 13 No. 2 page 86ff). (A list of Treaty adherents and SCAR members was published in *Antarctic* Vol..... and will be updated in 1994.)

Errata: Page 86 of *Antarctic* Vol. 13 No. 2. We listed Aurora as being beset in the winter of 1908. This should have read 1915.

"Ambassador of Goodwill and Friend of New Zealand"

The Byrd Memorial rededicated

A memorial to Admiral Richard E. Byrd, which has stood on Mt. Victoria in Wellington since 1962, has been substantially refurbished and was rededicated on Monday 21 June, 1993 in an official ceremony beginning at 1.30 p.m. Guests included Mrs Bolling Byrd Clark, daughter of the Admiral, Mrs Ruth Siple, widow of Paul Siple, who accompanied Byrd to the Antarctic on three expeditions and was the first scientific director for American national Antarctic operations, Mr Harold Austen, cabin boy for the 1929-30 Byrd Expedition and Mr John Lenkey III from the Admiral Byrd Monument Restoration Fund.

New Zealand enjoyed a long association with Admiral Byrd. In a booklet entitled "My Second Home" written by Arthur Leigh Hunt and published in Wellington in the 1960's, Byrd's five

expeditions to Antarctica are summarised. On each he travelled via New Zealand. For the first in 1928 to 1930 he arrived in Wellington on 5 November, 1928 aboard a whaling factory-ship *C.A. Larsen* with 14 of his men. The remaining 60 or so came on the two expedition ships *Eleanor Bolling* and *City of New York*, which reached Port Chalmers, the port of Dunedin on November 18 and November 25 respectively. Byrd spent two and a half weeks in Wellington meeting dignitaries and attending a round of receptions, before making his way, via Christchurch, to Dunedin for the expedition in which Little America was founded and Marie Byrd Land, the Rockefeller Mountains and the Edsel Ford Range were discovered. Flying the Ford Tri-motor, Floyd Bennett, he became the first man to reach the South

Pole by air. The expedition returned via Dunedin, Byrd remained in the country addressing audiences in Christchurch, Wellington and Auckland for some weeks after the expedition's ships left for America.

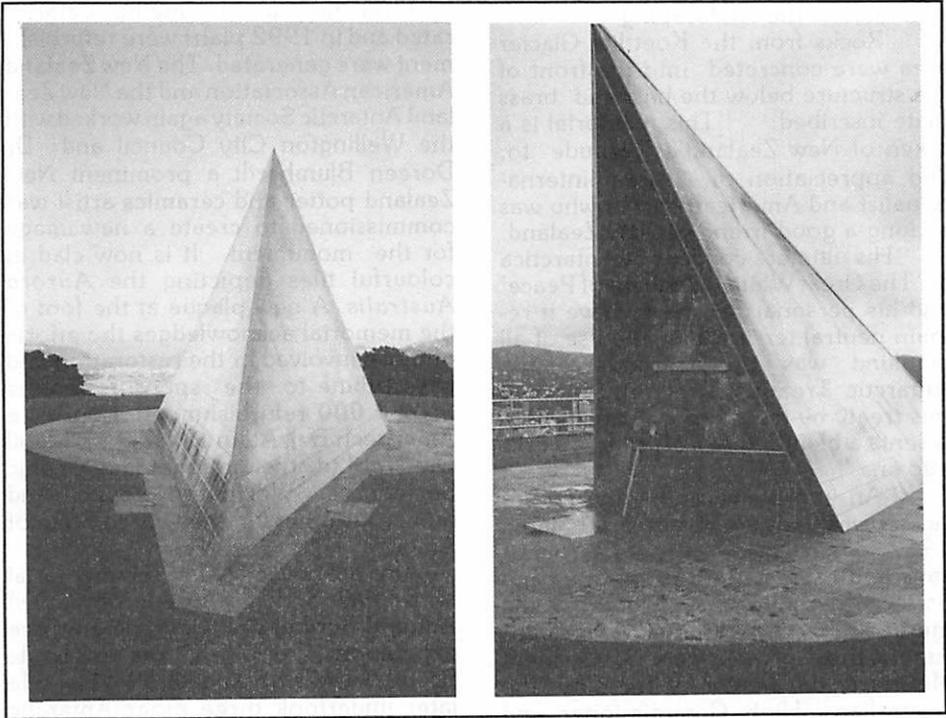
For the second expedition, from 1933-35, Byrd arrived in Wellington aboard the *Jacob Ruppert* and made the city his base with the two other expedition ships *Bear of Oakland* and *Jacob Ruppert* arriving a month later on their way south. After a further round of receptions and resupply of the vessel Byrd left for Antarctica on December 12. The visit had created considerable interest among the people of Wellington. This expedition continued to make significant geographical discoveries and scientific contributions and Byrd established the Bolling Advance Weather Station some 700 miles from the South Pole and spent five months there making scientific observations. The expedition returned to New Zealand via Dunedin and Byrd unwell from carbon monoxide poisoning experienced during his winter alone at the remote station, renewed his New Zealand contacts with less public fanfare.

The third expedition was organised by the United States Government. Byrd was appointed Commanding Officer in 1939-41 and arrived in Wellington aboard the *North Star* on December 27. Public interest in this expedition was not as great as the earlier two but crowds still visited the ship and the huge 55 feet long Snow Cruiser with which the expedition hoped to make long fast journeys across the Polar ice cap, (but which actually remained at Little America III) attracted considerable attention. Two bases were established during this first government expedition in 100 years, one in the Little America area and the other on the Antarctic Peninsula. While Byrd did not winter over Paul Siple was in charge of Little America III during the winter.

"Operation Highjump" 1946-47 was

the largest exploring expedition undertaken at that time and involved 13 US Navy ships and 4,000 men. Byrd was again officer in charge of the operation but not of the fleet. A major objective of this expedition was the training of large numbers of men and testing of many types of equipment in polar conditions. The fleet left for Antarctic waters in three groups but only the Central Group operated in waters south of New Zealand. The first national contact with the expedition was a five-day visit to Wellington of the submarine *Sennet* in mid February. Byrd arrived in March aboard the command ship *Mount Olympus* and his welcome extended to a state luncheon in addition to other receptions. Prophetically he forecast an international organisation to share scientific work in Antarctica. It was 11 years before SCAR was initiated in 1958. He also predicated that before very long machines capable of flying the 2,300 miles from New Zealand to possible polar bases would be available. He left Wellington on March 14 and r three days later the Dominion described the visit as "brief but memorable".

The fifth expedition named "Operation Deepfreeze" was undertaken in 1955-56. Byrd had come out of retirement to take charge of the developing United States Antarctic programmes and arrived in Auckland by air on 30 November 1955 accompanied by Paul Siple as Director of Scientific Projects. Sir Edmund Hillary, leader designate of the New Zealand party for the Commonwealth Trans-Antarctic Expedition was due to leave for Montevideo to join the British Advance Party. Byrd made contact and was offered American assistance to the New Zealand team. Operation Deepfreeze expedition aircraft and ships began arriving at Lyttelton and Christchurch. In the meantime Byrd and Siple visited Wellington and the use of South Island air facilities and the establishment of an American Base in the Ross Dependency



were discussed at ministerial level. New Zealanders also learned of Byrd's plans to build a base at the South Pole.

In a farewell message, written aboard the icebreaker *Glacier* Byrd said New Zealand seems to me to be the most civilised nation I have ever visited. He referred to the extraordinary kindness and hospitality he and his men had received during their visits in the preceding 27 years....."as far as the United States is concerned in the family of Nations, New Zealanders are brothers.....we need each other, and as the world shrinks with an ever increasing acceleration, bringing far-flung places close together, we will need each other more and more. His return journey to New Zealand was to be his last. On 11 March 1957 he died and was buried in the Arlington National Cemetery.

Arthur Leigh Hunt, a long time a

The Byrd Memorial on Mt. Victoria is Wellington New Zealand. Photos - Robin Ormerod.

sociate in Wellington and foundation member of the New Zealand Antarctic Society, considered an appropriate memorial. It had to be eminent and have a clear vision to the South Pole. Mt. Victoria, a high point in the central city, seemed the ideal location and approaches made to the Wellington City Council were favourable. Bruce Orchiston designed the monument in the shape of an arctic tent opening towards the south and Thomas V. Johnston R.A. was commissioned to create a bronze bust. The establishment of the monument was managed by Tracey Simpson, Chairman of a Committee of 20 Wellington citizens. It was built by Wilkins Davies Construction Limited and the Wellington City Coun-

cil oversaw the landscaping.

Rocks from the Koettlitz Glacier area were concreted into the front of the structure below the bust and brass plate inscribed: "This memorial is a token of New Zealand's gratitude to, and appreciation of, a great internationalist and American citizen who was so long a good friend of New Zealand.

"His ultimate concept of Antarctica as 'The Great White Continent of Peace' and his personal striving to have it remain neutral territory for the use of all mankind was the forerunner of the Antarctic Treaty. The ratification of this treaty by the member nations represents a blending of all his life's works into one."

"An impressive and colourful unveiling ceremony took place on 11 March 1962, when New Zealanders, Americans and representatives of other nations gathered to pay tribute to the memory of the famous American. Among those present were Government Ministers, the Mayor of the City, the Australian High Commissioner and Dean of the Diplomatic Corps, members of the diplomatic service and Naval personnel. The monument was unveiled by the Prime Minister and Co-Patron of the New Zealand-American Association Mr K.J. (later Sir Keith) Holyoake, assisted by the Commander of U.S. Operation Deepfreeze, Rear-Admiral David M. Tyree and the founder of the Byrd Fellowship of the Association in New Zealand, Mr Arthur Leigh Hunt.

During the unveiling, trumpeters of the Royal New Zealand Airforce played the fanfare and on completion Canberra's flew past in salute. A dedication service on behalf of the churches was carried out by the Rev. W.E.D. Davies. Cables of goodwill, received from President Kennedy and former President Eisenhower were read by Tracey Simpson. Flags of the twelve Antarctic Treaty Nations flew around the site of the monument.

Over the years the site has deteriorated and in 1992 plans were refurbished were generated. The New Zealand American Association and the New Zealand Antarctic Society again worked with the Wellington City Council and Dr Doreen Blumhardt a prominent New Zealand potter and ceramics artist was commissioned to create a new image for the monument. It is now clad in colourful tiles depicting the *Aurora Australis*. A new plaque at the foot of the memorial acknowledges the efforts of those involved in the restoration and pays tribute to the sponsors for the \$NZ60,000 refurbishment. They were Ameritech Bell Atlantic (NZ) Ltd, Mobil Oil (NZ) Ltd, the National Geographic Society, the Wellington Council and numerous others in the United State of America.

Also acknowledged at the memorial is Dr Paul Siple, who "accompanied Admiral Byrd to the Antarctic on three expeditions, 1928-30 (as an Eagle Scout), 1933-35 and 1939-41. He later undertook three other Antarctic Expeditions including one which leading the scientific team at the United States South Pole Station in 1956-57. Dr Siple became one of the foremost authorities on the geography of Antarctica, polar logistics and the principles governing the adaptation of humans to life in the cold regions."

Guest speakers at the rededication were the Hon. Fran Wilde, Mayor of Wellington, the Rt. Hon. Don McKinnon, Deputy Prime Minister. Mr Chris Laidlaw, MP for Wellington Central, Mr David Walker, Charge d'Affairs a.i., U.S. Embassy, Dr Cornelius Sullivan from the National Science Foundation and Mr Jeffery Stachera, Eagle Scout from the same troop as Dr Paul Siple in the U.S.A. and the Reverend Ian Bourne, Archdeacon of Wellington who gave the Benediction. At the conclusion of the ceremonies invited guests adjourned to the Civic Chambers in Wellington for an afternoon tea.

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

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