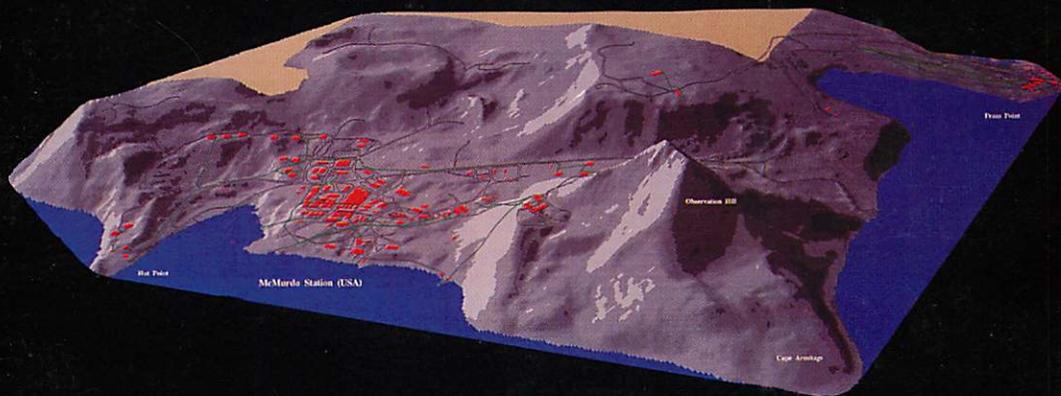


ANTARCTIC



Bulletin Vol. 13 No. 4, December, 1993.



ANTARCTICA

Gough Island (S Africa)

King Edward Point (U.K.)
Bird Island (U.K.)

Orcadas (Argentina)
Signy (U.K.)

Deag von Neumayer (Germany)
SANAE (S Africa)
Novolazarevskaya (Russia)

Syowa (Japan)
Maitri (India)
Aaku (Japan)

General Belgrano II (Argentina)
Coats Land (U.S.A.)

McMurdo (U.S.A.)
Scott Base (N.Z.)

Ellsworth Land (U.S.A.)
Marie Byrd Land (U.S.A.)

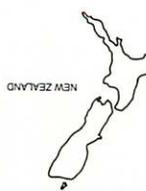
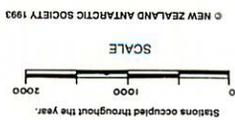
Victoria Land (France)
Wilkes Land (Australia)

Casey (Australia)
Vostok (Russia)

Queen Mary Land (Russia)
Dumont d'Urville (France)

Adelie Land (France)
McKean Island (Australia)

Campbell Island (N.Z.)



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Cover: Detailed DEM for part of Hut Point Peninsula showing building layout for McMurdo Station and Scott Base and roads between them. See ICAIR..

On 2 November 1993, the New Zealand Antarctic Society turned 60. No other organisation in this country has a longer commitment to New Zealand's continued presence on the ice. In this article Bill Hopper, Chairman of the Wellington Branch, traces the origin of the Society.

Society presses for New Zealand presence on ice

“That a society be formed, and that it be called the New Zealand Antarctic Society. Moved: Mr Toogood, seconded Mr Russell. Carried unanimously.”

.... And so New Zealand's first serious Antarctic organisation was founded by a group of Wellingtonians in the boardroom of the Dominion Farmer's Institute on Featherston Street on the evening of Thursday, November 2, 1933.

Present on that early summer's night were scientists, businessmen, educationalists, legal men, seafarers, a meteorologist and even the widow of a polar geologist of the “heroic era” of Antarctic exploration.

This unlikely group had two things in common. They all knew the founder and managing director of the Dominion Farmers' Institute. Arthur Leigh Hunt, and they all possessed a fanatical interest in that last frontier of the explorer's work, Antarctica.

Their first objective was “to group together all persons interested in expeditions, history, oceanography, geology, meteorology and natural history of Antarctica, sub-Antarctic islands and the surrounding seas.

Hunt was the driving force. He was an entrepreneur whose Antarctic interest and imagination was fired by a close personal friendship with Rear Admiral Richard Evelyn Byrd of the United States Navy and his business association with Australian Antarctic explorer, Sir Douglas Mawson.

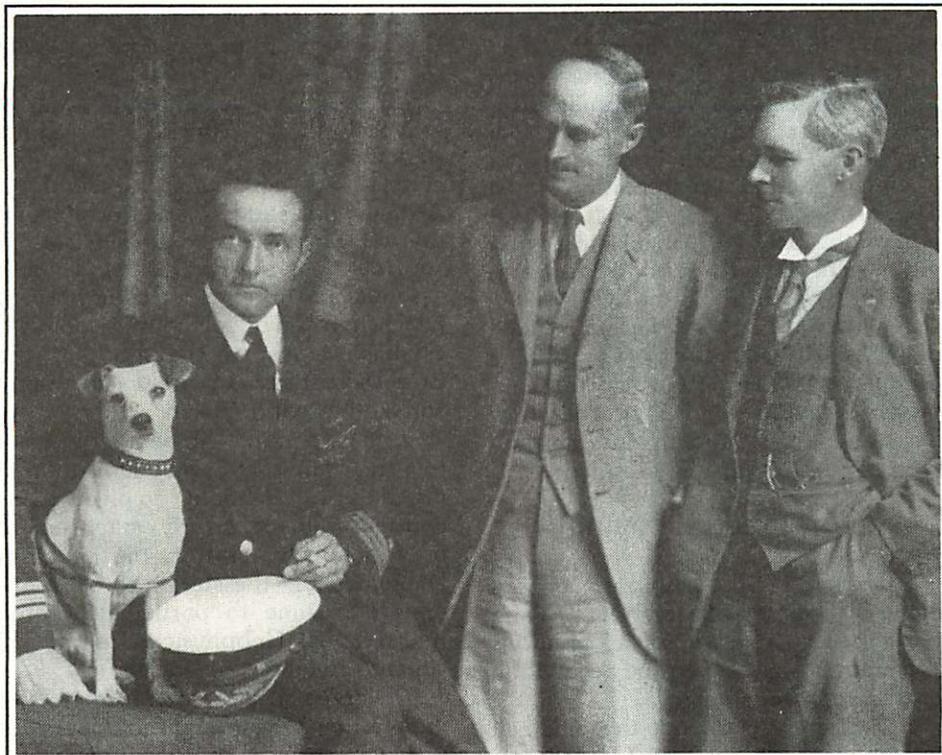
In those early days names associated with the fledgling society included Byrd, Mawson, and Sir Edward Evans

(of Captain Robert Falcon Scott's second expedition) as patrons, a judge of the Supreme Court, Mr Justice (later Sir) Hubert Ostler as president and two young men who were with Mawson on the 1929-31 British Australian New Zealand Antarctic Expedition, ornithologist Robert Falla and meteorologist Ritchie Simmers, as vice-presidents.

The secretary was Charles Collins, a young legal officer employed by the Public Trust Office in Wellington. This band of enthusiastic presided over a 14 member council.

There was Dr W.B. Oliver, director of the Dominion Museum; Dr J. Henderson, director of the Geological Survey; Captain W. Whiteford of the Marine Department and a young teacher of English at Wellington College, Leslie Quartermain.

In the early 1930's, the Society's goals were many and varied. Education by lectures and the printed word, pub-



Early connections: Byrd (with Igloo), Douglas Mawson and A. Leigh Hunt, Wellington 1928. Photo: - S.P. Andrew

licity for the Society and for Antarctic activities in general, the conservation of wild life and even the acquisition by New Zealand of a suitable vessel for polar work.

Hunt's band of visionaries were looked upon as being ahead of their time in lobbying for New Zealand participation in geographic, scientific and ecological exploration and research on the frozen continent.

Interest began to spread and in 1936 Harold Griffiths, an oil company executive, formed a branch in Dunedin. He had met all the big names in contemporary polar exploration and his enthusiasms for the mystique of Antarc-

tica was matched only by that of the Society's founder.

The annual meeting of the Society's council in 1937 was confronted with the question of the preservation of whales in the southern ocean. Hunt predicted the decimation of Antarctic whale herds and presented a motion that was carried unanimously, urging the New Zealand government to seek British help in securing a "complete international agreement to regulate the whaling industry". As always, Hunt's visions were prophetic.

Like many other organisations the New Zealand Antarctic Society hibernated for the long winter of the Second

World War, and was revived in 1949 by founder, Arthur Leigh Hunt.

On the revitalised council new faces abounded. Captain W.W. Stuart, Administrator of the Ross Dependency from the Marine Department, Frank Simpson, a journalist and Lieutenant Colonel Thomas Orde-Lees, a 70 year old veteran of the '1914-17 Shackleton expedition joined the three surviving members of the councils of the 1930's.

They were Les Quartermain, head of English at Wellington College, Ritchie Simmers who had gained a doctorate in meteorology and Dr Robert Falla now Director of the Dominion Museum, who took over the reigns as president.

Continued lobbying

The early 1950's saw continued lobbying of Government for New Zealand participation in Antarctic expeditions and a physical presence and occupation of the Ross Dependency.

But these were not the only self inflicted tasks of the New Zealand Antarctic Society. Council decided it was time to enter the publishing field, and two members, journalist Frank Simpson and Dr John Cumpston, of the Australian High Commission, were given a bold and daunting job: the collation of a book containing the best information available on Antarctic research and exploration.

In November 1952, "*The Antarctic Today - a Mid-Century Survey*" was launched. It was a 350 page treatise laden with topical information supplied by the leading Antarcticans of the day. Internationally acclaimed as an authoritative work, it was translated into Spanish by the Argentineans and also into Russian, with royalties even being paid by the USSR.

All this time the Society continued to be frustrated by Government inaction. In a foreword to "*The Antarctic*

Today", president Falla accused the Government of "negative policy" with regard to the Ross Dependency.

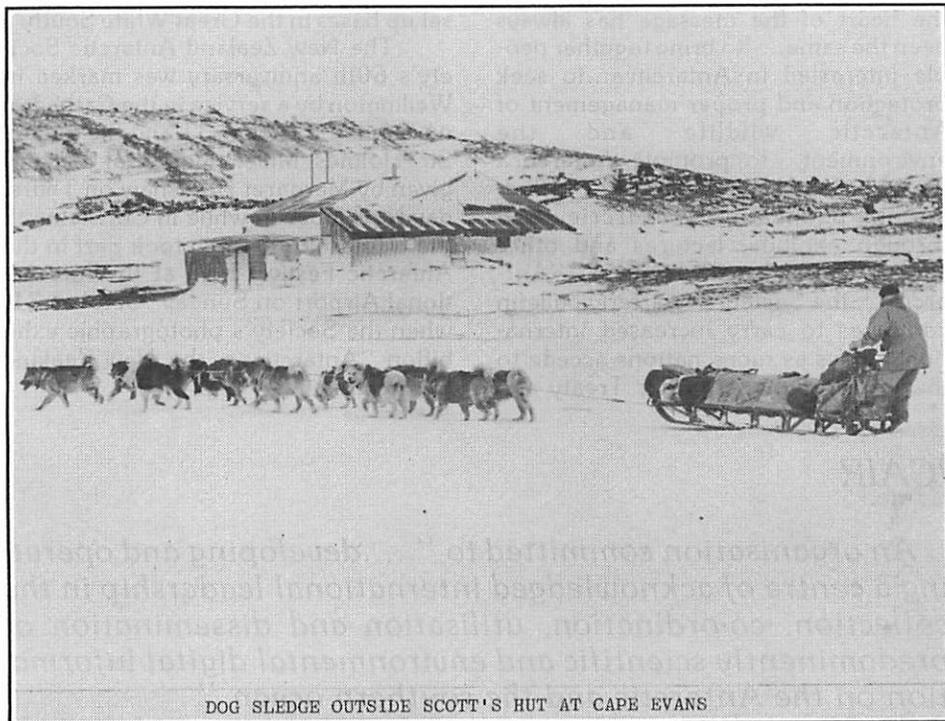
In 1953, a letter to the Minister of External Affairs, Clifton Webb, over the signatures of the president and the Society's new and dynamic secretary, Arthur Helm, stated: "The Society feels that some move to validate our claims to sovereignty in the Ross Dependency is essential and urgent.....The time is very near when New Zealand must, herself, establish a post on the shores of the Ross Dependency or else watch men of some other nation do so."

Still no action. The next letter went to Prime Minister Sidney Holland and urged the Government "to give serious consideration to the early establishment of a scientific station in the Ross Dependency....the station to be in operation in time to participate in the International Geophysical Year (IGY) which is to take place in 1957."

Eventually, after more letters and deputations Government announced it would contribute 50,000 pounds towards the cost of a proposed Trans-Antarctic Expedition and would set up a committee to organise a New Zealand base in the Ross Dependency to support the crossing party. And so the Ross Sea Committee was formed with Arthur Helm as secretary and the New Zealand Antarctic Society one of the contributing members.

Branches for Auckland and Christchurch

While all this was going on, a new branch was established in Auckland followed by one in Christchurch and under the editorship of Quartermain, a single-sheet newsletter became a quarterly bulletin carrying not only news of the Society and New Zealand's national endeavours, but also coverage of other



DOG SLEDGE OUTSIDE SCOTT'S HUT AT CAPE EVANS

".....to assist the Antarctic Division in the preservation and maintenance of Scott's hut at Cape Evans....." Photo: K. McBride, DSIR, 1971-72

nations' activities on the ice.

Next came a new publishing project with Dr Trevor Hatherton, leader of New Zealand's IGY party as editor. "Antarctica", a survey of scientific achievement and exploration appeared in 1965 published by Methuen of London with contributions from 17 eminent authorities in four different countries.

In the 1960's the Society took up a new challenge, to assist the Antarctic Division of DSIR in the preservation and maintenance of Scott's huts at Cape Evans and Hut Point and Shackleton's hut at Cape Royds. During the first half of the decade many members worked as unpaid volunteers clearing out the huts and undertaking basic maintenance.

Then in the 1969-70 summer the era of the "hut caretakers" began. Each year two members were selected to go

south to continue on the hut maintenance as part of the Ross Dependency Research Committee (RDRC) programme. The volunteers, unpaid, went south for the love of it with the one criterion being that they had not previously served in an expedition.

Responsibility for the huts was taken over the RDRC Historic Sites Management Committee at the end of 1980 with the New Zealand Antarctic Society being represented by its president. This task has now been vested in the Christchurch-based Antarctic Heritage Trust on the board of which the Society continues to be represented.

"Currently the Society has five branches, four in New Zealand and one overseas", says president Margaret Bradshaw of Christchurch. "Its objectives, have evolved over the years, but

the heart of the message has always been the same....'to bring together people interested in Antarctica...to seek protection and proper management of Antarctic wildlife and the environment....to promote Antarctica through the Society's activities including its publication *Antarctic*, and through exhibits, lectures and other activities as well as the media. "*Antarctic*", the Society's quarterly bulletin continues to carry increased international news as more nations accede to the terms of the Antarctic Treaty and

set up bases in the Great White South."

The New Zealand Antarctic Society's 60th anniversary was marked in Wellington by a service in the Cathedral on Sunday, October 31 and the annual Sir Holmes Miller Memorial Lecture given by Margaret Bradshaw on Thursday November 4, while in Christchurch the Canterbury branch took part in the Antarctic Festival held at the International Airport on Sunday October 31, when the Society's photographic exhibition "*Antarctica - the New Zealand Connection*" was displayed.

ICAIR

An organisation committed to ".....developing and operating a centre of acknowledged international leadership in the collection, co-ordination, utilisation and dissemination of predominantly scientific and environmental digital information on the Antarctic and the southern ocean."

Using information to further understanding of the Antarctic

Developed in response to a need for an Antarctic data and information system, ICAIR, the International Centre for Antarctic Information and Research, was established at the International Antarctic Centre in Christchurch in 1992. A joint initiative between New Zealand, the USA and Italy ICAIR operates under the umbrella of the Royal Society of New Zealand and is therefore politically independent. ICAIR is managed by a board of trustees comprising representatives from the participating nations. While ICAIR provides a confidential service it encourages the shar-

ing of its information in the true spirit of Antarctic scientific co-operation.

Writing for the July 1993 issue of *GIS Europe* Director, Dr Steven M. Smith described the aim of ICAIR as being to develop a centre of international leadership in the collection, coordination, use and dissemination of predominantly scientific and environmental digital information on Antarctica and the Southern Ocean. Mechanisms to achieve this will entail increasing the accessibility of environmental data to scientists and transforming scientific data and knowledge on Antarctica into forms

more easily understood and applied by decision makers and the general public.

ICAIR, he writes "employs the latest computer technology in its use and development of meta-databases., GIS and satellite data.

"Current hardware consists of a network of three Sun SPARC station2s with a 1.9 Gb of storage running ARC/INFO, Arcview and ERDAS Imagine, and three 486/50 PCs running ArcView, word processors and spreadsheets. All computers are backed up to a 5 Gb mass-storage device with two tape back-up units. Data can be input from a variety of media including CD-ROM, floppy disk, tape, colour scanners and directly from AO digitising tablets. The network runs on Ethernet, using a Frame-Relay connection to Internet. This set-up makes it easy to move data between workstations and when complete many of the data-bases will be accessible via Internet."

The organisation is offering consultancy services ranging from environmental impact assessment and reporting, design, development and implementation of management plans under the Madrid Protocol, database development and customisation as well as training for New Zealand and overseas researchers in fields such as GIS (data input, analysis and data output), satellite and other photographic image analysis.

Work currently being undertaken by the organisation includes:

> The development of a New Zealand Antarctic Science Directory, which is being based on the NASA Master Directory and a logistics and infrastructure database to support the activities of the New Zealand, US and Italian Antarctic Programmes.

> A comprehensive GIS data base for the Ross Sea region. The Environmental Protocol highlighted the need for

improved scientific and geographical information to undertake environmental management in Antarctica. Environmental Impact Assessment, conservation of flora and fauna, waste disposal and management, prevention of marine pollution, the protection and management of special areas and tourism are embraced in the document (see *Antarctic Vol 13 No. 2 pp.....*) ICAIR quickly recognised the need to integrate data to assist this process and is now developing a comprehensive environmental GIS data base for the Ross Sea region. Key data held in the database will underpin the implementation of the Protocol.

> Digital data bases are being compiled at scales ranging from 1:10,000 to 1:250,000 from existing maps of the Ross Sea area. Imagery from satellites and aerial photography is being used to supplement and enhance vector maps. Using their advanced technology scores of features can be entered. They include contours, spot heights, derived digital elevation models, ice free areas, lakes, bathymetry, geomorphology, geology and glaciology. Other features such as protected areas, historic sites and facilities



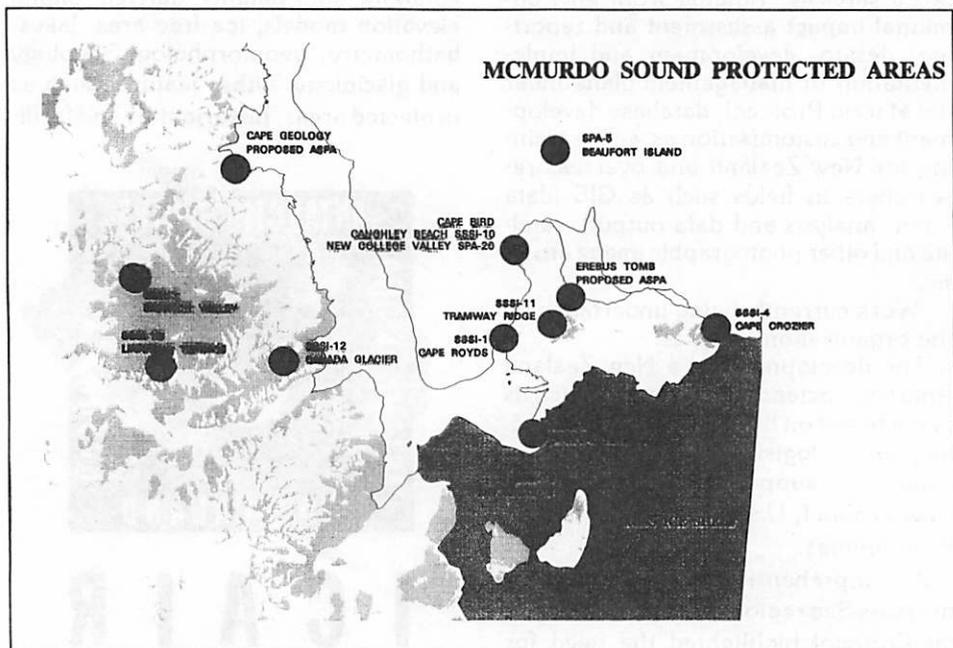
I C A I R

ties information are also being included. In addition, environmental-impact evaluations being generated by the three programmes housed at the IAC are added as detailed windows in the regional schema.

A primary role of the Ross Sea environmental database will be to support scientific activities. Data are being collected in many basic scientific studies in Antarctica and much of this information is being made available to ICAIR. This development will provide a reliable record for determining the cases and possible significance of the changes in the Antarctic environment and ecosystems. A comprehensive data directory for the Ross Sea region will enable users to determine what data are available and make it more accessible.

> One of ICAIR's major projects this season is to commence a review of management plans of protected areas (Sites of Special Scientific Interest (SSSI)

and Specially Protected Areas (SPAs) in the McMurdo Sound Region which is undertaken in close cooperation with the US National Science Foundation Office of Polar Programs and the New Zealand Antarctic Program and both the US and New Zealand SCAR National Committees. The review is being managed by Dr Colin Harris, who has recently completed a PhD in Environmental Management using GIS at the Scott Polar Research Institute in Cambridge and joined ICAIR in October. Dr's Harris and Smith flew south in early December to visit the 15 protected areas in the Ross Sea region. This number is made up of five SPA's and ten SSSI's. The majority of the sites are on Ross Island or in the Dry Valleys of Victoria Land. Two further areas are currently proposed to ASPA status: Cape Geology at Granite Harbour in Victoria Land and the Tomb at the site of the Air New Zealand DC10



which crashed on the lower slopes of Mt. Erebus in 1979 killing all crew and passengers.

The programme needs to be undertaken so that the plans meet the requirements of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.

International links

Managers of all Antarctic programmes need scientific information on the status and trends within ecosystems and on the risks and possible impacts that activities could cause. A joint NZ-US initiative to develop a management plan for Ross Island will become an integral part of the GIS environmental Database for the region. The area has significant wildlife, botanic, historic and tourist resources and a co-ordinated approach to the management will ensure that these can be conserved and that the value of and effectiveness of scientific programmes will be enhanced. GIS will play a pivotal role in integrating and synthesising the necessary information.

During the COMNAP meeting in Christchurch in June (see *Antarctic* Vol. 13 No. 2 pages 42-43) ICAIR held an open house to inform delegates of its capabilities, to demonstrate the GIS system and Image Analysis software as well as to discuss current projects and future collaboration between countries on information collection and dissemination.

In collaboration with the COMNAP Tourism subgroup ICAIR is developing an Antarctic Tourism database which will be accessible via INTERNET. An operational system is being developed for demonstration at the next Antarctic Treaty meeting scheduled to be held at Kyoto in May 1994.

Since June both Chile and India have expressed interest in collaborative

efforts. The Chileans are establishing a small information centre (CEDANTAR) at the University of Magallanes in Punta Arenas and, as a result of discussions in New Zealand with the President of Chile in October, (see *Antarctic* Vol 13 No. 3 page..). Personnel may be trained at ICAIR in GIS and remote sensing. The Indians are establishing an Antarctic Study Centre (ASC) at Goa and discussions regarding the dissemination of data and information are underway between the two organisations.

> Further collaborative effort is likely to involve ICAIR in supply of Antarctic data to the UNEP System. Under the UNEP-GRID (the United National Environment Programme, - Global Resource Information Database), network GRID-Arundel in Norway is responsible for the supply of data on the Arctic and Antarctic to the UN. The issue is being discussed between the Ministry of Foreign Affairs and UNEP and a decision is expected in 1994.

Satellite data

> During the year ICAIR has hosted two Ph.D. students from the US (University of Pennsylvania and Harvard). Supported by the US National Science Foundation, their deployment at ICAIR their deployment was for three months to work on Russian satellite imagery. The KFA-1000 satellite has recently been declassified and data from it is now commercially available from a company in Texas. Each of the black and white (panchromatic) images has a resolution of 4-7 metres and covers an area 50 x 60 square miles. The aim of the project was to assess the imagery as a monitoring tool in the Antarctic as the Russian data is more detailed than any other commercially available satellite data. A stereo pair of cloud free images over the Dry Valleys was selected for the study which is on-going.

> EOSAT (the Earth Observation Satellite Company), recently launched Landsat 6, a new generation of satellite with additional sensors. Unfortunately the satellite was lost. Landsat TM data are multi-spectral and objects can be more clearly differentiated than in panchromatic imagery. The data has a resolution of 30 metres and each full scene covers 185km square. EOSAT, (the Earth Observation Satellite Company for whom Landsat 6 was launched and unfortunately lost) has recently awarded ICAIR a grant of \$US8,200 to establish whether Landsat Thematic Mapper satellite images can be used to assess environmental change in Antarctica. The funds will enable ICAIR to purchase two 100km square scenes

taken in different years over Dry Valleys to assess the suitability of the imagery as a mechanism to detect change.

ICAIR is also developing a range of customised map products for sale at the International Antarctic Centre Library and the Visitor Centre. A separate range of maps are being generated for the educational market, particularly schools.

Although the organisation has been operational since the beginning of 1993 it was only officially launched in Christchurch on 6 October 1993, with a subsequent function in Wellington on Monday November 24 attended by about 100 guests and at which the Governor-General was a key speaker.

NZAP

In brief.....

Cape Roberts update

Scientists and representatives from the British, German, Italian, New Zealand and United States Antarctic Programs met in Washington, DC from September 21-22 to work out details of a major collaborative scientific project to run from 1994 to 1998. (see *Antarctic* Vol 13 No. 2 page 43). The project, which is costed at around \$4 million, will core strata at Cape Roberts, off the coast of Antarctica in order to study the history of changing sea level and climate from 30 to 100 million years ago. The study will test the theory that past sea level changes have been largely due to growth and decay of ice sheets, and also look at the possible connection between the rifting of the Antarctic continent and ice sheet formation.

The programme follows previous scientific drilling in the region by the United States, Japanese and New Zealand Antarctic programmes but will core strata much older than before and require the setting up of a base at Cape Roberts, 125 km north-west of McMurdo Station and Scott Base in the Ross Sea region. The strata will be cored in a series of four holes, each 500 metres deep from a rig set up on the two metre thick sea ice from ten to 20 km offshore. Water depths range from 100 to 5000 metres, which, when combined with sub-zero temperatures, will make the drilling a particularly challenging task.

The project will be managed by the New Zealand Antarctic Programme which will be responsible for coordinating the logistic support and drilling operation, including safety aspects. Overall responsibility however rests with an international Steering Committee (ISC) which is charged with facilitating and planning the scientific work of the project. The committee is made up of representatives of participating coun-

tries and is chaired by Dr Fred Davey from the Institute of Geological and Nuclear Sciences in Wellington. Gillian Wratt, Director of the New Zealand Antarctic programme, chairs the Operation/Logistics Management Group which will oversee the operation of the project and Dr Peter Barrett, Director of the Antarctic Research Centre at Victoria University also in Wellington, is the science co-ordinator. A Comprehensive Environmental Evaluation, covering the project has already been circulated by New Zealand through the international community and received widespread approval. The Washington meeting concluded with the participants agreeing on a Record of Understanding to serve as a guide for their cooperation for the project.

Agreement with Chile

On October 5, New Zealand and Chile signed an agreement on Antarctic co-operation. New Zealand's Foreign Minister the Rt. Hon. Don McKinnon and Chile's Foreign Minister Enrique Silva Cimma were the signatories. It identifies three specific areas of co-operation: collaboration on an Antarctic sea research programme; the development of closer links between the Chilean Antarctic Data Information Agency and ICAIR, and the development of city-to-city links between Christchurch and Punta Arenas. The agreement will help develop contacts between the scientists and science institutions.

Thai Princess visits Scott Base

Among the Distinguished Visitors at Scott Base this season was Princess Maha Chakr Sirindhorn from Thailand.

Accompanied by Programme Director Gillian Wratt, Police General Serm Charuratan (Chief of the Royal Court Security Police) and Christine Fletcher, MP for Eden, the party travelled south on Friday 19 November arriving at 11 p.m. They were met at Scott Base by SENZREP Dave Geddes. The following morning Antarctic Field Training Leader Andrew Thompson took the party out among the pressure ridges in front of Scott Base for television coverage before visiting the field training area, the Crary Lab at McMurdo and the New Zealand facility at Arrival Heights. On the Sunday they flew to Cape Royds and Cape Evans, visited the Erebus Glacier Tongue and scientists working on sea physiology and physiology of Antarctic fish. On the Monday they flew to Vanda station siting Brattina Island, the Transantarctic Mountains, Taylor Valley and head of the Taylor Glacier, the VXE Ice Falls at the top of the Wright Valley before returning to Vanda for lunch. During the afternoon they visited scientists undertaking wind profiling in the Dry Valleys before returning to Scott Base via Marble Point. During the evening they climbed Observation Hill. The party returned to Christchurch on the Sunday. The Princess, who has a Ph.D in development education, is interested in education and employment for the Thai people.

Rugged cross in for repair

The cross on Observation Hill, erected in memory of Captain Robert Falcon Scott, was blown down earlier this year and has been temporarily removed to Scott Base for minor repairs. The 4 x 2 metre cross, made out of Jarrah, an Australian hardwood, was created by Frank Davies, a shipwright

on the *Terra Nova*, the ship used by Scott's last expedition. Initially it was embedded some 30 cm into the rock but

this season it will be permanently set into a concrete foundation with a protruding metal bracket.

ANARE's tadpole that got away

Kelvin Michael IASOS/Antarctic CRC with acknowledgment to ANARE Science Branch, voyage support staff, the Antarctic Science Advisory Committee, Zelcom Technics Integra and the Marine Board of the Australian Navy. Reprinted from ANARE News winter, 1993

In recent years satellite remote sensing has proved of great value in Antarctic environmental studies, but satellites are not much use in estimating sea ice thickness. The standing method, drilling a hole, is labour intensive and restricted to spot readings. In common with research teams in North America and the UK, among other countries, the Institute for Antarctic and Southern Ocean Studies (IASOS) sought a more convenient method by creating an automatic underwater vehicle (AUV) to provide a stable, versatile platform for a variety of oceanographic research.

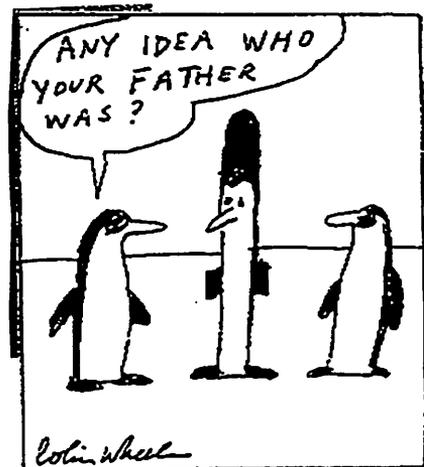
The raw material was a late 1950's Royal Navy torpedo, 53 cm in diameter and 5.4 metres long, weighing and displacing about a tonne. With help from private computer firms, a controller was designed and installed into the torpedo, along with an upward looking sonar, precision depth sensor and other sonar navigation devices interfaced to the computer.

Several trials in Storm Bay over the 1992-93 summer showed that Tadpole could follow instructions and with a well designed course close the loop and return to its start. On April 29 it had its first pack-ice trial from *Aurora Australis*

at Ice Station Onion. It ran with no trouble, but proved hard to find. It was finally spotted by a sharp-eyed bird observer who detected the flashing beacon and directed a helicopter to the spot.

On May 3, at the place to be immortalised as Ice Station Cauliflower, Tadpole failed to return from its second mission and was never found despite an extensive search. It apparently had deviated from its intended course and missed the lead in the ice.

Tadpole's trails showed a potential for torpedo AUV's in Antarctic research, but obvious pitfalls must be overcome. A successful system must be able to home in on a sonar beacon to enable its recovery. Work has begun on a new Tadpole, but it will not be deployed in the Antarctic till 1994-95.



Courtesy *New Scientist*

JARE 35

Twenty-three programmes make up the 35th Japanese Antarctic Research Expedition

JARE 35 was scheduled to leave Tokyo aboard the icebreaker *M/S Shirase* on 14 November 1993 and arrive at Syowa Station on East Ongul Island in late December. Following deployment of the winter party of 40 scientists and support staff and their supplies the vessel is scheduled to leave the Station on 10 January 1994. She will continue general oceanographic and biological surveys, begun on en route, until the end of February and provide further logistic support for the 11 scientists undertaking the summer programme in which there are also five others including two construction personnel from NIPR. Captain Takehiro Hisamatsu will be in command of the *M/S Shirase* which returns to Tokyo on 13 April 1994. Glaciologist and Professor Okitsugu Watanabe from the National Institute of Polar Research (NIPR) is the leader for the summer activities and Kotaro Yokoyama, also a glaciologist, but from the National Institute of Agro-Environmental Sciences, will lead the winter party.

Twenty-three scientific programmes are being undertaken by the expedition, many of these will continue over the winter. Additional logistic support will be provided by the Two Sikorski S-61A and one Bell-47G-21 helicopters carried aboard the *Shirase* and by a Pilatus Porter PC-6B2-H4 (JA8228) and Cessna A-185F (JA3889) owned by NIPR whose pilots and maintenance

crew will winter over. Eight of the programmes are biological in nature. The second year of the Sea Ice Ecology and Flux Study (SIEFS) programme will be carried out. The objectives of this five-to-ten year programme are to study the biological processes in seasonally ice-covered regions. These include temporal changes of primary production and its sedimentation and decomposition processes, the metabolic dynamics of zooplankton and nekton, energy transfer into higher trophic levels, and paleoenvironmental studies of the sea ice area. Y. Naito and M. Fukuchi from NIPR are the principal investigators. Their major areas of operation are between 35deg E and 40deg E around Syowa, between 45deg and 55deg E and between 55deg and 60deg E in the Indian sector of the Antarctic Ocean. Two other areas of Breid Bay (around 24deg E) and Prydz Bay have also selected as reference sites. (Prydz Bay is already a CCAMLR monitoring site.) This season however, not only are shore-based studies around Syowa Station being undertaken but an overwintering programme and ship-based work are part of the overall plan.

Temporal and spatial variability of primary production and its downward flux are to be investigated through mooring experiments in the coastal fast ice area in the Lutzow-Holm Bay near Syowa Station. A. Tanimura and M. Fukuchi from NIPR will be undertaking

this research. A Tanimura is also studying the bioenergetics of the zooplankton community. In this project the metabolic rate of zooplankton will be measured under laboratory condition and *in situ* in order to estimate their food requirements. Direct measurements of growth and food consumption rates will also be carried out.

The swimming behaviour and energy expenditure of Antarctic fishes are to be observed under laboratory and *in situ* conditions. An acoustic transmitter will be attached to a fish and its movement monitored with three dimensional directions. Y. Miyamoto from Tokyo University of Fisheries is responsible for this project.

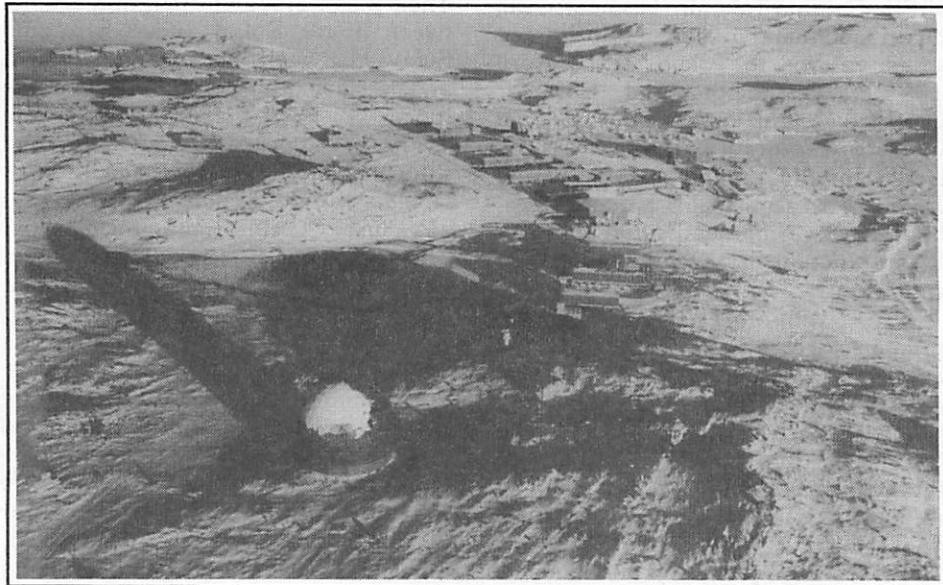
Also from the Tokyo University but from the ocean Research Institute is Dr Ichiro Takeuchi, a marine biologist, who, as part of an ecological study of benthic amphipods, will be sampling with bait traps and SCUBA diving in the areas of the coastal fast ice area and the shelf break. The metabolic rates of the

amphipods will be measured under laboratory and *in situ* condition to estimate food requirements.

Taxonomical and ecological studies of pico-, nano and micro organisms are being undertaken by Dr Masanobu Kawachi, a biological oceanographer, from Tsukuba University, during the cruise of icebreaker *Shirase* to and from Syowa Station. Advantage will be taken of her stay in the area to make the same observations in the coastal fast ice near the Station to evaluate the important role of the sea-ice related production processes.

The effects of underwater light on fish behaviour is the subject of a study by Dr Taeko Hayashi, a marine biologist from the Tokyo University of Fisheries. Experiments for determining reactions of antarctic fishes to underwater light will be carried on board and *in situ*.

Multipurpose Satellite Data Receiving Parabola Antenna at Syowa Station, January 1989



Irradiance will be measured quantitatively and qualitatively for its effect on behaviours such as foraging in the coastal waters including ice covered areas near Syowa Station.

Two marine biologists, Dr Kentaro Watanabe from NIPR and Toshihiko Sato from Tsukuba University are among the winter party and are expected to continue some of these observations at the conclusion of summer activities.

Geodesy

A geodetic survey will be carried out in Rundvagshette, Innhovde, Padda and Langhovde using Trimble 4000 SST GPS receivers.. GPS observations will be conducted at Syowa Station using the same receivers. Hisao Ikeda, a geodetic engineer from the Geographical Survey Institute will be going south for the summer and is likely to be involved in these programmes. In addition, GPS will be used to re-establish the geodetic control network. Gravity and geomagnetic measurements will be performed in selected areas and a the control network will be revised. Gravity anomaly maps and geomagnetic anomaly maps will be based on these surveys. Absolute gravity measurements and continuous GPS tracking is be carried out as part of the Japanese contribution to IAGBN and IGS. Large scale colour orthophoto maps of bare rock areas around the Lutzow-Holm Bay area are being prepared.

Gravimetric and geomagnetic surveys are to be continued aboard *M/S Shirase* by scientists from NIPR, the Ocean Research Institute at the University of Tokyo.

Geology and geomorphology:

Three programmes focus on geol-

ogy and geomorphology; a geological survey will be undertaken around Syowa Station by geologists Dr Noriyoshi Tsuchiya from Tohoku University and Dr Toshiaki Shimura from Niigata University. Detailed investigation of petrology, structural geology and geochronology will be carried in selected ice-free areas of the Lutzow-Holm Bay region, the Prince Harald and Prince Olav Coasts.

Project leaders for the geomorphological field work around Syowa Station are Kasuomi Hirakawa (summer party) and T. Sawagaki from Hokkaido University. Detailed investigations of the geomorphology will be carried out in selected ice-free areas in the vicinity of Syowa, the focus being raised beach problems in relation to environmental change and an experimental study of current periglacial processes.

On the homeward voyage for the *Shirase* a short visit to Mt. Riiser-Larsen, in Enderby Land will be made for more geomorphological field work, the main purpose being a study of glacial geomorphology. The field component of these programmes is being undertaken by geomorphologist Kazuomi Hirakawa and glaciologist. Dr Takeo Hondoh who is also from Hokkaido University.

Dome-Fuji - drilling programme

Work on the Dome F project will continue. The principal investigator is the team leader Dr Okitsugu Watanabe from NIPR. This is a five-year programme entitled "Dome Ice Coring Project at Dome Fuji, East Antarctica". It began in 1992 and will continue until 1996. A 2,000-3,000 metre deep ice core will be drilled using a newly developed system in 1995 and 1996 to re-

trieve detailed palaeo-environmental signals recorded in the Antarctic ice sheet.

Earlier this year a reamer was tested to expand the drilled borehole diameter and casing of tubes into the borehole were carried out at the ice sheet margin near Syowa Station in April 1993. Glaciological observations will be carried out along the route from Syowa to Dome F and fuel drums transported to that location between October and December.

At Dome F, the glaciological traverse team will conduct shallow ice coring to a 100m depth and casing FRP tubes into the borehole. They will also establish the first hut of the Dome-F station.

Other programmes

Personnel involved in two *solid earth geophysics* programmes, will remain at the station over the winter. Continuous gravity observations are being made by Dr Naoto Ishikawa, a geophysicist from Kyoto University and Kazunari Nawa also a geophysicist, but from the Earthquake Research Institute at the University of Tokyo. A superconducting gravity meter will be used for the observations which will continue throughout 1994 into 1995. Simultaneous earth tide observation will be made by La Coste and Romberg gravimeters.

Dr Ishikawa is also involved in summer field work with geophysicist Dr Funaki from NIPR which during which they will undertake palaeomagnetic sampling in the Lutzow-Holm Bay, Prince Olav Coast and Yamato Mountains. Preliminary measurements of natural remnant magnetisation will be carried out by the team at Syowa Station where they will also spend the winter.

Lower and upper atmospheric science programmes are also being undertaken.

Between 1992 and 1996 T. Yamanouchi and S. Aoki from NIPR will be involved in the project of Antarctic Atmospheric Chemistry which is part of the International Global Atmospheric Chemistry Programme (IGACX/IGBP). This project is comprised of several coordinated observations of greenhouse gases, tropospheric aerosols, stratospheric ozone and associated components and horizontal and vertical wind profile. The emphasis is on the production and decay processes, the horizontal and vertical transport of materials from low to high latitudes, from the stratosphere to the troposphere and cryosphere. The exchange processes of the minor constituents between the atmosphere and snow or ice needs to be clarified and this analysis is related to the Dome F project. In order to meet their objectives of these components large facilities such as a GC-mass spectrometer, laser heterodyne spectrometer, laser radar, wind profiler and sampling balloon are being developed together with a precise and long range continuous measuring system.

Part of this work is being carried out in conjunction with H. Tanaka and I Nagao from Nagoya University. Extensive observation of atmospheric sulfur components, especially dimethylsulfide (DMS or CH₃SCH₃) are to be made in order to understand the release from the ocean surface to the atmosphere. Long term on site observations will be continued for CO₂CH₄ and surface ozone. Visible spectrometer measurement for the stratospheric NO₂, ozone and OC10 will also be made as will sampling for CFC's and carbon isotopes of CO₂(d13c). None of these scientists are going to Syowa this season and the programmes will be maintained over the winter by other personnel. It also seems likely that some of the preliminary work for the new components of the programme will be under-

taken by the winter team.

Satellite observations

Data from the Marine Observation Satellite (MOS-) -1, Synthetic Aperture Radar (SAR) of the European Remote Sensing Satellite (ERS)-1 and the Earth Resources Satellite of Japan (JERS) has been received at Syowa Station since 1992. The data is being processed at Earth Observation Center (EOC) of the National Space Development Agency of Japan (NASDA) in order to make analyses of polar atmosphere and cryosphere. The team involved in this programme are H. Enomoto from the Kitami Institute of Technology, H. Warashina from the Sendai National College of Technology and T. Yamanouchi, H. Ito, from NIPR. Again these programmes will be maintained by base personnel as these investigators are not destined to go south this season.

Upper Atmosphere science programmes focussing on physics and the ionosphere are being continued being continued. Telemetry data from the aurora observation satellite, EXOS-D (Akebono) was received at Syowa Station during 1993 and this will continue. Data from the Scandinavian aurora observation satellite, "Freja" is being received on a "campaign basis" and coordinated with ground-based aurora observations at Syowa.

In 1992 imaging riometer was installed and this has operated continuously. Together with another imaging riometer in Iceland, the pair will provide data for studying conjugacy of auroras in both hemispheres throughout the year. Both of these projects are the responsibility of N. Sato from NIPR and will be operated by base scientists on his behalf.

A new digital All Sky Camera will be installed at the Station in 1994. It will use a CCD camera as an imaging device

and an engineering work station for the data processing and recording. Once the new system is established the old style film-camera, which has operated continuously since 1966, will no longer be used. One reason for the up-grade is that the old All Sky Camera uses a large fish-eye lens system, with a 180 degree field of view, from which it has been possible to obtain an image every ten seconds. In 1992 however the supply of the high speed B/W photo film came to an end. The data from the programme so far are stored in the WDC-C2 for Aurora in the National Institute of Polar Research. The more than 3,000 rolls of 100ft photo-film from Syowa are to be disseminated to scientists through the WDC system.

The new type of camera is characterised mainly by the CCD device which is used for the image detector which has a pixel number of 1000 x 1018. By keeping the temperature of the device at less than -30deg C, it becomes possible to obtain clear auroral images with an exposure time of less than four seconds without the use of an image intensifier. The data will then be digitised and transferred to a work station. Quick look data processes will be carried out at the station. Each image data and the summary data displays through the observation night will be recorded on an 8 mm digital tape recorder of five GBytes and magneto-optical disk system of 600 Megabytes respectively. The quick look image data is to be stored, on an optical disk system, every ten seconds keeping the same time resolution with the previous All-sky camera data.

M. Kubota from Tohoku University is responsible for observations of thermospheric winds and temperatures using a Fabry-Perot Doppler Imaging System at the station. The objective of the observations, which will begin in February 1994, is to investigate the

thermospheric dynamics of auroral activities by measuring two-dimensional distributions of thermospheric winds and temperatures with high time resolution. The instrument is a field-widened, to 165 degrees, Fabry-Perot interferometer whose interference fringes are imaged on a proximity focused photon counting imager. Target emission are auroral 630.0nm (OI) and 557.7 nm (OI). Expected time resolution measuring wind speed and temperature is a few tenths of a second.

In order to determine the arrival direction of ELF/VLF emissions observed at Syowa Station, three components of wave electromagnetic fields (Bx, By, Ez) are recorded in analog form. These will be digitised afterwards and analysed with sophisticated method using wave distribution function. The principal investigator for this experiment is Professor Hayakawa of the University of Electro Communications. This programme will also be maintained by wintering scientists.

The VHF 50 MHz auroral radar will be fully renewed in February 1995. The new system can cover a wider observable field than previously as it has a beam which can be scanned more than 160 degrees in azimuth direction. The spatial distribution of radar echoes and their Doppler velocities will be observed on a routine basis.

An FW/CW ionospheric radar will be operated continuously at Syowa Station for Y. Makita, K. Nozaki and T. Kuchi from the Communications Research Laboratory in Tokyo. The radar can observe echo intensity of virtual height of the ionosphere with high resolution.

This programme will later be supplemented by the installation of an HF band Doppler pulsed radar which is scheduled to be installed at the station in February 1995. The new system receives coherent back scatter from the

field-aligned plasma irregularity in the polar cap ionosphere. The line-of-sight plasma drift velocity is obtained from the Doppler Shift of the back scatter. This radar has a field of view of 3,000km in radial range and 52 deg in azimuthal angle. The programme will be undertaken in collaboration with the existing HF radar at Halley Bay station in order to obtain vector drift velocity of the ionospheric plasma. It forms a component of Super DARN (Dual Auroral Radar Network).

Ocean physical sciences

Hydrographic observations comprising tidal, oceanographic and antarctic circumpolar current observations with drifting buoys is to be continued. A bathymetric survey will be conducted off Lutzow-Holm Bay for M. Hishida from the Hydrographic Department Maritime Safety Agency in Tokyo. A physical and a chemical oceanographer Ahihiko Ogawa and Hirofumi Okano from the Maritime Safety Agency are part of the summer team aboard the *Shirase* this season and it is expected that they will be involved in this programme.

Human biology and medicine

During the winter of 1993 S. Horiuchi from Ehime University and R. Maeda from Osaka University undertook two human biology programmes. The first relates to physiological adaptation to the cold environment and will involve the taking of blood and urine samples for analysis as well as carrying out other examinations of JARE. The second, part of the Polar Psychological Project planned by an ad hoc group, Antarctic Space-related Human Factors Research, SCAR, involved in a psychological test battery being conducted on the wintering personnel in 1993. This

project will continue in 1994. The test battery was proposed by Dr Suedfeld from the University of Colombia. T. Morimoto, Kyoto Pref. University Medicine and M. Kume from the Waseda University of the National Space Development Agency (NASDA) are the principal investigators. Two doctors from NIPR in the wintering party are likely to undertake this work. They are Ichio Obinata and Tsuginori Yoshida.

The winter party

Five meteorological engineers from the Japan Meteorological agency form part of the wintering team. They are Yuzuru Inagawa, Yoshikatsu Yamanoto, Yuji Taguchi and Toshihiro Abo and Osamu Ijima. There will be one ionosphericist, Kyoji Iwasaki from the Communications Research Laboratory from the Ministry of Posts and Telecommunications and a space scientist, Noriaki Obara from the same organisation. Four geophysicists are included in the party. They are Kazunari from the Earthquake Research Institute at the University of Tokyo, Youichi Wakino from the Kakioka Magnetic Observatory at the Japan Meteorological Agency, Dr Minoru Funaki from the NIPR and Dr Naoto Ishikawa from Kyoto University. In addition to the deputy-leader of the party there are three other glaciologists. They are Dr Hitoshi Shoji from Kitami Institute of Technology, Takeshi Saito from Kyoto University and NIPR and Dr Takayuki Shiraiwa from Hokkaido University. One meteorologist has been included. He is Michihiro from Tohoku University and two marine biologists, Dr Kentaro from NIPR and Toshihiko from Tsukuba University.

Seven mechanical engineers include Taka-aki Hamashita, Keiji Hagiya, Yuji Konishi, Kouichi Moriyama, Yoshiaki Sato and Eiichi Kobo from NIPR, and

Kazuhisa Nakagaw from Kyoto University of Education. Of the three radio engineers, Shinji Yabu comes from the Maritime Safety Agency, Masashi Ito from the Ministry of Posts and Telecommunications and Atsushi Tanaka from NIPR. There is also one electrical engineer Hirsohi Nishimura and a civil engineer Masuru Sakamoto both from NIPR. One architect has been included in the party. He is Ken Yoshizawa from Niigata University.

Logistic personnel

Logistic support staff include two pilots, Kazuyuki Koyano and Jun-ichiro Ichiki and an aircraft maintenance engineer Hideki Imaseki are from NIPR.

Two cooks will sustain the team over the winter. They are Akitsugu Komatsu from NIPR and Takahiro Matsui from the Maritime Safety Agency.

International links

International links are being maintained by the Japanese. The foraging and diving performance of the Blue-eyed shags at Macquarie Island will be studied by Y. Naito from NIPR and A. Kato from the University of Tokyo. The diving performance in relation to diet and chick growth and the physiological aspects will be studied as part of this ANARE-JARE project.

Dr Harvey J. Marchant, a biologist from the Australian Antarctic Division, Mr Geoffrey L. Fraser from the Australian National University and Mr Marcos Ruiz Quinones, an electronics expert from the New Mexico State University will be included in the summer party.

KARP

Seventh season of Korean Antarctic activities begins in December

The activities of 7th Korea Antarctic Research Program (KARP) to be carried out during the 1993-94 field season and winter of 1994 include a biological cruise, a coastal marine science programme, geological studies, seismological observations geophysical work at King Sejong Station, and a shore-based winter marine programme.

Erebus, a 975 ton tug supply ship owned by Compagnie Nationale de Navigation in France and sailing under the command of Captain Alexandre Veyser, will be employed by the programme for the biological cruise which will involve 26 scientists led by Dr Soon-Keun Chang, Director of the Polar Research Center at Seoul in Korea. The vessel will deploy the summer programme personnel, resupply King Sejong Station and land a party of 15 there in December 1993 for the winter of 1994.

The focus of the oceanographic research this year is on the biological sciences, the programme being designed to enable the scientists to examine regional differences, relationships and trophodynamics of the physical, chemical and biological processes around South Shetland Islands and in the marginal ice-edge zone of the Weddell Sea. A total of 58 stations have been selected for sampling along the coastal shelf, the continental shelf break, the island shelves, the confluence of the Bellingshausen -Weddell Seas, a portion of Drake Passage and marginal ice zone near the Weddell Sea. (See dia-

gram).

Although a number of previous studies have sampled at or near the Bransfield Strait area, only a mesoscale study had investigated the coupling between the physical and chemical processes and the interactions among bacteria, phytoplankton, zooplankton, krill and benthos around the Antarctic Peninsula area. A new understanding of ecosystem dynamics and the mesoscale upper-ocean circulation can emerge only from intensive study of a more restricted geographic region.

The cruise will comprise three north-south transects around the South Shetland Islands from Smith Island in the west to Elephant Island in the east and a marginal ice-edge transect in the Weddell Sea to determine regional differences on biological, physical and chemical distribution patterns and processes. Answers to two major questions are being sought by the team. Firstly, what are the mechanisms which result in regional differences in distribution, composition, standing crop and productivity at all trophic levels and secondly what mechanisms are the ecological interface among distinct biological communities near the Antarctic Peninsula and what are the dynamics of these regional communities.

To address these questions they will measure the distributions of bacteria, phytoplankton, zooplankton and benthos and whenever possible their rate processes over a wide range of conditions in the different regions and

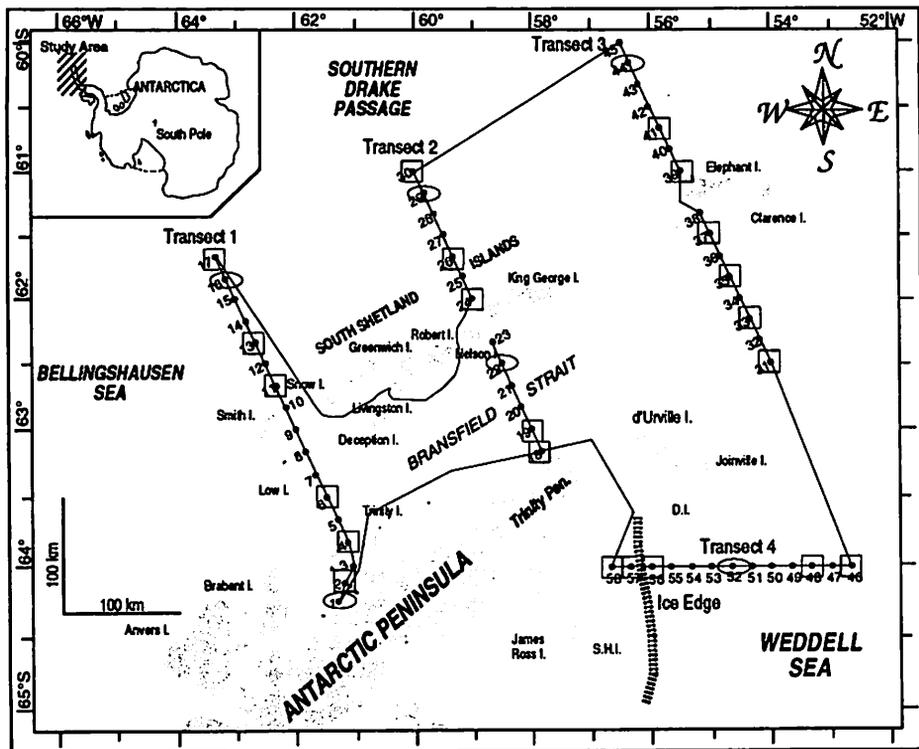


Figure 1. The 7th KARP Biology Cruise Track and Stations (93/94 Field Season)

relations with physical and chemical parameters. They will basically use the CTD/Rosette sampling system, Bongo net, and phytoplankton net at every station and in some selected stations MOCNESS and Grap samplers will also be used.

Research from the samples will focus on:

- > Bacteria, bacterial cell abundance, distribution, microbial uptake and catabolism and physiological rates;
- > Phytoplankton: composition, abundance, cell condition, distribution patterns of dominant species, grazing pressure, physiological rates such as in situ primary productivity, chl a biomass.
- > Zooplankton and Krill: zooplankton tow using the Bongo net; discrete water sampling (MOCNESS), taxonomy, abun-

•	: All Stations
○	: Bongo, CTD cast, PhytoNet
○	: MOCNESS Stations
□	: Grab Stations
—	: Cruise Track

- dance, biomass, dry weight of representative species and developmental stages, distributions and physiological rates of zooplankton and krill
- > Physical factors: stability of water column, measurements of water column properties, CTD casts, geostrophic circulation, water masses
- > Chemical factors: dissolved inorganic and organic nutrients (nitrate + nitrite, ammonium, phosphate, silicate, DON, DOP, and dissolved carbon dioxide and methane, new production and regener-

ated production measurement, C/N ratio, f-ratio.

Geological sciences

Glacial Marine sedimentation and recent glacial history will be studied by a group led by Dr Soon-Keun Chang and comprising Moon Young Choe, Byong-Kwon Park, Ho li Yoon, Myung Woo Han, Hyun Chul Kim, Yong Kwon Kim, Won Dae Pack, Kyung Sik Choi. The Antarctic Peninsula is one of the most suitable sites to search for evidence of the Quaternary ice advances both on land and on the seafloor, and the evidence of climatic and eustatic changes since the last glacial maximum. Situated between the subpolar glacial regime of the northern Antarctic Peninsula and the maritime glacial regime of the South Shetland Islands, Maxwell and Admiralty Bays receive ice from a number of glacial sources, including large outlet glaciers from the adjoining landmasses. This makes it an ideal test area for various models of glacial marine sedimentation. According to past studies, a reconstruction of the glacial history since the late glacial maximum, suggest that grounded ice filled the bay in Late Wisconsin time, retreated from the cove at least 13000 years before present, and was followed by a marine transgression. These studies were, however, largely based on the sediment cores rather than seismic reflection profiles. Hence it is necessary to obtain seismic reflection data from these areas to compare with the information obtained from the sediment cores.

With the commencement of the 7th KARP cruise in December 1993 the team intends to obtain more than 250km of seismic reflection profiles in fjords such as Maxwell, Admiralty and King George Bays to infer the glacial advance and retreat during the Holocene.

A field survey and petrological and

geochemical study of the granitic rocks in the northern part of the Antarctic Peninsula will be carried out during the 1993/94 summer period. The aim of this study is to clarify the chemical features of the granitic rocks related to the Andean Orogeny of the Antarctic Peninsula. The results, will be combined with the previous work, and applied to the interpretation and reconstruction of the tectonic evolution of the South Shetland Islands and the Antarctic Peninsula.

Coastal biology

Water depths around Marian Cove and the coastal area off the Weaver Peninsula will also be measured during the 7th Karp field period. A continuous depth measurement survey will be extended to Maxwell Bay area from next year.

At King Sejong Station, Korea's permanent year-round station located at 62deg 13 min S and 58deg 47 min West, land-based studies will be carried out.

Among these is an investigation of solar radiation on a horizontal surface. For this programme, a precision double dome spectral pyranometer (285-3000nm) was installed in February 1988 and a UV radiometer of 295-385nm was added in February 1993. During the coming season a UV biometer of (295-320) will also be installed in order for scientists to study the effects on biologically harmful UV-B radiation on selected organisms as a paramter for monitoring long-term effects on the ecosystem in this area. They plan to analyze characteristics of global solar radion and UV radiation and correlate their results with weather phenomena at King Sejong Station.

Geomagnetic variation will be studied at King Sejong Station. Between 1989 and 1992 an observation system

comprising a Ring-Core fluxgate, proton magnetometer, strip chart recorder and other acquisition equipment for geomagnetism was installed at the station. The sensors however, were submerged under snow water in the summer and other troubles precluded efficient operation of the system. During the 7th Karp field season, the system will be repaired, waterproofed and the operational parameters defined so that data can be accumulated and used for research. It is hoped that the data will be transmitted via the GOES satellite to INTERMAGNET (International Real Time Global Geomagnetic Observatory Network) to Korea. From the results the diurnal variation at the station can be researched and a comparison made between the geomagnetic field at the station and in Korea. In addition it will be used as basic data for the research of the relationship between magnetosphere and ionosphere at King Sejong Station.

Seismicity study.

In January 1992, phenomena, such as rolling-stones, were observed by Argentine scientists working on Deception Island. A total of 70 seismic events were recorded during that year by a seismometer installed at King Sejong Station (KSS). Ten of these had an amplitude greater than two centimetres. The largest, recorded on 17 June, 1992, exceeded the maximum limit of all the seismometers with the same size and waveform on King George Island, (these being at KSS (Korea), Great Wall (China), Arctowsky (Poland)).

It is well known that the area near King George Island exhibits many interesting active tectonic processes such as the subduction of the South Shetland Trench and back-arc spreading of the Bransfield Strait. Seismicity in this region is closely related to these tectonic

activities. A short-period seismometer with three components has been in operation in the KSS since 1989 but at present mechanical problems are precluding the acquisition of quality data from this system. For example only analog records can be obtained, and because the KSS is located near the beach, waves and winds interfere with its operation. During the 1993/94 field season efforts are to be made to reduce the interference, the digital record system of the seismometer will be repaired and maintenance of the site carried out so that good quality data can be obtained and used to help shed light on the seismicity of the region.

The benthic boundary layer is the interface between the water and the bottom sediment. It is an important feeding ground for benthic organisms and is also the ultimate sink of particles which contain organic material and settle. The quantity and the nature of organic matter delivered to the benthic community characterise the community in terms of the constituent species and their abundance. Therefore measuring the organic flux to a benthic community is indispensable in understanding the marine benthic ecosystem. However the environmental nature of the benthic boundary layer is not fully understood in the Antarctic seas. Near-bottom sediment traps and benthic chambers will be deployed on the sea floor about 20 metres below the surface in Marian Cove. Flux of organic matter reaching the subtidal benthic communities will be measured from the trapped material. Utilization of organic material by benthic organisms will be estimated from the changes in the concentration of the material trapped in the benthic chamber.

The size of breeding populations for both species, Gentoos and Chinstraps, in rookery close to King Sejong Station will be measured. The

breeding chronology will be documented and success estimated. Scientists will try to estimate the rate of chick loss as the birds progress through the early stages of life. The growth of chicks will be monitored and the fledging rate measured at the end of the season. Their diet will be examined by stomach flush techniques and time depth recorders will be deployed so that their foraging effort can be estimated to determine how it changes at each stage. A programme of chick banding will be continued.

An ecological investigation of the *Notothenia neglecta* population begun in previous years is to be extended to the early part of the life history of this species of Antarctic fish. In the spawning season, the size of the sample will be expanded to document the reproductive event more accurately. Fertilization and culture of the eggs will be attempted and a number of juveniles will be reared to get a rough measure of their growth rates. Some effort will also be given to obtain the data on other abiotic, biotic components in the habitat of *N. neglecta*. A routine sampling programme will be maintained on a monthly basis by an overwintering biologist of 7th Karp party during 1994 but during the summer Young-Chul Kang and Hyung-Chul Shin will be scientists undertaking the coastal marine biology programmes.

Winter activities

In all 15 Korean personnel will spend the winter of 1994 at King Sejong Station. Four members of this party are scientists under the leadership of Ki Soo Nam. The others include Hae Chul Kim, Yong Min Park, and Yong Jung Yoon. The rest of the party comprises one doctor, one meteorologist, one communication technician, one cook and seven maintenance person-

nel. Supplies for their 12 month stay beginning in December 1993 will be offloaded from the *Erebus*.

Scientific activities for the winter team will include experimental studies on feeding strategies of *Laternula elliptica*, in response to the seasonal variation of the water column and benthic microalgal production. Changes in the quality and quantity of fecal materials produced by this bivalve species, in response to seasonal changes in species composition and standing stock of phytoplankton will be studied.

Growth rate and production of dominant benthic animals will be estimated. Primary production of a macroalgae such as *Himantothallus grandifolius* will also be determined so that scientists can estimate the importance of macroalgae relative to phytoplankton or benthic diatoms in the Antarctic coastal waters. As a preliminary study for environmental monitoring in the Antarctic coastal waters, several dominant benthic species and habitat sediments will be analysed to determine the concentrations of heavy metals and toxic organic compounds and an indicator species will be selected for continuous monitoring programmes. Penguins and fish will also be used as biological parameters for monitoring programmes.



Gentoo



Chinstrap

USAP

The Peninsula and shipboard programmes

Palmer Station's seasonal projects began with the arrival of the teams involved in the Peninsula Long-Term Environment Research (LTER) project on the *R/V Polar Duke* shuttle cruise from Punta Arenas on 13 August, 1993. Two vessels, the *R/V Polar Duke* and the *R/V Nathaniel B. Palmer* will provide the logistic support for science activities and base resupply. The science population at Palmer will remain high until the departure of the final *R/V Polar Duke* cruise on 8 February 1994 and the SAAM - Special Assignment of the Airlift Mission - on February 18. Palmer Station will sustain four seasonal research projects and seven year-round projects during the winter.

Researchers operating in the vicinity of Palmer Station and the LTER area will investigate seabird ecology and population dynamics and Adelie penguin reproductive success and energetics. LTER personnel will study phytoplankton production, bio-optical properties of the southern oceans, krill population and energetics. In addition, determinations of the sulfur chemistry within the antarctic troposphere and the biological effects of increased UV radiation on antarctic biological systems will be investigated. Observations by a remotely operated vehicle and sediment trap analysis will determine inputs of glacial materials into the Arthur Harbour Marine system.

R/V Polar Duke is a 219 feet ice-strengthened research vessel which is being chartered by the National Science Foundation for use in the southern ocean and antarctic regional waters. During

the 1993-94 season ten cruises are scheduled and the total of 303 days involvement with the programme includes SAAM support and a period in the shipyard in Talcahuano. The first cruise of the season was scheduled to begin at Punta Arenas in Chile on October 3, last for 33 days and, either wholly or partially, support five different research projects.

Dr Barbara B. Prezelin from the Department of Biological Sciences/Marine Sciences Institute at the University of California at Santa Barbara and a party of 12 other researchers were among the early arrivals at the station. They will undertake a programme involving work at Arthur Harbor and on board the *Polar Duke*. Between October 3 and November 7, others of the party will be aboard the vessel which will operate in the Bellingshausen Sea. All are studying the effects of ozone diminution, ultraviolet radiation and phytoplankton biology. The biological consequences of increased ultraviolet (UV) radiation reaching the Earth's surface due to the antarctic ozone hole has recently been documented. Based on direct *in situ* measurements of UV radiation and primary productivity, ozone-related damage to the phytoplankton was estimated to result in a minimum of a 6 to 12 percent reduction in primary productivity within the marginal ice zone of the southern ocean. The party, this season, will further examine this topic by developing a space and time climatology of spectral irradiance arriving at and penetrating the southern ocean. The mag-

nitude and kinetics of UV-dependent production of organic carbon and UV photo damage will also be determined and analysed in the context of a bio-optical model of primary productivity. Results will significantly enhance the prediction of changes within phytoplankton communities experiencing greater radiation and provide an empirical basis for developing models designed to assess the consequences for higher trophic levels in the antarctic food web. Dr Raymond C. Smith from the Computer Systems Laboratory CRSEO at the University of California at Santa Barbara is involved in the project and the work of his team of nine, some of whom will deploy to Palmer Station/Arthur Harbor or on the vessel, is dedicated to assessing the impact of ozone-related increases in UV-B radiation on phytoplankton communities. They will make specific use of several in-water instruments including a Bio-optical Profiling System (BIOPS), a ROV, a UV spectroradiometer, a floating subsurface irradiance and upwelled radiance sensor and free fall irradiance probes to obtain data. Both teams, however will also be making use of the specialised equipment aboard the vessel to make measurements, at the Arthur Harbor and the LTER area some 200-400 km from Palmer Station.

LTER

Another party, some of whose members also deployed early to Palmer Station for field work the Arthur Harbor area is led by Dr William R. Fraser from the Polar Oceans Research Group at the Old Dominion University at Long Lake in Minnesota. This group of ten has a staggered deployment, the last going south on early January of 1994. Their project is part of the Long Term Ecological Researcher (LTER) on the

Antarctic Marine Ecosystem, an ice dominated environment.

Historical records indicate a six to eight year cycle in the maximum extent of the pack ice during the winter. This pattern is supported by observations made during the 1980s. Data gathered during the last decade, show that following the same cycle Adelie penguins had a higher survival rate in winters with heavy pack ice. During this LTER project investigators from six universities will define ecological processes linking the extent of the annual pack ice with the biological dynamics of different trophic levels within antarctic marine communities. Generally the focus will be on the yearly variations in representative populations from the food web - Adelie penguins, skuas, krill and antarctic silverfish - and on the mechanistic links controlling observed variations. These data will allow development of broader characterisations applicable to other large marine environments. To achieve their results the team is using remote sensing, annual monitoring and a series of process-oriented research cruises to collect data at several spatial and temporal scales. Modelling will be used to link multiple spatial and temporal scales between the biological and environmental components of the ecosystem. This season, for example seabirds' nesting sites will be observed daily within the LTER study area, 50 - 75 km from Palmer Station and during cruise seven of the *R/V Polar Duke* (see *Antarctic Vol 12 No. 10*) from 22 August to 29 September. Zodiacs are being used to monitor seabird communities on local islands and data will be analysed in laboratories both aboard the vessel and at the station.

Dr's Langdon B. Quetin, Robin M. Ross from the Marine Science Institute of the University of California at Santa Barbara and Raymond Smith from the Computer Systems Laboratory at the

same University are also involved in this project. Dr's Quetin and Ross will make use of a cruise in January to undertake field work in the area between Anvers Island and Marguerite Bay, while Dr Smith's area of work is Arthur Harbor and the LTER area 200-400km from Palmer Station which he too will visit on the January cruise.

Also from the Old Dominion University but taking advantage of the October cruise of the *R/V Polar Duke* is a party undertaking studies of the demography of an antarctic seabird community for Dr Wayne Trivelpiece. Their field of operation is at Copacabana Station on King George Island and the focus of their study are penguins, the major predators of krill (*Euphausia superba*) and an important component of the antarctic marine food web. To understand thoroughly the structure and function of the antarctic ecosystem, biologists must have information on population dynamics, as well as factors that regulate the size of penguin populations, especially the dominant antarctic genus -*Pygoscelis* penguins. The three pygoscelid penguins - Adelie (*P. adeliae*) chinstrap (*P. antarctica*) and gentoo (*P. papua*) nest sympatrically on King George Island where they have been studied by members of this team for the last ten years. The National Science Foundation has a field camp on the western shore of Admiralty Bay. Penguins have been regularly banded at this site, and their breeding ecology and population biology has been studied. Results indicate that each species responds differently to winter conditions, differs in annual survival levels and has different age and sex requirements for maintaining population levels. The primary objectives of the programme are to determine the age-specific demographic parameters for these populations and compare these parameters with Adelie populations in differ-

ent environments.

Deployed to Palmer and remaining there from early October to early December is a party led by Dr Osmund Holm-Hansen from the Scripps Institution of Oceanography whose team of six is studying the effects of ozone-related increased UV-B influences on photosynthesis, photo adaptation, and viability of phytoplankton in Antarctic waters.

Early in November the vessel provided SAAM support, ferrying a party from King George Island to the station. Then in mid November the *R/V Polar Duke* returned to Punta Arenas to offload materials to the *Nathaniel B. Palmer* in preparation for her voyage to the Ross Sea (see page 167) and on November 24 she left the port in support of further scientific work, this time in the Weddell Sea.

Aboard were two parties, one of 16 scientists, led by Dr Joseph J. Torres from the Department of Marine Science, at the University of South Florida at St. Petersburg in Florida, is studying the Antarctic ice edge bloom and its importance to intermediate trophic levels. The antarctic ice edge has a frontal system with different implications for different trophic levels. During the summer, primary producers and microheterotrophs flourish in the melt water lens that is created in the euphotic zone (upper levels of the ocean penetrated by light) at the retreating ice edge. By contrast, any enhanced standing stocks of longer-lived consumer species (with generation times of a year or more) at the ice edge must be the result of immigration or production in place. This research will test the hypothesis that the summer ice-edge bloom acts as a biological magnet to concentrate metazoan consumers and as a southward moving generator, facilitating group and reproduction in zooplankton species. Research conducted in the Scotia-

Weddell Sea region during the summer focused on the distribution, abundance and biological activity of zooplankton and micronekton in the upper 1,000 metres of the water column in the open-water marginal ice-zone and pack-ice regions of the study area between 60degS and 40 deg W. The team aim to describe the physical environment, map the extent and activity of the ice-edge phytoplankton bloom using *in vivo* fluorescence, and estimate primary production. Zooplankton/micronekton community structure will be characterised using data from an optical plankton sampler as well as from nets and trawls. Biological activity of the zooplankton will be evaluated through studies of metabolic, grazing, and egg production rates, and diet and metabolic enzyme activity. The resultant data will describe the zooplankton/micronekton community structure, major trophic relationships, grazing impact and patterns of energy utilisation for species living in the study area, showing clearly the impact of the ice-edge bloom on the intermediate trophic levels.

Dr Richard Harbison from the Biology Department at the Woods Hole Oceanographic Institution and two other scientists are studying gelatinous zooplankton, specifically the trophic relationships of *salpa thompsoni* and *salpa gerlachei* in the southern ocean. They live near the Antarctic Peninsula and both form immense blooms that nearly dominate the biomass. A knowledge of the biology of these species is essential to understanding the trophic relationships and global processes occurring in the southern ocean. In order to develop an energy budget for them, the party will investigate the feeding, and defecation rates, assimilation efficiency, growth, reproduction and metabolism of both species. Feeding rates will be measured in both the laboratory and the field and the results compared.

Growth, reproduction and metabolism will only be measured in the laboratory. The potential effect of hyperiid amphipod parasites on the growth and reproduction of salps will also be considered and several species of fish that inhabit the ocean near Palmer Station will be captured and their feeding on salps and other gelatinous zooplankton observed in the laboratory.

These studies will provide important data on their trophic position in the southern ocean both as consumers of phytoplankton and as the prey of other organisms. This work is an essential prelude to further projects studying recruitment and population structure in southern ocean planktonic communities. In addition, the research proposed will provide basic information on the ways in which oceanic zooplankton cope with the seasonally variable food resources of the southern ocean.

Salps will be collected from the Weddell Sea using a variety of net systems. Feeding studies will be carried out on board the vessel but divers will take underwater footage of them feeding in their natural habitat. This voyage will conclude at Punta Arenas on December 27.

The first cruise for 1994 will begin on January 1 at Punta Arenas. Most of the work being undertaken is in support of the LTER project and relevant personnel will be deployed to Palmer Station where the cruise will end on February 8. Among those on board will be members of Dr Prezelin's and Dr Fraser's teams. They will be joined however by the two other parties also involved in aspects of LTER research.

On February 9 the vessel will leave Palmer for King George Island returning two days later with personnel involved in SAAM. On February 15 this party will be returned to King George Island and the vessel will go to Punta Arenas, where after five days she will

begin the first of shuttle operations to Palmer withdrawing scientists and completing resupply for the winter. Shuttle trips will be made again between March 12 and 26 and again between March 31 and April 30.

When the vessel finally leaves Palmer for the season, year round project personnel and instrumentation will continue to monitor a spectra of select ultraviolet bands reaching the Earth's surface at the station for intensity and seasonal occurrence, satellite images from the Defence Mapping Satellite Program (DMSP), ambient air parameters, very-low frequency (VLF) radio waves and seismic occurrences.

Maintenance

Between May 5 and June 4 the vessel will be at Talcahuano in Chile undergoing maintenance and on 9 June until 9 July she will undertake a winter cruise in support of the Dr's Quetin-Ross science project.

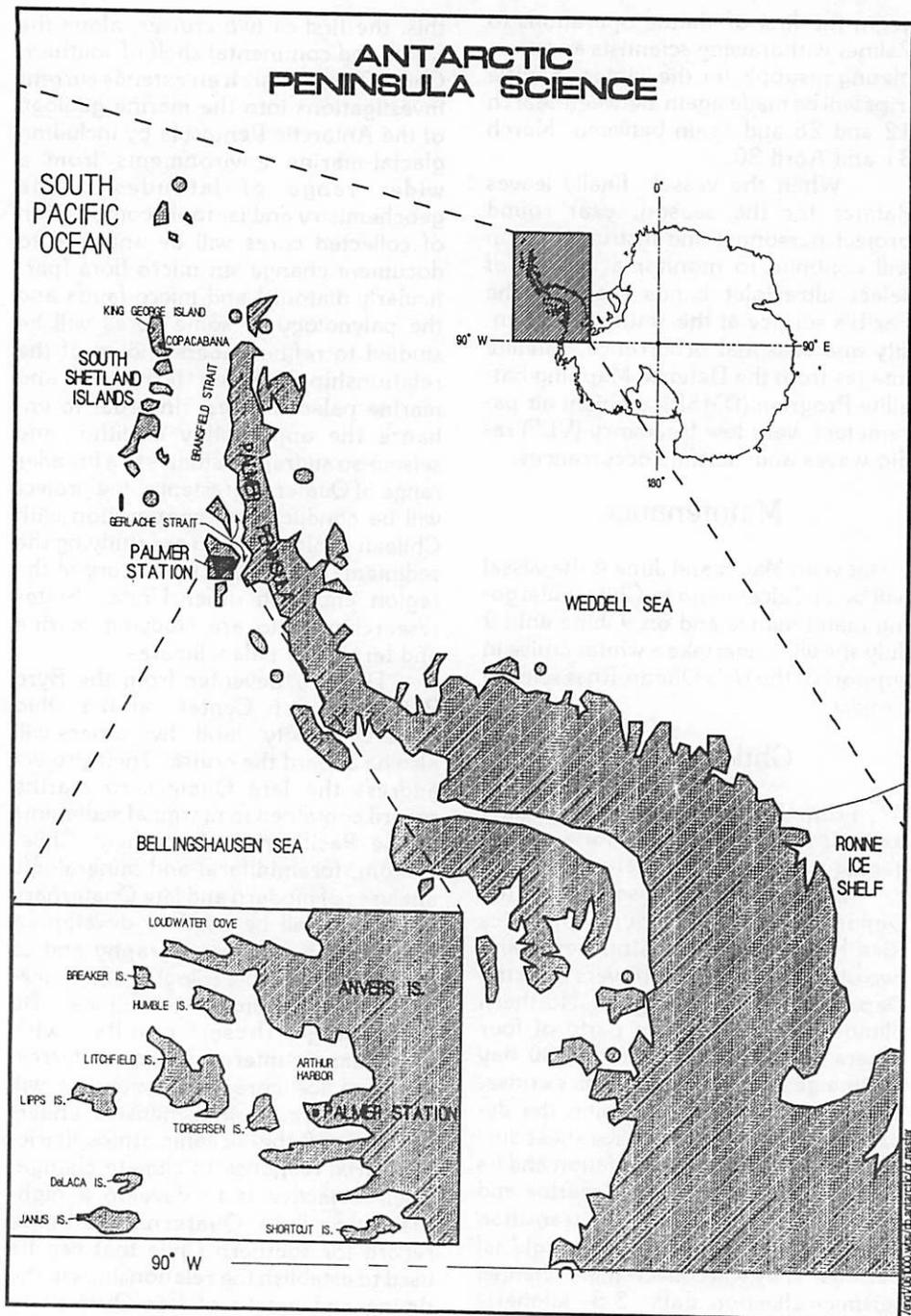
Chilean fjords

From July 14 she will be heading towards the Chilean fjords for a marine geology and geophysics cruise.

Dr John B. Anderson from the Department of Geology/Geophysics Rice University in Houston Texas and two others and Dr Jay Stravers from the Department of Geology at Northern Illinois University and a party of four others will be aboard for this 30 day marine geology and geophysics cruise. Their objective is to examine the dynamics of the Patagonian ice sheet during the late Wisconsin glaciation and its response to changes in the marine and terrestrial climate during the transition from the last glacial and interglacial periods. They will collect single-channel seismic-reflection data, 3-5- kilohertz profiler data and piston cores during

this, the first of two cruises, along the fjords and continental shelf of southern Chile. This research extends current investigations into the marine geology of the Antarctic Peninsula by including glacial-marine environments from a wider range of latitudes. The geochemistry and isotopic composition of collected cores will be analysed to document change in micro-flora (particularly diatoms) and micro-fauna and the palynology of some cores will be studied to refine understanding of the relationship between terrestrial and marine paleoclimates. In order to enhance the applicability of litho- and seismo-stratigraphic studies to a broader range of Quaternary science, the project will be conducted in cooperation with Chilean geologists who are studying the sedimentary and tectonic history of the region and with other United States researchers who are studying marine and terrestrial paleoclimates.

Dr Amy Leventer from the Byrd Polar Research Center at the Ohio State University and five others will also be aboard the cruise. Their project address the late Quaternary marine record contained in marginal sediments of the Pacific rim of southern Chile. Diatom, foraminiferal and mineralogic analyses of modern and late Quaternary sediments will be used to develop a high-resolution biostratigraphy and to reconstruct paleo-ecologic, paleo-oceanic and paleoclimatic conditions. By comparing these results with paleoclimatic interpretations of terrestrial and ice core data scientists will have a more comprehensive understanding of the oceanic-atmospheric-terrestrial response to climate change. Their objective is to develop a high-resolution late Quaternary climate record for southern Chile that can be used to establish the relationships in the timing and extent of late Quaternary glacial/climatic fluctuations between the



Antarctic Peninsula and South America and to complete a regional framework for future paleoclimatic studies of the non glacial history of southern South America and the Antarctic region.

The voyages of the *R/V Nathaniel B Palmer*

The *R/V Nathaniel B. Palmer* is operated for the National Science Foundation by Antarctic Support Associates (ASA), on a long-term lease from Edison-Chouest Offshore, Galliano, Louisiana. This research vessel was built in 1992 and this year has begun her second season of operations. The *R/V Nathaniel B. Palmer* is ice-classed (ABS-A2) and capable of breaking three feet of level ice at three knots. She is 308.5 feet in length with a draft of 22.5 feet and can accommodate 37 scientists. Normally she sails with a crew of between 20 and 24 with six to eight science support s personnel. There are over 4000 square feet of exterior main deck working area and over 5500 square feet of temperature-controlled laboratory space on the vessel.

During this, her second season of operations, the vessel will support seven oceanographic research cruises in the southern ocean, her geographical range spanning the Ross, Amundsen, Bellingshausen and Weddell Seas mainly in ice-bound regions that were not previously accessible to other research vessels. Geologic, geophysical, biological, chemical and oceanographic research will be conducted.

The first cruise departed from Punta Arenas in Chile on 10 October 1993. This 32 day biological oceanography cruise in the Scotia and Weddell Seas supports two main science programmes. The first is led by Dr Kenneth Mopper from the Chemistry Department of Washington State University who with

five other investigators will undertake sampling and radiometric monitoring of phytoplankton in order to evaluate the development of photosynthetic responses to ultraviolet light. The project integrates field and laboratory work in order to obtain baseline information from the euphotic zone on marine photochemistry related changes in the UV-radiation levels. Additionally they will determine the flux by *in situ* chemical actinometry, action spectra for photochemical production of various reactive species and for products of dissolved organic matter degradation and the properties of fluorescence and absorbency in dissolved organic matter. The information will serve as a basis for understanding and predicting the effects of UV-radiation-induced marine photochemical processes on the productivity and ecology of the euphotic zone.

The second project, led by Dr Patrick J. Neale from the Smithsonian Environmental Research Center involves a party of ten other researchers. Knowing that increases in middle ultraviolet radiation associated with the antarctic ozone hole have been shown to inhibit the photosynthesis of phytoplankton they will try and estimate the effect of ozone depletion of primary productivity in the marginal ice zone. Their research will refine the assessment by specifying detailed, wavelength-dependent biological weighing functions for the inhibition of photosynthesis by UV radiation and will consider the mitigating effects of vertical mixing. Experiments will be both *in situ* and controlled and the results incorporated into a model of photosynthesis and photo inhibition in the water column for predicting the influence of zone depletion on primary production, particularly in the marginal zone.

Conductivity, temperature, and depth (CTD) measurements will also be

made. The cruise will end at Punta Arenas on 11 November 1993 and the vessel will spend 21 days in port leaving again on 4 December for Palmer Station.

Voyage two

From Palmer she will sail towards the Ross Sea for a 30 day marine geology/geophysics cruise during which high-resolution seismic techniques and core sampling will be used to study the seismic stratigraphy and glacial history of the Ross Sea continental margin. This cruise will end at McMurdo Station on 18 January 1994.

On board for the leg from Punta Arenas to Palmer will be Dr Gail M. Ashley and a party of three from the Department of Geological Sciences at Rutgers University in New Brunswick. During their stay at Palmer they will operate mainly at Arthur Harbor and in Loudwater Cove where their project will test the hypothesis that frazil ice and anchor ice form in glacial meltwater flowing into subpolar marine water and possibly form deposits different from those in temperate and polar glacial environments.

Zodiacs will be used to deploy a remotely operated vehicle (ROV) near the Marr Ice Piedmont in Arthur Harbor and Loudwater Cove to detect anchor and frazil ice and to study the glacier terminus. They will also take CTD profiles, water samples and use sediment traps to study processes of dispersal and obtain sedimentary and bottom cores to document these processes. A station Furuno echo sounder will be deployed from the Zodiac to investigate the bottom topography and GPS employed to determine the exact geographic locations within Arthur Harbour and Loudwater Cove. If successful the study will identify significant new mechanisms of sediment dispersal and

lead to further understanding of ice-front processes in Antarctica.

Continuing on the voyage the NBP will then deploy to McMurdo Station arriving on 5 December. Here Dr Louis R. Bartek and his team of seven investigators from the Department of Geology at the University of Alabama will board for a 44 day marine geophysical cruise. The team is to conduct an integrated seismic, sedimentological and palaeontologic investigation of the glacio-marine stratigraphy of the Ross Sea continental shelf. Their purpose is to better understand the Cenozoic history of Glaciation in the Ross sea region. To achieve this they will acquire seismic images and sediment cores of the glacial sediments by using high-resolution seismic profiling data to locate regions where the Pleistocene glacial till is thin or absent and undertake piston coring at these locations, if till is penetrated. This will provide sedimentary records of Cenozoic depositional environments and possible important clues on variations in the antarctic ice sheets. The seismic profiling will allow first order correlations of Cenozoic sedimentary units that are represented by sediments recovered in the piston cores. The results will be important proxy records of the history of both the west antarctic ice sheet and east antarctic ice sheet, and this, in turn, will provide important constraints to climate models. The cruise will end at McMurdo station again on 18 January 1994.

On January 20 the vessel is scheduled to depart for a 23 day marine geology and geophysics cruise. On board will be Dr John B. Anderson, Department of Geology/Geophysics at Rice University, Houston in Texas. and a party of 13 others from Rice University, the University of Colorado and Hamilton College. Their purpose is to establish the most recent (late Wisconsin-Holocene) history of ice-sheet ad-

vance and retreat in the Ross Sea. Their objectives include reconstruction of the late Wisconsin i paleodrainage regime, including ice-stream divides; reconstruction of former grounding zone positions; determining limits of the timing of ice-sheet retreat from the shelf and acquisition of geophysical, sedimentological and paleontological data that may indicate what environmental factors influenced the retreat of the ice sheet. Experts from various fields will interface with glaciological, physical oceanographers and climatologists who will address the problem of ice-sheet stability and record of climate and glaciological change.

On 13 February 1994 another group of scientists will embark at McMurdo Station on the R/V Nathaniel B. Palmer which is then destined for further work in the Amundsen and Bellingshausen Seas. This party of eight, led by Dr Stanley S. Jacobs from the Lamont-Doherty Geological Observatory of Columbia University in New York will be undertaken a physical/chemical studies during this 50 day oceanographic cruise. Upwelling warm, deep water covers the Amundsen and Bellingshausen seas ice shelves and delivers significant amounts of heat to the sea ice and ice shelves at the edges. The regional precipitation is heavy, historically maintaining a perennial ice cover. Within the last few years however satellite images have shown that the ice has been receding dramatically and that large areas of open water remain through the winter in sectors that had earlier been covered. These irregular distributions are likely to be accompanied by altered surface water properties and possible changes in the deep circulation. There are indications that the conditions favouring a reduction in the sea ice may migrate westward towards the Ross Sea and may have already contributed to a gradual warming over recent decades on the

western side of the Antarctic Peninsula. This project will be the first systematic oceanographic study of the continental shelves of the two seas and will include temperature and salinity profiling, water sampling for ocean chemistry and continuous precision bathymetry. This cruise disembarks at Punta Arenas in Chile on 4 April 1994 and five days later the vessel enters the Talcahuano shipyard for maintenance t until the May 24. Sea engineering trials to test modifications are scheduled from May 29 until June 13 when she is due to arrive at Punta Arenas.

Five days later she will begin supporting the multifaceted ANZFLUX project which will establish two drift stations, each lasting about 15 days, in the Weddell Sea. A third shorter drift over Maud Rise will also be undertaken if conditions permit. The vessel will return to Punta Arenas on 27 August, 1994. Because this 70 day cruise exceeds the normal underway capability of the vessel she will be moored to the ice during the two 15 day segments of the project. Normally the vessel does not carry helicopters but the feasibility of temporary modifications are being examined.

The Weddell Gyre, a large clockwise-flowing oceanic feature in the central Weddell Sea, transports relatively warm saline Circumpolar Deep Water (CDW) from near the Antarctic Circumpolar Current to the south and west into the Weddell Basin. While this water mass, which cools and freshens as it flows away from the Weddell Gyre, is made up primarily of cool, lower CDW with a maximum temperature of about 0-4deg (the upper warmer CDW loses it identify as the mass cools and freshens), the water that flows southwest between the 3,000 metre high ocean floor feature Maud Rise and Antarctica is at a depth of more than 150 metres and warmer with a maxi-

imum temperature of about 1.0°C. Observations and the results of theoretical models suggest that the ocean in this region is only marginally stable.

Although surface waters appear to mix rapidly with deep waters, the flux of salt from the surface to deeper waters increases only slightly, either because it is lost or as ice forms or because surface waters receive only a limited amount of fresh water.

Water from the southern oceans surrounding Antarctica, particularly from the Weddell Sea region, has a critical role in maintaining the character of deep water throughout the world. In the mid-1970's a large polyna (lake-like area of open water that forms within the pack ice) developed in the central Weddell Sea, causing surface waters to mix with deeper waters and release vast amounts of heat to the atmosphere. This enhanced the cooling and ventilation processes that are necessary to produce Antarctic bottom water.

Identifying the mechanisms that control turbulent fluxes in the Weddell mixed layer is the key to understanding what conditions might again cause a phenomenon like the mid 1970 polyna and widespread convection. Learning more about the dynamics in this region may also be important to predicting the effects of climatic trends on ventilation of the deep ocean.

To obtain the necessary data, approximately 21 investigators participating in nine projects will be supported by the *R/V Nathaniel B. Palmer* for 70 days during the 1994 winter. These projects, make the ANZFLUX programme and are designed to acquire measurements that will extend to scientific understanding of the dynamics and thermodynamics of momentum, heat and salt flux through the upper ocean and its ice cover into the atmosphere. Two opposing theories based on observations and models that use data

obtained from arctic regions with similar conditions attempt to predict the magnitude of the heat flux in this region.

The most recent observations were made by investigators during the 1986 *Polastern* cruise and indicated that north and west of the Maud Rise (the "cold regime") heat flux is about 20 watts per square metre. This flux increases to about 40 watts per square metre to the south and east. They also found that there is a seasonal cycle, and greater heat flux activity during the winter. Using the experience gained in both the Antarctic and the Arctic, the group will record these data at the two drift stations and their immediate surroundings and from their results they hope to be able to provide a complete picture of upper ocean mixing.

At the conclusion of the voyage the *R/V Nathaniel B. Palmer* will return to Punta Arenas departing again on September 1 for the Ross Sea. On board will be a team of eight scientists lead by Dr Martin O. Jeffries, from the Geophysical Institute at the University of Alaska in Fairbanks.

During this 50 day cruise the snow cover characteristics on sea ice floes, ice-floe thickness, and the physical and structural characteristics of the Ross Sea in the late winter will be undertaken in order to define better how sea-ice types vary by geographical locations; how the processes in the antarctic ice pack are deforming it, and the large scale thermodynamics and heat exchange processes. Specific sea-ice characteristics will be related to the synthetic-aperture-radar (SAR) signatures observed from the Japanese JERS-1 satellite. These include snow cover characteristics (depth, temperature, density and stable isotopic compositions; and structural characteristics of ice (amounts of different types such as snow, ice, frazil, platelet or congelation). Because

different ice types result from variations in the conditions under which ice forms, the team will gain a better understanding of the sea-ice parameters and their geophysical controls by integrating their observations with SAR data analysis and modelling studies. The late-winter season is optimal for this work because the ice is at its maximum thickness and extent. The results derived from this programme will be useful in defining

the kind of air-ice-ocean interactions that can be studied using SAR data and will have broader relevance and application to atmospheric, biologic and oceanic investigations in the Southern oceans.

The party will disembark at Lyttelton where the vessel will pick up Dr Jeffries and his party for a repeat of his work in the Amundsen and Bellingshausen Seas.

ANARE sub Antarctic

Tracking albatrosses across southern seas

Graham Robertson, Australian Antarctic Division, Hobart, Henri Wiemerskirch, CNRS, France

Albatrosses' legendary flight capabilities are deeply entrenched in the marine folklore, courtesy of a 19th century fable, and the recollections of early mariners of the southern oceans. Birds could seemingly appear from nowhere over vast tracts of featureless ocean and follow ships in endless procession over windswept waters, only to disappear as mysteriously as they had arrived.

These days the mystery of the albatross is less shrouded, but their remarkable powers of flight and penchant for following ships remain. Compared to the early days though, there are few albatrosses wandering the Southern Ocean. Albatrosses catch prey near the ocean's surface and follow ships, behaviour that makes them vulnerable to commercial fishing fleets harvesting the same waters.

Commercial fishing-particularly the long-lining method where baited hooks are captured by albatrosses during long line deployment - is thought to be responsible for declining global

populations of several albatross species. The response of wildlife science and management agencies has been to combine attempts to modify commercial fishing practices, particularly their method of line deployment, with research on the foraging ecology and behaviour of albatrosses, so that the interaction between albatrosses and fishing fleets, and the periods of vulnerability in the bird's life cycle, can be understood.

Thanks to recent advances in satellite telemetry, this last point can now be addressed by putting tiny lightweight satellite-dedicated transmitters on the backs of albatrosses. Developed in the mid-1980's, satellite transmitters are a perfect tool for tracking the movements of albatrosses. The birds are large enough to carry devices, they frequent middle-to-high latitudes where satellite overpasses are relatively numerous, and their pelagic wandering are enormous.

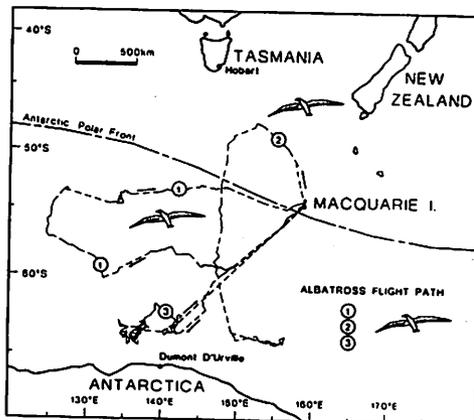
The most abundant albatross species in the Australian region of the Southern Ocean is the three kilogram light

mantled sooty albatross. It breeds in substantial numbers at Macquarie Island and is a bi-catch species of the long-line fishing method. To determine their foraging ranges, in November 1992, we deployed 30-gram transmitters on five light-mantled sooties during the incubation phase of their breeding cycle. To minimise transmitter weight battery size was reduced to the extent that units were powered for less than 28 days, equivalent to just two 10-14 day feeding trips while being relieved by partners of incubation duties. As it turned out, problems with the transmitters and predicted battery life meant we recorded only two complete trips and two partial trips, where batteries became exhausted while the birds were at sea.

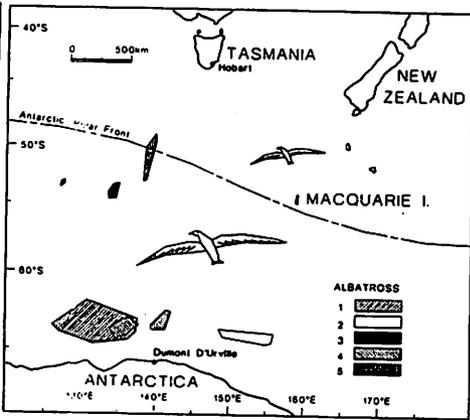
Even so, the results were spectacular. The two birds with complete tracks flew 6463 and 6975 km in ten and 15 days (see figure). These birds exhibited

two different patterns of flight, commuting flight where over two to four days they flew at great speed to particular areas of the ocean, and foraging flight, where birds spent between three and 11 days "working" an area before returning to Macquarie in less than two days' flying time. When commuting, they average 37km/hour and peaked at 84km/h and stopped flying for only a few hours at night. When foraging the birds continuously changed direction and flew more slowly, about 13 km/h on average, as they presumably searched for food. (Albatrosses feed mainly on live squid by diving into the surface layers of the water, and on dead squid floating on the surface.)

Perhaps the most interesting finding was where albatrosses flew to feed. Most birds foraged in Antarctic pelagic waters up to 2200 (average of all birds: 1721) from Macquarie Island in a south-westerly direction and adjacent to the



Map 1: Flight paths of three light-mantled sooty albatrosses on foraging flights from Macquarie Is. The transmitter battery for bird 2 failed at sea; hence the return track to the island is not shown. The long, looping flight path of the same individual probably reflects the interplay between wind direction when the bird left the island



and albatrosses' great flight capacity. Transit flight is energetically inexpensive, and time spent on the wing may profitably be spent seeking floating food items before reaching distant foraging waters. Map 2: The main foraging locations for five light-mantled sooty albatrosses. Drafting J Cox

Antarctic continent (see figure). The wind direction in the mid-latitudes is predominantly westerly, and to reach Antarctic waters and return in time to relieve their mate from incubation duties light-mantled sooties had to fly in cross winds, occasionally against the wind, and with a tail wind when returning to Macquarie. Light mantled sooties are small albatrosses about a third the weight of wandering albatrosses, yet their speed on transit flights exceeds that of the wanderer. Their tendency to spend much of their time across and down wind may explain their remarkable airspeed and their ability to exploit feeding zones great distances from their nesting sites. (Distant foraging waters may also minimise competition with other albatross species in waters near Macquarie).

The study has several spin-off for conservation. First, although light mantled sooties breed in the subantarctic they appear to rely, at least during incubation, on Antarctic resources. Consequently, protecting the birds' breeding site or the 200 nautical mile economic zone around that site from human activities will not necessarily protect long-ranging bird species like light-mantled sooties.

Second, if our results are typical for light-mantled sooties during incubating, the birds during this stage of the breeding cycle would be unlikely to encounter long-line tuna fleets, since that fishery is largely restricted to waters north of 50deg S. Nonetheless our sample size was small and our study was restricted to a two week period. An expanded study is needed to examine between-year differences in foraging ranges and to assess foraging ranges at other stages of the birds' breeding cycle.

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First Antarctica Lodge, Little America

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Until the recent publication of Eugene Rodgers' (1990) account of Rear Admiral Richard E. Byrd's 1928-30 Expedition to Antarctica it was not widely known that the leader relied heavily on the staunch loyalty of Freemasons for its success. What is even less known was that Byrd's second expedition (1933-35) was equally reliant on his Freemason personnel, and, to some extent, these could be considered as Masonic expeditions - the first and last (as far as is known) of their kind to Antarctica.

Despite their scientific achievements, Byrd's two expeditions to Antarctica were fraught with problems and somewhat sinister actions. These have been admirably researched and recounted by Rodgers (1990) in his analysis of Byrd's personality. Byrd was obsessed with loyalty and a fear of mutiny, had a rather secretive nature and was often suspicious of many of his expedition members. His behaviour was sometimes paranoid. When circumstances became difficult he often became emotionally isolated and insecure.

Byrd was a devout Freemason and he recruited many fellow Masons whom he knew he could trust. At least 14 members of his first expedition and 13 members of his second expedition were Masons (see Table 1). However, while there was nothing unusual in selecting his expedition members for this reason, Byrd's obsession for loyalty led him to

indulge in a rather bizarre ritualistic behaviour which is clearly documented by Rodgers (1990), (p. 144-146). Byrd appears to have had a particular relationship with the younger expedition members and, whether they were Masons or not, he succeeded in inducting several of his team at Little America Station into a self-designated fraternity which he called the "Loyal Legion". According to Rodgers, Byrd's induction of Paul Siple invited him "to join a fraternity, the purpose of which is to ensure, as far as possible, that neither now nor in civilisation any person or persons in the expedition be permitted to be disloyal or mutinous." In other words, that you join with me in trying to prevent the spirit of loyalty of the expedition from being lowered by disloyal, treacherous or mutinous conduct on the part of any disgruntled members. No one but myself will know who the other members are until we return to civilisation, when at some suitable time, in my home, they will be made known to each other.

The oath of this secret brotherhood was strongly influenced by Masonic traditions. In this way several young members were indoctrinated (E.J. Demas, F.E. Crockett, J. De Ganahl, C.F. Gould and possibly K.F. Bubier, E.E. Goodale and C.E. Lofgren), while A.H. Clarke refused Byrd's propositioning. This combination of Freemasons and "Loyal Legionnaires" appears to have given Byrd a greater degree of security, at least during his first expedition.

During his second expedition to Little America Byrd again relied on the trust he held for his fellow Masons, although details are less well documented. There is no mention in any of Byrd's published personal accounts (Byrd, 1930, 1935, 1938) that any of his expedition members were Freemasons. Similarly, there is no reference to this in the Expedition's "newspaper," *Little America Times* (Horowitz, 1933-35). However, it is on record (Anon 1935) that, on the final day of his second expedition, 5 February 1935, on

Table 1. Freemason members of Byrd's First and Second Antarctic Expeditions

<u>1928-30 Expedition</u>	<u>1933-35 Expedition</u>
R.E. Byrd	R.E. Byrd
B. Balchen	L. Barter
Q.A. Blackburn	Q.A. Blackburn
R.G. Brophy	L. Clark
G.L. Brown	J.M. Gillies
(Captain, <i>Eleanor Bolling</i>)	H.F. Gjortson
K.F. Bubier	H.I. June
C.E. Lofgren	G. M. Mitchell
A.C. McKinley	I.S. Oretiz
F.C. Melville	R.E. Round
(Captain, <i>City of New York</i>)	O. Schonyon
A.N. Parker	J.S. Sisson
B. Roth	F.C. Voight
J.T. Rucker	
S.A. Strom	
G.W. Tennant	

board *Jacob Ruppert*, 13 Freemasons held a special meeting to open Antarctica's first Freemason's Lodge. The expedition's station Little America, inland from Bay of Whales, western Ross Sea, was closed on 5-6 February by the expedition members and men from the two ships *Bear* and *Jacob Ruppert* Byrd (1935, p.382) recorded "All the night of the 5th [February] and into the morning of the next day the *Bear's* splendid crew, assisted by Innes-Taylor, Poulter and a few hands from the *Ruppert*, laboured to clean out the cache..... About 8 o'clock [0800hr 6th February] the *Bear* cast off and steamed out of the Bight [Bay of Whales] out to tranship cargo, in the lee of the Barrier".

During that evening the group of Masons attended the first meeting of First Antarctica Lodge No. 777, New Zealand Constitution. Nine different jurisdictions from four countries were represented (see Table 1 and Fig 2). The minutes of the meeting read as follows:

"5 February, 1935

Minutes of the First Antarctica Lodge No. 777, held in the mess-room of the Expedition Ship *S.S. Jacob Ruppert* at the Ice Barrier Ross Sea, Lat. 78-deg - South, Long. 173-30 West on Feb.5 1935

The lodge was tyle at 9.30 p.m., the following officers and brethren being present: Wor.master, Bro. G.M. Mitchell, Warren Amesbury, Mass., U.S.A., and Masters 161 N.Z.; Sen. Warden, Bro., J.G. Sissons [sic], Mokoia No. 213, Wellington N.Z.; Jun. Warden, Bro. H.J.F. Gjortson, St. Olaus fil de tre Soiler, Norway; Sec'y Bro. R.E. Round, Canterbury, Kilwinning 23, Lyttleton, N.Z.; Sen. Deacon, Bro. J.M. Gillies, Lilley Ellis 3236, Birkenhead, England; Jun. Deacon, Bro. F.C. Voight, Overseas No. 40, Providence, R.I., U.S.A.; In.Guard, Bro. I.S. Ortiz, Union 31, New London, Conn., U.S.A.; Chap., Bro. L.L. Barter, Acacia No. 9, Lawrence, Kansas, U.S.A.; Tyler, Bro.

First page of the Attendance Book, First Antarctica Lodge, No. 777, New Zealand Constitution, Little America, 5 February 1935

Attendance BOOK. 1st Antarctica Lodge - No 777 N.Z.C. Little America.

--- FEBRUARY 5th --- 1935 ---
 G.M. Mitchell W.M. Warren Amesbury Mass Masters 161 N.Z.
 J. Sissons S.W. Mokoia No 213 Wellington N.Z.
 H.J.F. Gjortson J.W. St. Olaus fil de tre Soiler, Norway.
 R.E. Round Sec. Cant. Kilwinning No 23 Lyttleton N.Z.
 J.M. Gillies S.D. Lilley Ellis 3236. Birkenhead England.
 F.C. Voight J.L. Overseas 40 Providence R.I.
 I.S. Ortiz I.G. Union 31 New London Conn.
 L.L. Barter Chap. Acacia 9 Lawrence Kansas.
 R.E. Round Name Lodge 454 N.Y. City.
 Harold J. Jones Name Lodge 454 N.Y. City.
 Jun. G. (Kilwinning) H. John's Lodge 29 Scott, Washington.
 G.H. Nicholson St. John's 24 Dept. Auckland New Zealand.
 Lewis Clark Name Lodge 454 N.Y. City.

Q.A. Blackburn, Steward, Bro O. Schonyan, St. John No. 94 Lodge, Invercargill, N.E.; Bro. R.E. Byrd, Kane Lodge No. 454, New York City, U.S.A.; Bro. H.L. June, Kane Lodge No. 454, New York City, U.S.A.; Bro. L. Clark, Nassau 536, Brooklyn, U.S.A. [the latter three being members while the others were officers].

Lodge was opened in the First Degree, and as this was the first and presumably the only meeting of the Lodge, the Secretary reported that there was no correspondence requiring attention. The Wor. Master, Bro. G.M. Mitchell, then delivered a lecture on 'The first Degree Tracing Board' from the Ritual of the Grand Lodge of Massachusetts, U.S.A. Fraternal greetings were then offered, by each brother present on behalf of his mother lodge. The lodge was closed at 10:30 p.m. and at the request of Bro. Junior Warden, all the brethren remained to partake of some refreshments.

Toasts were proposed during the evening honouring the countries of the attending brothers. Thus honoured were King George V, King Hakon of Norway and President Franklin D. Roosevelt. This last toast was proposed by Bro. R.E. Byrd, leader of the expedition.

The meeting closed with a vote of appreciation to the wives of Wellington N.Z. brethren who provided the refreshment to be partaken of at this South Pole meeting''.

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Vaughan expedition

The Mount Vaughan Antarctic Expedition has suffered a major set back. The DC-6 aircraft chartered by the expedition from Allair Air Transport crashed while landing near Patriot Hills on November 27. Aboard were the expedition's fuel supplies and the 20 dogs, dog handler, veterinarian, a radio operator and a crew of four. Only the radio operator, named as George Menard from Talkeetnae, was injured. He suffered a broken leg, was treated at Patriot Hills and evacuated. Since then the party has been returned to Punta Arenas by the South African Hercules, chartered for the summer by ANI to support its summer operations.

At the time of going to press plans for the future of the expedition are uncertain.

The expedition, which aimed to cover the 500 miles from Patriot Hills to Mount Vaughan had already been scaled down. Shortage of money and time were cited as the main reasons. Vaughan, a member of 1928-29 Byrd expedition, had hoped to climb the mountain named for him on his 88th birthday.

It now seems likely that the expedition will take place in a scaled down form in January. Vaughan is expected to be accompanied by two guides and a National Geographic Film Unit crew for the summiting of the mountain. According to expedition headquarters in Anchorage it now seems unlikely that transportation will be available for the go dogs and rest of the team members.

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