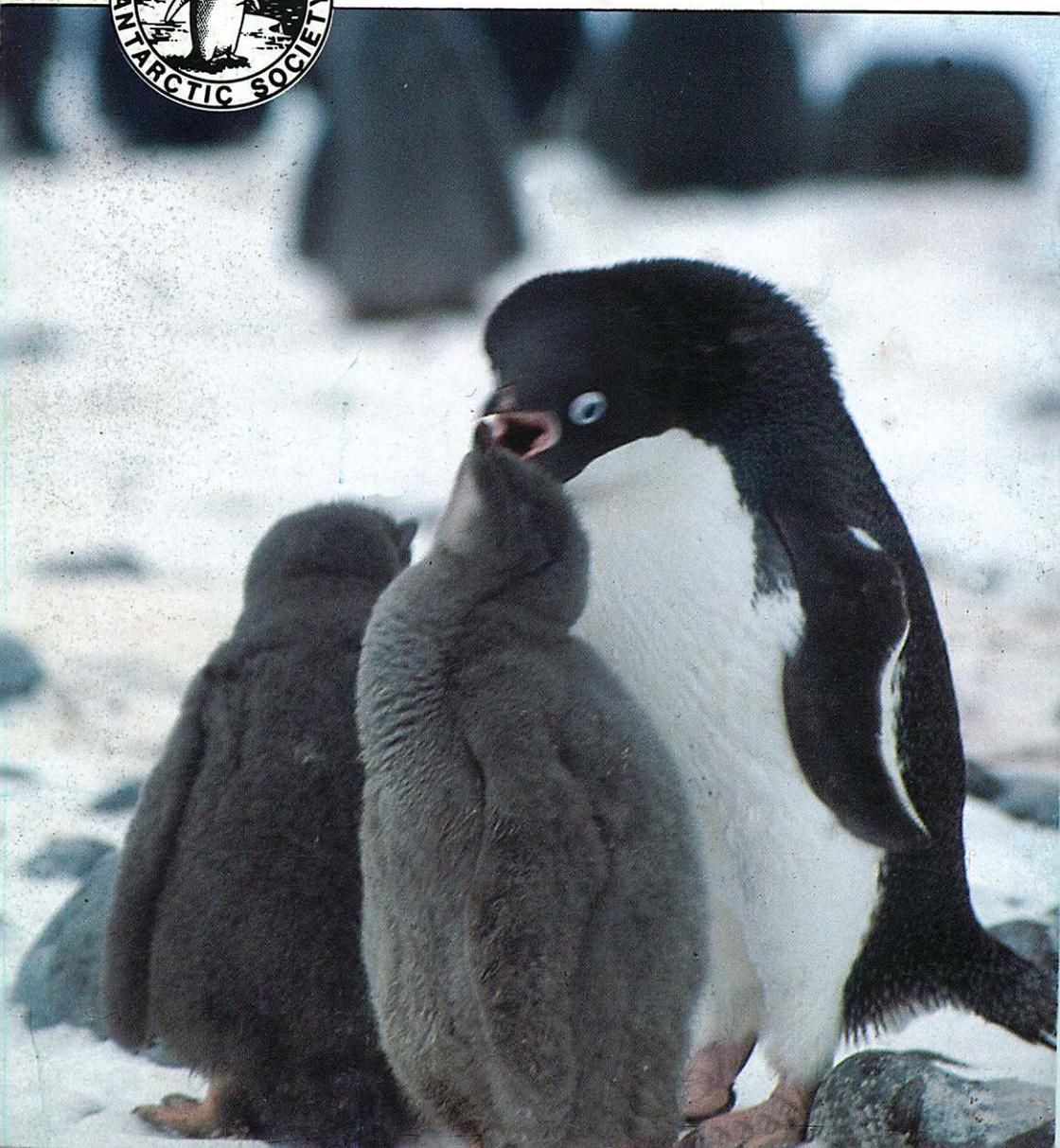


# ANTARCTIC



Bulletin Vol 13. No. 12, December 1995





# ANTARCTIC



Cover: Adelie Penguin feeding chick. Photograph courtesy of NZAP.

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# INTERNATIONAL

## CAPE ROBERTS ON TRACK

The multinational Cape Roberts project to core the oldest strata in the Ross Sea sedimentary basins is on track to begin drilling in October 1996, according to project manager Jim Cowie, the man in charge of the complex and tightly scheduled logistical task.

The project team hopes to repeat last January's successful unloading onto sea ice off Cape Roberts of 280 tonnes of equipment from the Italian ship *Italica* during a similar exercise this coming January.

The equipment is all part of creating a 'mini-Scott Base' at Cape Roberts, which includes a desalinating plant supplying water all through the camp buildings.

January's equipment drop will see the rest of the drilling gear delivered including the rig which was constructed in Christchurch by Southern Cross Engineering. The drilling rig equipment includes a sophisticated mud system that will be critical to the success of the project.

The mud system is a key part

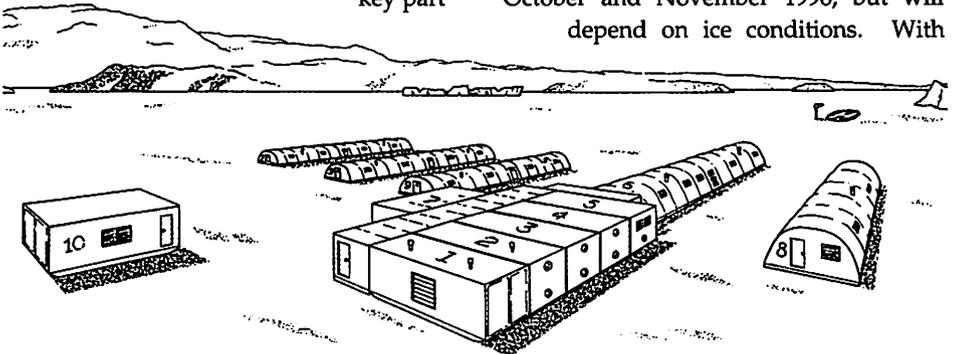
of the Cape Roberts project's heavy emphasis of environmental sensitivity while drilling, says Mr Cowie.

The *Italica* will also be delivering the remaining converted containers. Each container, specially converted by another Christchurch firm — Dawn Construction, has a purpose built sledge which enhances speed of unloading and transportation.

Mr Cowie will fly down for the unloading and hopes ice conditions permit successful unloading of the equipment, although other more complex delivery options are available.

In addition to the 280 tonnes dropped last January, the project's science operations manager Alex Pyne led a four day tractor train with D4 and D5 Caterpillar bulldozers from Scott Base to the site over the sea ice in October. His team undertook a trial set up of the Cape Roberts camp which went very smoothly, says Mr Cowie.

Drilling is planned to commence in October and November 1996, but will depend on ice conditions. With



around 35 top international scientists involved in the project Mr Cowie is hoping a start can be made on time otherwise the project may be delayed a year.

Antarctic will report on the progress of the *Italica* shipment in our March edition.

### WHAT IS THE CAPE ROBERTS PROJECT?

The Cape Roberts Project is a cooperative venture between scientists, administrators and Antarctic support personnel from 5 countries — Britain, Germany, Italy, New Zealand and the United States of America.

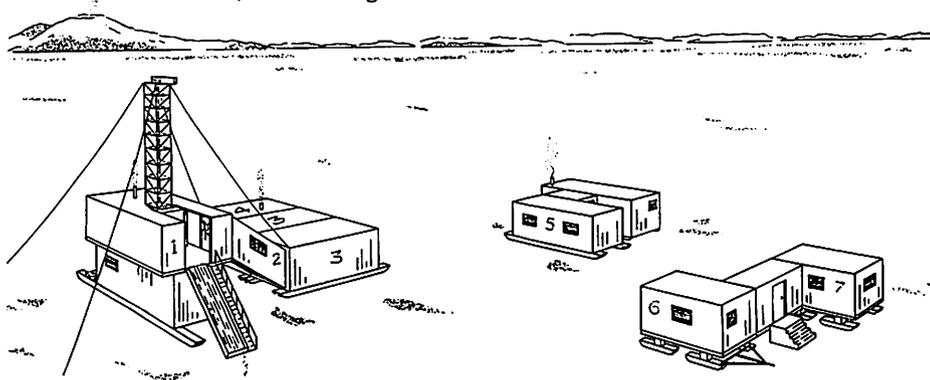
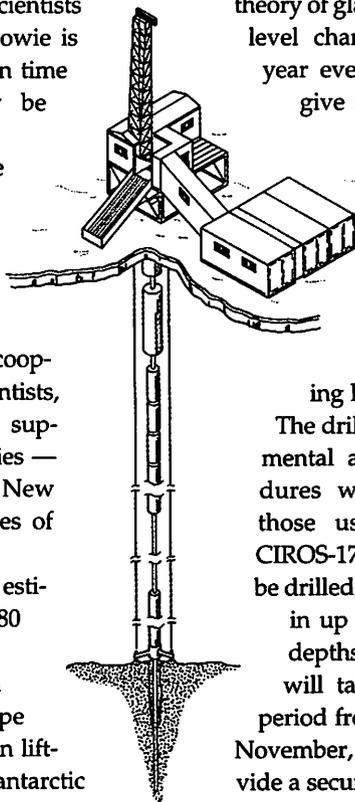
The strata being drilled are estimated to be between 36 and 180 millions years old and lie just beneath the sea floor at a unique location off Cape Roberts, where they have been lifted up by the rising Transantarctic Mountains and exposed by erosion.

The core will be used to address two major problems. It will contain the most direct and accessible record of Antarctic climate and ice sheets (if they existed) for testing the

theory of glacially induced global sea level changes for pre-40 million year events. The core will also give the age and tectonic setting for the initiation of rifting to form what is now the West Antarctic Rift System, whose western margin is the Transantarctic Mountain Front, separating East and West Antarctica.

The drilling system and environmental assessment/safety procedures will be developed from those used in the drilling of CIROS-170km South. Holes will be drilled from the 2m thick fast ice in up to 400m of water and to depths of up to 400m. Drilling will take place over a 40 day period from early October to mid-November, when the fast ice can provide a secure drilling platform.

The project will involve scientific and logistic input from several countries, and will provide further experience in scientific drilling for the investigation of the glacial and tectonic history of Antarctica.



## CAPE ROBERTS PROJECT TIMETABLE

### 1995

January First material shipped to Cape Roberts.  
August Meeting of ISC to review science programme and personnel.

### 1996

January Final shipment of equipment to Cape Roberts.  
August 25-30 Advance party on Winter fly-in to check sea ice. If OK they travel to Cape Roberts to set up camp and rig for drilling.

October 5 to  
November 20 First drilling season

### 1997

February Publication of Initial Report  
August Workshop to review scientific results, and prepare for second drilling season.

August 25-30 Advance party on Winter fly-in to check sea ice. If OK they travel to Cape Roberts to set up camp and rig for drilling.

October 5 to  
November 20 Second drilling season.

### 1998

January Removal of Cape Roberts camp and review of area for compliance with Comprehensive Environmental Evaluation

February Publication of Initial Report

August Workshop to review results from both seasons, and finalize their publication.

## ANI CELEBRATES 10 YEARS

1995 marks the 10th Anniversary of Adventure Network International's (ANI) operations in Antarctica.

"I feel we have come a long way since those early days and have grown into a reputable and respected company. To date we remain the only private company in the world offering flights and programs to the interior of Antarctica", says ANI Managing Director, Ms Anne Kershaw.

ANI will be operating 2 Twin Otters, 1 Hercules C130 and ANI's Cessna 85.

Programmes they will be involved with include:

- Vinson — Erehard Loretan (Swiss) who has just completed his 14th 8000m will guide a group for ANI as part of the 10th Anniversary celebrations. Doug Scott (UK) will do the same.
- Emperor Penguins — The company will run 2 trips to Emps this year with Frank Todd as ornithologist.
- Expeditions — Roger Mear (UK) and his Footsteps of Scott Expedition

- 1985/87 will travel overland from Berkner Island via the South Pole to the Ross Sea and exit the continent by cruise ship.
- Borge Ousland (Norway) will travel on the same route as Roger Mear at a different time. Borge travelled solo unsupported to the North Pole in 1994/95.
  - David Hempleman-Adams will travel overland from Hercules Inlet to the South Pole. He travelled to the North Magnetic Pole in 1990.
  - Marek Kaminski (Poland) will travel from Berkner Island to the South Pole. Marek reached the North Pole with a partner in May this year.
  - Bernard Voyer (Canada) will travel overland from Berkner Island to the South Pole with T. Petry. They have travelled extensively in Greenland.
  - Chilean Mountain School — will travel overland from Patriot Hills to the South Pole.
- ANI will also offer support to the Chilean FACH and perhaps the Uruguayan Air Force for their personnel to stay at Patriot Hills.
- As part of their anniversary celebrations ANI will also take four children to Antarctica as guests. They will learn about the continent, the environment and politics. They are all underprivileged children between 13 and 15 years old.

## INTERNATIONAL EVENTS

### 1996

- 25-29 March — **Second Environmental Monitoring Workshop.** College Station, Texas, USA.  
 Contact: Dr. M.C. Kennicutt II, Geochemical and Environmental Research Group, 833 Graham Road, Texas A&M University, College Station, TX 77845, USA. Telephone: 409-690-0095; Fax: 409-690-0059. Email: mck@gerg.tamu.edu
- 30 June-5 July — **Fifth Quadrennial Conference of the International Organization of Paleobotany.** Santa Barbara, California.  
 Contact: S.J. Vito, Campus Conference Services, Santa Rosa Hall, University of California at Santa Barbara, California 93106-6120, USA.
- 1-4 July — **International Polar Desert Ecosystems Symposium/Workshop.** Christchurch, New Zealand.  
 Contact: The Secretary, Polar Desert Symposium, NIWA, PO Box 8602, Riccarton, Christchurch, NZ. Telephone: 64-03-348-8987. Fax: 64-03-348-5548. E-mail: carol@chch.niwa.cri.nz

#### *Description*

Research efforts from several nations are currently being focused on ice-free polar desert ecosystems. This symposium is aimed at providing a venue for international exchange of ideas and reporting of research progress, in this sensitive area of our planet. It is intended that a symposium volume will be produced, entitled Polar Desert Ecosystems. Ice free polar deserts are among the most extreme deserts on earth, and life is geared to water

available from the brief summer glacier melt and the moisture from the minimal precipitation. These deserts are located in areas highly sensitive to global atmospheric change. For instance, very small changes in temperature will greatly affect moisture available as water changes from solid to liquid phases and springtime depletion of ozone has increased UV<sub>B</sub> dosage. Human habitation in these deserts represents significant environmental concerns with the new Antarctic Treaty Environmental Protocols.

**Symposium Topics:**

- Polar lakes
- Polar desert streams, Soil structure
- Terrestrial and aquatic microbiology
- Influence of UV-radiation
- Factors influencing glacier melt
- Regional climate and climate change
- Adaptations to cold temperature
- Salinity and desiccation

12-15 August — **International Symposium on Representation of the Cryosphere in Climate and Hydrological Models.** Victoria, British Columbia, Canada.

Contact: The Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK.

14-16 August — **XXIV SCAR Meeting.** Cambridge, UK.

2-6 September — **Third International Penguin Conference.** Cape Town, South Africa, 2-6 September 1996.

Contact: John Cooper, E-mail: jcooper@botzoo.uct.ac.za, African Seabird Group, PO Box 34113, Rhodes Gift 7707, South Africa.

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## **HALL LEADS SEVENTH EXPEDITION**

Well known Christchurch mountaineer Rob Hall is undertaking his seventh expedition to the Antarctic this season.

He will led the fifth expedition of Christchurch based adventure tours operator Adventure Consultants Ltd to the Ellsworth Mountains.

The December expedition will fly to the east side of the Sentinel Range, establishing a base camp on the Crosswell Glacier.

The four person team will first climb Vinson Massif and then attempt Mt Tyree, the two highest peaks on the con-

continent. No ascents of these peaks have been made from the eastern side so if successful the climbers will pioneer new routes on both of them. Mr Hall has reached the summit of Vinson Massif on four previous occasions via the Branscomb Glacier from the west.

Logistics for the expedition will be provided by Adventure Network International with access to the continent from Punta Arenas to the ANI camp at Patriot Hills by Hercules aircraft and the final leg to the mountain by lighter ski-equipped aircraft.

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# NATIONAL PROGRAMMES



## NEW ZEALAND

### NEW ERA IN NEW ZEALAND'S ANTARCTIC INVOLVEMENT

New Zealand Prime Minister Jim Bolger's announcement of the formation of a New Zealand Antarctic Institute at the recent Deep Freeze celebrations in Christchurch heralds a new era in the country's Antarctic research programme.

Due to begin operation from 1 July 1996, the new institute will be created from the merger of the New Zealand Antarctic Programme (NZAP) and the Ross Dependency Research Committee.

The new entity will be an independent Crown institute structured along the lines of a private sector company with a chief executive who is responsible to a board of directors and chairman.

Various sources have indicated support for the concept. Although details are yet to be confirmed it seems that the new body will provide a clearer definition of who is responsible for Antarctic policy and operations in New Zealand.

Although the government decided not to make funding of Antarctic operations contestable it is clear from the new commercial structures being used that Cabinet wants a change in culture and greater value for its money.

Formal details of the institute are yet to be announced but will be released before Christmas, says the Ministry of Foreign Affairs Antarctic Policy Unit director Stuart Prior. *Antarctic* will carry full details of the new institute in its March issue.

*Extracts from Prime Minister's Bolger's announcement:*

"In 1988 I was privileged to be given the opportunity to visit Antarctica.

That visit had a lasting impression on me. I found its scale impressive and the scenery not boring but stunning.

I will return at the first opportunity.

In Antarctica the world has a unique and quite irreplaceable opportunity to avoid the destruction and exploitation of the environment that has often followed the explorers.

What scientific research is revealing in Antarctica is turning out to be of critical importance to the future of the planet.

For many people, Antarctica has become synonymous with wider environmental awareness because of issues such as:

- the remarkable findings on the depletion of the ozone layer above Antarctica;
- the debates over the implication of global warming on the Antarctic ice-cap which contains 70 per cent of the world's fresh water; and
- the realisation that human impact can have a devastating and lasting impact on the fragile ecology of Antarctica, for example, in the form of oil spills.

And I don't need to remind you of the huge influence Antarctica has on our own weather.

My Government is wholly committed to continuing an active Antarctic pro-

gramme that will demonstrate New Zealand's continuing interest in Antarctica and promote those essential values that New Zealanders hold dear.

Late last year my Government directed that a review take place covering our interests and activities in Antarctica.

The review, which has recently concluded, looked at our Antarctic goals and the organisational structure of our Antarctic programme.

It considered how best to build on our past achievements and to encourage continuing strong links with our partner the United States and other nations working in the Ross Sea region.

(The Cabinet) reaffirmed that our national vision for Antarctica, as we look ahead into the next century, is the conservation of the intrinsic values of the continent and the Southern Ocean for the benefit of the world community and for present and future generations of New Zealanders.

We agreed that this vision should be

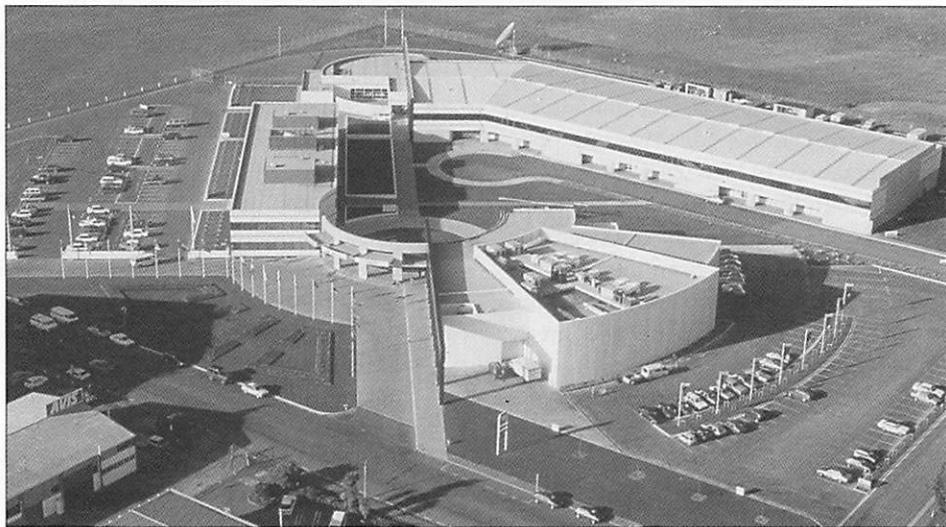
reflected in active and responsible stewardship of Antarctica through an innovative and forward-looking national Antarctic programme conducted for scientific and peaceful purposes in accordance with the principles of the Antarctic Treaty System.

I am pleased to announce that the key outcome of this review is that my Government has decided in principle to establish an independent New Zealand Antarctic Institute here at the Antarctic Centre.

The new Institute, which will be a separate Crown Entity, will manage the New Zealand Antarctic programme and incorporate the functions of the Rose Dependency Research Committee.

It will become the focal point catalyst for our national and international activities in Antarctica.

It will enable Christchurch to build further on its status as the leading Antarctic gateway city."



*The New Zealand Antarctic Institute will be based at the International Antarctic Centre in Christchurch. Photograph courtesy of NZAP.*

## SCOTT BASE STAFF FOR 1995/96

### Senzrep

Malcolm Macfarlane/Peter Brookman

### Operations Support Manager

Rex Hendry

### Senior Comms Operator

Keryn Evison

### Comms Operator

Sharon Taylor, Sandra Restieaux

### Field Training Inspector

Jo Haines

### Science Technician

David Hornstein\*, Robyn Holland

### Field Support Officer

Jim Henderson \*

### Engineering Services Manager

Ron Rogers\*

### Base Engineers

Steve Harry\*, Steve Palmer\*

### Mechanic

Ron Rogers\*, Jeremy Ridgen

### Electrician

Mike Pahl\*

### Carpenters

Richard Struthers, Peter Walton, Mike

Brophy

### Plant Operators

Murray Knox, Maurice Davis

### Telecom Technician

Eric Trip\*, Cary Grice

### Canteen Engineer

Shaun Smith

### Chef

Stewart Hopkins\*

### Kitchenhand

Ray Ellis

### Cargo Handler

Jon Stewart

### Base Support Officer

Robyn Holland\*

### Domestic

Alana Muir\*, Jacqui Unwin

### Base Services Officer

Gordon Martin

\* *Winter over staff*

## RESEARCH AT THE LAST FRONTIER

Spare a thought for those New Zealand scientists currently stationed in Antarctica where temperatures have reached as low as —50 degrees Celsius recently.

Researchers from the National Institute of Water and Atmospheric Research (NIWA) have been camping in tents about 100 km from Scott Base in the Dry Valleys.

These ice-free oases covering 4800 square kilometres are one of the most harsh and unusual environments on earth.

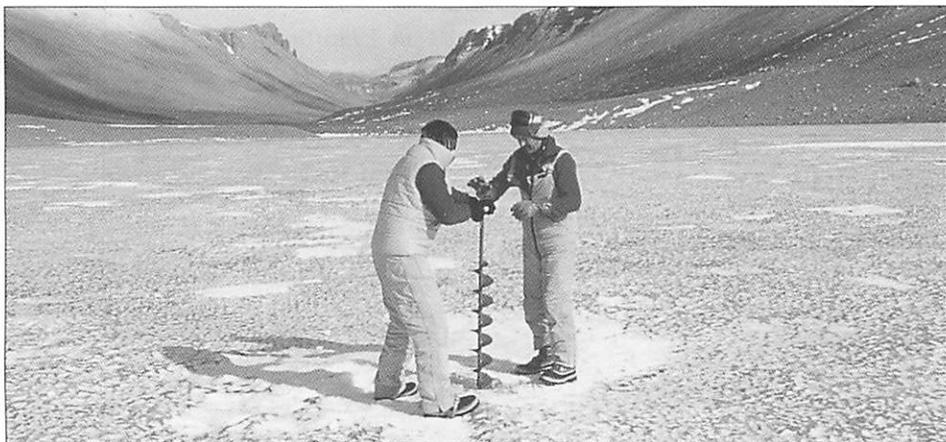
Scientists believe the Transantarctic Mountains, inland of the valleys, have risen at such a rate that the Antarctic ice cap — interwoven glaciers radiating out

from middle of the continent — has been prevented from flowing to the sea.

It hasn't rained in this environment for over two million years and any snow that falls is quickly blown away by the strong winds that race through the valleys each day.

The cold, dry desert environment is similar to what might exist on other planets and the dominant life form — cyanobacteria slimes — are like the organisms which began life on earth.

The scientists are studying how the return of sunlight in spring might trigger the primitive plants into activity. Results to date suggest that they may remain active through the four months of winter darkness, somehow gaining



*NIWA biologists drilling the frozen cap of Lake Vanda in the Dry Valleys.*

energy from chemical processes deep in the lakes. Despite being covered by four metres of ice scientists have found the temperature near the bottom of Lake Vanda, 70m metres deep, can reach a warm 22 degree Celsius through a glasshouse-type effect.

The NZAP will support a Victoria University science party looking at the quantity and quality of UV light reaching the ice, and thereby contribute to studies of the ozone hole's effects on plants and animals.

In the biology field, a team from Landcare Research will conduct aerial surveys and ground studies of Adelie penguin colonies, as a possible indicator of environmental change. Similar studies on the Antarctic Peninsula by British researchers, and by scientists in Australian territory, suggest changes to sea ice and ocean currents due to warming temperatures may be affecting the penguins' krill food supply and breeding success.

Scientists from both Canterbury and Auckland Universities will look at the

ways Antarctic fish have adapted to living below the sea ice, at temperatures where ice would form in the blood of other animals. Natural antifreeze and reduction in the amount of haemoglobin in the blood are some of the ways they have found to cope. The Sea will also come under the research spotlight: from its molecular structure to the remote sensing of iceflows from satellites. Industrial Research Limited are interested in the process by which sea ice doubles the size of Antarctica over winter, breaks up by mid summer and exercises a major bearing on the climate of the southern hemisphere.

Several projects will investigate the impacts of human presence on the Antarctic environment. These include an Institute of Environmental Science and Research study on the effects of oil on permafrost soils and related works by Landcare Research on whether microbes resistant to such spills could have future biological clean-up application.

*By Tim Higham, New Zealand Antarctic Programme.*



## AUSTRALIA

### ANTARCTIC SCIENTISTS INVESTIGATE PENGUIN DEATHS

Australian scientists monitoring an Adelie penguin colony at Bechervaise Island in Antarctica are seeing two- to three-week-old chicks dying at the rate of 50 a day in what appears to be due to a natural fluctuation in the availability of their major food source, krill.

The effects of this phenomenon are being evaluated by Antarctic Division scientists, in the fifth year of a long-term monitoring program at the penguin colony, located near Australia's Mawson station. Their innovative automated recording system weighs the penguins and records the direction and time at which birds move to and from their breeding colony. The system has provided very good long-term information on this population, with minimal disturbance to the birds, and provides the best tool that scientists have of monitoring such dramatic fluctuations in penguin numbers.

"The Adelie penguins' ability to successfully rear their chicks depends largely on how difficult it is to catch food", said Dr Knowles Kerry, the program's chief investigator. "Last year the parents from this colony spent between 7 and 30 hours on a foraging trip; this season they are away 7 days or more and are coming back empty. Satellite tracking has also shown that they are foraging further afield."

"Only 126 of the 1800 chicks hatched now remain. This failure is apparently due to a natural shortage in food availability, and not to any human interference. There has been no harvesting of krill or fish in this area for the last five years."

Australian scientists studying other Adelie penguin colonies near Davis and Casey stations report a normal survival rate in their chick populations. However, scientists at the French station Dumont d'Urville are reporting a similar failure of Emperor penguin chicks.

Antarctic Division scientists will now survey other more remote Adelie penguin colonies in the Mawson and Davis region, and will also investigate populations of Emperor penguins.

Natural fluctuations in local populations of plankton and predators have been observed commonly in most regions around the Antarctic and are thought to be related to large-scale ocean current changes.

Early last year a similar phenomenon was noted in bird species around the South Atlantic island of South Georgia, where the populations all suffered from a lack of krill. In that case the abundance of krill was restored later in the season.

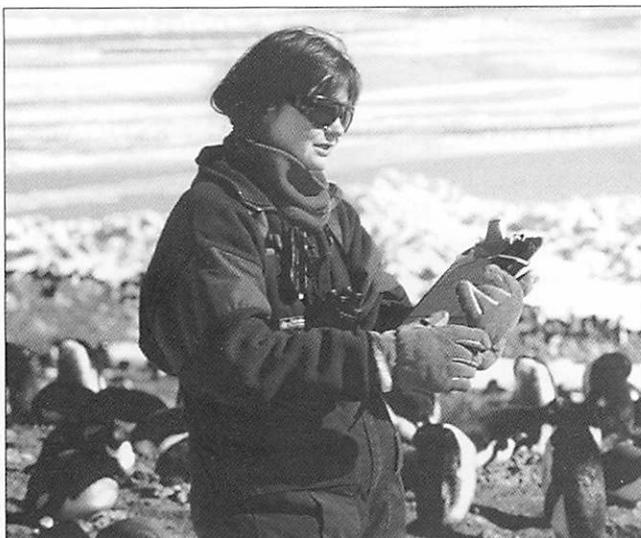
"We don't know why such huge oceanographic shifts occur. But the Southern Ocean is one of the world's major ecosystems and we are working to understand the effects of global and local change on its environment and on the animals that live there", said Dr Stephen Nicol, Biology Program Leader at the Antarctic Division.

"We can learn a lot from this particular failure, sad though it is. The colony will recover, and the Adelie penguin, with a world-wide population of over 2 million pairs, is of course a common and long-lived species-so this poses no threat to

their Antarctic population. But we are presented with the opportunity to study an event that simulates heavy fishing, and the removal of the penguins' food supply."

The Antarctic Division's Adelie penguin monitoring research program is tailored to the goals of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), part of the Antarctic Treaty system. The primary objective of the Convention is to conserve the marine species

that are harvested in Antarctic waters, as well as all organisms dependent on them. CCAMLR's Ecosystem Monitoring Program (CEMP) aims to detect changes in the condition, abundance and distribution of Southern Ocean animals that are not commercially harvested, but that are dependent on those that are, such as krill.



*Cambridge University biologist Fiona Hunter recording Adelie penguin behaviour. Photograph courtesy of Tim Higham, NZAP.*

As it is not practical to attempt to monitor all the animals and their interactions, species like the Adelie penguin, that are particularly sensitive to changes in food availability, have been selected for monitoring.

*Supplied by the Australian Antarctic Division.*

## FIRST EVER WINTER VOYAGE TO ANTARCTIC A GREAT SUCCESS

The Antarctic icebreaker, *Aurora Australis*, returned to Hobart on 2 September 1995 following a very successful first ever mid-winter voyage to Antarctica.

Important to the success of the voyage was the cooperative planning and execution of the research program, that used both oceanographic and sea ice research techniques to examine a large area of sea ice and the water beneath it. Throughout winter, the sea ice encircling Antarctica expands to a total of 20 million square

kilometres-almost doubling the size of the continent.

Climate models have indicated that effects of the greenhouse induced global warming on physical and biological systems, may be amplified in the polar regions.

Sea ice is known to be one of the key links between the deep ocean and the atmosphere. It plays a crucial role in many of the meteorologic, oceanographic, biologic and sedimentologic processes in the Southern Ocean. The voyage was neces-

sary to find out how significant sea ice is in this linkage and its role in climate change.

Voyage leader and chief investigator, Dr Ian Allison, said "The voyage was an outstanding success. The research program went better than our wildest expectations."

One of the objectives of the voyage was to investigate the processes of sea ice growth during the winter, and hence to determine the rate of ice growth. Unlike ice in an ice-tray in a refrigerator, Antarctic sea ice does not grow only by slow steady freezing. Sea ice can grow from the aggregation of small crystals that form rapidly in the upper layers of the ocean when open water is exposed to the cold air. Or it can grow by slow direct freezing on the base of an existing floating ice sheet. Scientists can tell from the crystal structure of the ice whether it has formed rapidly in open water, or by slow bottom freezing. Samples analysed on this voyage show that both processes are equally important.

Scientists on the voyage also discovered for the first time that both growth

processes occur in episodic spurts. These are related to the passage of synoptic low pressure systems every 3 to 7 days. Typical storms in the Indian Ocean sea ice zone have strong easterly winds that induce high ice drift rate and push the floes together, so that there is little open water. They are also accompanied by relatively high temperatures so that there is little ice growth on the bottom of existing floes. Winds after the passage of the cyclones tend to the south to south-west, opening up new cracks and leads between the floes and bringing air as cold as — 30°C from the Antarctic continent. Rapid ice growth both in the leads and on the bottom of floes occurs during these periods. This relationship between ice growth rate and the passage of synoptic systems is one more example of the complex interaction between ocean, ice, and atmosphere. Antarctic scientists are keen to examine in detail the information collected, and to plan for an even more ambitious sea ice/oceanography voyage to be held in the winter of 1998.

*Supplied by the Australian Antarctic Division.*



## UNITED STATES

### ANTARCTIC RESEARCH TARGETS THE SUN, MELTING ICE AND DINOSAURS

A giant balloon will circle Antarctica carrying a telescope trained on the sun, geologists will seek dinosaur remains entombed in Antarctic rocks, and scientists on snowmobiles will search for a prime site to drill a deep ice core to unlock West Antarctica's climate history.

These studies are among the 136 US science projects now underway during the 1995-96 Antarctic research season, supported by the National Science Foundation (NSF), and based mainly out of three research stations during Antarctica's summer, from October

through to February.

Almost three-quarters of the research program — spanning astronomy and astrophysics, earthscience, glaciology, oceanography, atmospheric science, and biology — is supported out of McMurdo Station, located at sea level on Ross Island, and at Amundsen-Scott South Pole Station, high up on the ice cap. Another quarter of the research is conducted from Palmer Station on the Antarctic Peninsula and on two research vessels.

## **ANTARCTIC RESEARCH HIGHLIGHTS THIS SEASON**

### **Flare Genesis Probes the Sun**

In December or January, one of the world's largest solar telescopes will be lifted into the Antarctic sky beneath a huge balloon, which will circle the continent in a steady wind pattern. With 24-hour daylight, the telescope will be able to peer at the sun nonstop — imaging sunspots with unprecedented resolution, and mapping associated magnetic fields believed to cause solar flares. The research team led by David Rust of Johns Hopkins University aims to understand how magnetic fields at the sun's surface emerge, coalesce, unravel, and finally blow up as solar flares. They hope the work will lead to reliable forecasts of solar activity, as well as the arrival of shock waves and atomic particles from the sun. Excellent quality images are expected to be available shortly after the flight.

### **Neutrino Visions in Antarctic Ice**

Drilling resumes at the South Pole to complete AMANDA, the largest neutrino detector on earth and part of the vanguard in the new field of neutrino astronomy. The Antarctic Muon and Neutrino

Detector Array is looking for high-energy neutrinos — sub-atomic particles that are spawned by supernovae, pulsars, neutron stars, or other sources beyond our galaxy, with the aim to one day map such neutrino sources in space. AMANDA, a joint enterprise of the University of Wisconsin, the University of California (Berkeley and Irvine), the University of Stockholm, the University of Upsala, and the German Electron Synchrotron (DESY), has been watching the sky for supernovae since early this year. As construction of the array continues, a hot water drill will plumb the ice; then, photomultiplier tubes, like beads on a string, will be lowered one-to-two kilometres down into the holes, which will close up as the water refreezes. Six new strings are being added this year to the four already installed. The ice at the South Pole has proven to have singular clarity for detecting the bluish flashes of light — Cherenkov radiation — that tell of a neutrino collision.

### **Hot Vents in Polar Seas**

Researchers aboard NSF's icebreaking research vessel, the Nathaniel B Palmer, have just completed a survey of the complex ocean bottom in the Bransfield Strait at the northern end of the Antarctic Peninsula. Geophysicists Lawrence Lawver of University of Texas-Austin, and Gary Klinkhammer, Oregon State University, have explored a unique region where continental crust is rifting apart, perhaps like the Gulf of California opened in its earlier stages of evolution. Hydrothermal vents have been found near this rift, where plumes of hot water with dissolved minerals are spewing forth, possibly from natural smokestacks called "black smokers". The study will add to knowledge of volcanic processes

and mineral formation in a rift zone. Unusual communities of deep-sea life, known to inhabit hot vents, could also live here, but have not yet been found at these high polar latitudes.

#### **A Hunt for Dinosaurs**

In the Transantarctic Mountains, a team headed by Augustana College geologist William Hammer will survey remote mountain tops protruding from the ice sheet for fossils of mammals and reptiles, including dinosaurs. In much of the continent, fossils and rocks are concealed beneath ice that can be miles thick. Exposed rocks in the study area near the Shackleton Glacier, however, offer excellent prospects to yield animal remains from the middle Triassic to the lower Jurassic, similar to the dinosaurs and other fossils recovered in the past near the Beardmore Glacier. The vertebrate fossils offer insight on how these animals evolved at high latitudes and what climates were like when they lived.

#### **Counting Tree Rings in Antarctica's Fossil Forests**

The Shackleton Glacier region harbours abundant plant fossils, including remains of ancient forests, mineralized peat deposits, and pollen. A team headed by palaeobotanist Edith Taylor, University of Kansas, will collect and describe in detail this ancient flora, helping to reconstruct what the Antarctic was like during Permian and Triassic times about 200-280 million years ago.

Also based at the Shackleton camp, a special field base for research coordinated by Ohio State University geologist David Elliott, other geologists will be seeking to fill in the picture of how past environments and life evolved in Antarctica. Until the late Mesozoic, about 100 million years

ago, Antarctica sat at the centre of the supercontinent of Gondwanaland — a history these studies will flesh out.

#### **West Antarctic Ice: Stable or Not?**

West Antarctica's ice cover, drained in part by dynamic, fast-moving ice streams flowing into the Ross Sea, is the largest ice sheet on earth resting well below sea level. The history of the ice, and its potential for future "collapse," or rapid disintegration, continues as the focus of a multi-year, multidisciplinary research effort. In places, the ice sheet shows rapid and dramatic changes that could portend a rapid rise in sea level across the globe — or may not.

Geophysicists Donald Blankenship, University of Texas Austin, Robin Bell, Lamont-Doherty Earth Observatory, and Carol Finn, US Geological Survey, spearhead an effort to fly an aircraft filled with geophysical instruments over the ice streams. They will use the data to model ice sheet behaviour, as will a University of Wisconsin group.

Down on the ice surface, a traverse team headed by University of New Hampshire glaciologist Paul Mayewski is extracting ice cores and examining them for clues to climates past — ultimately looking for the best site for a deep ice core.

#### **Tiny Extraterrestrials at the South Pole?**

Antarctica's ice is a famous storehouse for meteorites, ranging from large to microscopic. A team led by Susan Taylor of the Cold Regions Research and Engineering Laboratory plans to begin collecting millions of micrometeorite from the new well that provides water for South Pole Station, a project that will last five years. As the ice melts in the well, meteorites are postulated to concentrate at the bottom of the hollow, promising what may be the rich-

est and best-dated source of dust from space.

### **An Antarctic Lake at First Light**

After the long Antarctic winter gives way to the earliest rays of the sun, life in the unique, permanently frozen lakes of Antarctica's Dry Valleys begins to unlimber. This August, a team led by Montana State University biologist John Priscu travelled to the lakes to watch photosynthesis begin, the initial step in understanding the dynamics of microbe

assemblages (cyanobacteria and eubacteria) living in the ice of at least seven Dry Valley lakes. The study will help illuminate the dynamics of carbon and nitrogen in the valleys, and complement existing studies of microbial communities in sea ice. Such life in Antarctica may be analogous to Mars, which is thought to have had liquid water in the past. Microbial life may still linger in the ice and rocks on that planet.

*Supplied by the National Science Foundation.*

## **SENATE TO REVIEW ANTARCTIC POLICY**

The US Senate Appropriations Committee is concerned about the ability of the NSF to continue to fund a U.S. permanent presence on the continent given severe budget constraints. This situation is exacerbated by the need for the NSF to upgrade or replace its ageing facilities, with NZ \$200,000,000 estimated to replace the deteriorating South Pole station. The Committee has questioned whether the

1982 policy to maintain a presence in the Antarctic is still valid.

This policy, mandated by Presidential Memorandum 6646, calls on the NSF to be the lead agency for the US Antarctic Program. It calls for the US to maintain a year round active presence on the continent and to maintain three stations: McMurdo, Palmer, and South Pole. The cost to maintain a US presence in



*The United States' McMurdo Station. Photograph Courtesy of NZAP.*

Antarctica is expensive due to the remote location and severe weather conditions. The NSF required NZ \$166,770,000 in logistics and operations support in the fiscal year 1995 and NZ \$29,060,000 to support scientific research activities.

The powerful Senate Committee has directed the National Science and Technology Council to undertake a Government-wide policy review of the US presence in the Antarctic. The review will examine the validity of the policy contained in Memorandum 6646 — specifically the need for a year-round presence, the need for three stations, and the roles of the NSF, Department of Defense, and other Government agencies.

The review will also examine the policy in the context of the value of the science performed in Antarctica and other US interests and address the affordability of continued US presence in Antarctica in light of the severe budget environment and examine options for reducing annual logistic and operational budget needs.

At a minimum, budget-saving options

### SHIP SHAPE

	LM GOULD	POLAR DUKE
<b>Class</b>	ABS-AL	Baltic Sealer
<b>Dimensions</b>		
Length	230 ft	219 ft
Breadth	46 ft	43 ft
Draft	18 ft	19 ft
Gross Tons	1599 tons	1594 tons
Horse Power	4200 BHP	4500 BHP
Propeller	2-VAR Pitch	1-VAR Pitch
Accommodation	44	41
<b>Lab Spaces</b>		
Wet Lab	425 ft <sup>2</sup>	400 ft <sup>2</sup>
Hydro Lab	426 ft <sup>2</sup>	300 ft <sup>2</sup>
Dry Lab	356 ft <sup>2</sup>	300 ft <sup>2</sup>
Elect. Lab	420 ft <sup>2</sup>	400 ft <sup>2</sup>
Aquarium	6 tanks	6 tanks
Cargo	9 Milvans	7 Milvans

*Adapted from The Antarctic , October 1995 No. 2, Vol 95-96*

may include greater international cooperation, less than a year-round human presence, and closing one or more of the stations.

The results of the review are to be submitted to the Committee by March 31, 1996.

*Adapted from The Antarctic, October 1995 No. 2, Vol 95-96.*

## NEW SHIP COMMISSIONED

A new ship is on the horizon for the US Antarctic programme. The *Polar Duke's* Antarctic career is ending much before her time, but a newer and better ship, the *L M Gould* will replace her in a couple of years. Delivery is due on or about

1 June 1997. The original ten-year contract for the *Polar Duke* has already been exceeded, and Congress has mandated that a U.S. yard-built ship flying the U.S. flag must be used. The *Polar Duke* is a Norwegian flagship built in Nova

Scotia, so doesn't meet the requirements.

Although the *Polar Duke* was originally made for oil exploration, she entered Antarctic service in 1984 and has served admirably ever since. So much so that the National Science Foundation wanted a "Duke-like ship at a Duke-like price."

If the *Duke* was so great, why didn't they convert her into an American flag-ship? Quite simple — it seems the cost of converting her would have exceeded the cost of leasing a new ship. Also with

the required Coast Guard inspection of U.S. flagships, there would have had to be expensive changes made, such as removing the asbestos, so financial conversion was not feasible.

There were three competitors in the bidding to build the new ship, one with an oceanographic capability, a definite improvement over the *Duke*. And there was a clear winner, both price-wise and technically, the people who built the *Nathaniel B Palmer*, Edison Chouest Offshore of Louisiana.

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## NEWS BRIEF

The United States Federal Budget crisis, which stopped pay for many non-essential US civil servants, reached as far as Operation Deep Freeze in Christchurch.

Three non-essential civilian staff from the navy's electronics calibration section in Christchurch were sent home until the pay problem was resolved in the United States. Normal essential supply operations to the Antarctic continued and were not affected.

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## JAPAN

### SEAL UNDERWAY SOON

A key part of the Japanese Antarctic Research Expedition's (JARE) future scientific programme SEAL (or Structure and Evolution of East Antarctic Lithosphere) is almost underway.

The fundamental aim of the project is to consider the question "How has the earth evolved, and how has the interior structure formed since its origin as a planet?"

This is a simple but fundamental question geoscientists raise, and in order to get an answer to this, geoscientific investigations have been carried out all over the world.

On the basis of the geoscientific work performed by JARE it has established that the

Antarctic region including Queen Maud Land and Enderby Land is an ideal field from which the question above can be answered, because the continental crust in this region is composed of Archean to Paleozoic ages covering nearly 3500 million years. The fundamental idea of JARE's research is to clarify the structure and evolution of the lithosphere by means of a variety of methods and techniques in geoscience. Moreover, recent fluctuation of continental ice sheet is also considered based on the glacial landscape, sediments and features of the continental shelf, etc.

#### Project outline

JARE are planning to carry out geoscientific

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tific field work in Western Enderby Land including the Amundsen and Casey Bay regions, and intracontinental nunataks during the period of 1996-2001.

The geoscientific themes are as follows:

- Formation of ancient crust and its composition.
- Structure and compositions of lower continental crust.
- Origin of ultra-high temperature metamorphism.
- Tectonics and geochronology of the Napier and Rayner Complexes.
- Paleomagnetic intensity and paleolatitude of East Antarctica in Precambrian.
- Formation and evolution of continental ice sheet.

Actual field operations include:

- Geological field survey and sampling of rock specimens.

- Geomorphological field survey and sampling of sediments.
- Sampling of rock specimens for Paleomagnetic studies.
- Gravity and geomagnetic measurements.
- Seismic experiments and accompanied geodetic observation and drilling.

#### International Links

Enderby Land has been attracting the interest of geologists from all over the world. These include Australian and British geologists who have been engaged in early surveys in Enderby Land which they plan to reopen in the future.

SEAL has a mutual relationship with the International Geological Correlation Program (IGCP) and will therefore facilitate international cooperation during the project by inviting a few foreign scientists every year.

## SUMMER RESEARCH ACTIVITIES

Fifty-six members of JARE and two observers are on board the research vessel *Shirase*. The *Shirase* departed on 14th November 1995 and arrives at Syowa Station in late December 1995.

Hiroshi Kanda from the National Institute of Polar Research will be leading the expedition, which will conduct a range of research, including on board observations, such as studies in the area of Ionosphere, Meteorology and Atmospheric chemistry, gravity, Geomagnetism, physical, chemical and biological Oceanography.

Another research ship the *Harukei-Maru* will visit the Antarctic between December 1995 and February 1996. Leading research on the ship will be Takemi Ishihara and OIC will be Captain Tadami Ebihara.

The *Harukei-Maru* research includes reflection seismic survey, refraction seismic survey, depth sounding, sub-bottom profiling, gravimetric and geomagnetic surveys, measurements of terrestrial heat flow and bottom sampling.

The third JARE research vessel playing Antarctic waters this season is the *Unitaka-Maru* from January 1996 to February 1996.

Professor Yukuya Yamaguchi will be leader of research and Captain Isao Kasuga the OIC. Their program of research is physical oceanographic study, the community structure of plankton in Southern Ocean, primary productivity near the ice-edge area and acoustic estimation of zooplankton and micronekton.



## KOREA

### BUSY PROGRAMME FOR KARP

Dr D Y Kim will lead KARP's 9th expedition to the Antarctic.

KARP's comprehensive range of scientific investigations to be implemented from its bases and ships include;

#### **Biological Oceanography**

Designed to examine trophodynamics and biological processes in the Bransfield Strait and the ice of the Weddell Sea during austral summer from 15 Dec. 1995 to 25 Dec. A total of 40 stations in 3 transect have been selected for sampling. The focus will be on mesoscale studies with special interest in the coupling between the physical and chemical processes and the interactions among bacteria, phytoplankton, zooplankton, Krill, and benthos.

#### **Coastal marine ecosystem study**

Primary concerns are to understand the roles of benthic communities in carbon and nitrogen cycles. In this coming season, oxygen consumption rates and nutrient fluxes of shallow marine benthic communities will be measured in Marian Cove to quantify the organic matter processed by the nearshore benthic communities. Respiration of a dominant infauna, the bivalve *Laternula elliptica* will also be measured in order to assess the contribution of this species to organic matter mineralization. In addition, beginning at this season and for the next whole year, seasonal variations in species composition, abundance and productivity of water column microalgal populations will be investigated in the nearshore waters near the station in order to under-

stand the dynamics and furthermore to clarify the interactions with benthic communities. Pharmaceutical research using the sponge *Suberites* sp. occurring in the shallow waters near the station will be continued. Furthermore, long-term monitoring on human impacts will be initiated this coming season in the coastal area around the station. Some key organisms including lichens will be used as indicator species for heavy metal and some other pollutant contaminations.

#### **Chemical oceanography**

Nutrients and chlorophyll a concentrations in Bransfield Strait, Antarctica. Inorganic nutrients and chlorophyll a will be measured in the proposed study area in accordance with the other field of research.

#### **Geological Sciences**

Field geological surveys will be made in the Livingstone and King George islands to interpret and reconstruct the tectonic evolution of the South Shetland Islands and the northern Antarctic Peninsula region. The focus will be on sedimentological and petrochemical aspects. Core sediments will be collected in eastern Bransfield Strait, Weddell Sea and Maxwell & Admiralty bays for facies analysis of contourites. About 5m long gravity corer made to collect seafloor igneous rocks of the Bransfield Strait.

#### **Geophysical Science**

To know the subsurface structure, two-dimensional electrical survey system will be made around King Sejong Station on King George Island and will be monitored

for a year-round.

Seismicity near King Sejong Station will be studied using a short-period seisotter with three components, which has been in operation in the KSS since 1989. Geomagnetic observation system will be checked and optimized. Data will be transmitted via the GOES satellite to INTERMAGNET (International Real Time Global Geomagnetic Observatory Network). Through the analysis of geomagnetic data, we will investigate the

diurnal variation at the station and compare the geomagnetic field between the station and Korea. In addition, data will be used for the research of the relation between magnetosphere and ionosphere, at King Sejong Station, Antarctica.

Marine seismic reflection and magnetic surveys will be made in the eastern Bransfield Strait, Antarctica. 12 channel system will be used to investigate geologic structures and tectonic evolution in back-arc region.



## SUB-ANTARCTIC

### BEYOND THE ROARING FORTIES — BETTER THAN BEING THERE

The *Beyond the Roaring Forties Subantarctic Experience*, currently under construction at the Southland Museum and Art Gallery, is a world first. It is a joint project between the Museum and the Department of Conservation to present and interpret New Zealand's unique Subantarctic Island area. Visitors can experience something of the fascinating wildlife, giant alpine flowers, atrocious climate, spectacular landform and share in the stories of human suffering and endurance that are a compelling part of subantarctic history.

Attempts to tame and exploit the subantarctic islands have been defeated, leaving only relics and misery. Human loss has been wildlife's gain. Safeguarded by their isolation, the islands are a last stronghold for a unique cargo of plants and animals. They also provide vital landfalls for oceanic birds and mammals to rest and breed. More species of

penguin and of albatross are found here than anywhere else in the world.

Few people will ever have the opportunity to discover Australasia's subantarctic islands first hand. Yet their story is part of New Zealand's heritage, with a significance that extends beyond national boundaries. The concept has evolved as a partnership between Department of Conservation (which is responsible for managing New Zealand's subantarctic islands) and the Southland Museum and Art Gallery. It is a partnership which recognises that increased awareness and appreciation of the islands special character is also essential to ensure their future protection.

*Beyond the Roaring Forties* is designed to give visitors a sense of the subantarctic islands with out the daunting prospect of a long voyage through notoriously rough seas. Visitors also have the satisfaction of knowing that they can enjoy the experi-

ence without fear of damaging fragile ecosystems.

The first stage of the project, a 25 minute, state of the art audio-visual has already received wide acclaim. Work has now started on a complementary, subantarctic gallery which uses an exciting range of interpretive media to extend the subantarctic experience. Visitors can expect a surprise encounter with a Hooker's sea-lion; to feel the wind in their hair as they take a walk across Adams Island and to stand on the deck of the *General Grant* during her final, agonizing minutes, wedged in a cleft beneath awesome cliffs on the Auckland Island's west coast.

Southland's close association with the subantarctic make it the natural home for *Beyond the Roaring Forties*. Its presentation at the Southland Museum and Art Gallery is equally appropriate. The museum has an established reputation for innovation and design flair. Its ambitious pyramid development and tuatarium are already popular drawcards, attracting 130,000 visitors last year; a number which is expected to increase to 150,000 in 1996. At the same time, *Beyond the Roaring Forties* is a major project with national significance. There is little doubt

that it will achieve a recognition which extends far beyond the Southland region.

### **THE SOUTHLAND MUSEUM AND ART GALLERY**

The Museum, sited on the southern edge of the picturesque Queens Park in New Zealand's southernmost city of Invercargill, was opened in 1871.

After serving the city well for 80 years it experienced a major redevelopment with the existing building being covered by the largest pyramid in the Southern Hemisphere in 1990, a shape was chosen both for functionality and aesthetic appearance.

The complex features 500 million years of natural history, including moa remains, and 800 years of human history. Additionally there is an active exhibition programme of art and craft by local artists as well as touring national and international exhibitions.

The Museum houses the largest public display of live tuatara and has established the world's most successful captive breeding programme, helping to ensure their future and provide an international attraction.

## **HEARD ISLAND PLAN RELEASED**

As mentioned in the September issue of *Antarctic*, the Australian Antarctic Research had formulated a draft management plan for Heard Island. The results of the consequent consultation process have been consolidated into the final Heard Island Management Plan. Its main points are summarised below.

The management of Heard Island will be governed according to this vision:

*Acknowledging the outstanding natural qualities of the Territory of Heard Island and McDonald Islands, and its great importance to the ecosystems of the Southern Ocean, management of the Territory will allow natural processes to proceed with minimal human intervention and will assign highest priority to conserving its environment, its*

*value to research and its unique cultural heritage.*

The management plan identified the key features of Heard Island's environment as:

### **Biology**

The Territory features essentially undisturbed biological patterns and processes, many of which are characteristic of subantarctic islands. The quality of the Territory's natural environment is mostly attributable to the absence of any known introduced macro-fauna and — flora which have been responsible for the major and often irreversible alterations occurring within other subantarctic island groups.

*Terrestrial flora* — The Territory is the most significant subantarctic island group whose terrestrial ecosystems have not suffered irreversible impacts from introduced animals and plants. Dramatic glacial retreat in some areas of Heard Island has increased significantly the area available as habitat for plants. The current rate of increase in habitat availability is probably not equalled on any other subantarctic island. The isolation of plant communities together with increasing habitat availability provides valuable opportunities to study plant colonisation.

*Mammals* — The seal populations provide outstanding examples of the larger Southern Ocean ecosystem. The Antarctic fur seal and the elephant seal populations provide an excellent opportunity to study the ecology and behaviour of recolonising seal populations. Heard Island is one of the best land-based sites in the world to study the leopard seal and its role in the subantarctic ecosystems.

*Birds* — The Territory is a key subantarctic

breeding location whose bird fauna, like that of other subantarctic islands, is characterised by superabundant numbers and low species diversity. The high degree of nest fidelity exhibited by the bird species is believed to have contributed to endemism in the region. The bird fauna therefore provides excellent opportunities to study species diversity and endemism, population dynamics and colonisation behaviour of subantarctic birds. The absence of introduced predators of burrowing petrels and sheathbills makes the Territory an especially valuable location for observing these birds. The Territory is also the home of the endemic and rare (less than 100 breeding pairs) Heard Island cormorant.

*Terrestrial invertebrates* — The Territory's invertebrates provide an excellent opportunity to study invertebrate speciation in the subantarctic. Heard Island is the home for a relatively large number of terrestrial invertebrate species compared with vertebrates and plants, with a correspondingly greater species diversity. The invertebrate fauna of the Territory is the least disturbed of any subantarctic island and provides a unique opportunity for study, as a natural experiment, of evolutionary processes in action. Many arthropod species have their most southerly distribution here, and the small populations of Coleoptera and Diptera illustrate unique adaptation to the environment.

*Marine biology* — The Territory's marine species may have undergone specialised development due to the isolation of the region. With the possible exception of some Soviet fishing in the Heard Island region in the early 1980's the marine zone has remained free from commercial fishing and virtually free of human interfer-

ence. There are considerable opportunities for further scientific research into an undisturbed, possibly unique, subantarctic marine ecosystem.

#### **Atmospheric sciences**

Heard Island is one of the few sites in the important climatic region between Antarctica and the lower latitude continents where contiguous land based meteorological observations are possible. Such observations make an important contribution to the analysis and prognosis of global weather and to the long term monitoring of climate change. Heard Island's unique geophysical position and freedom from mainland atmospheric interference and pollution make it a useful base for

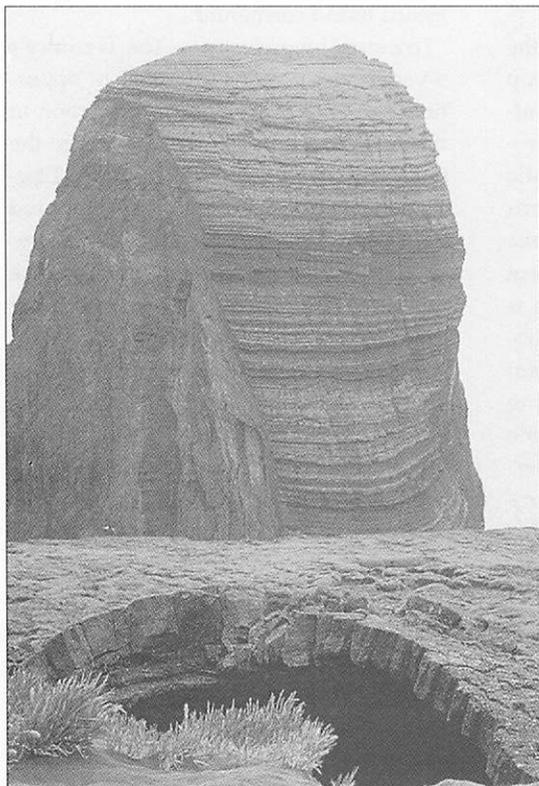
ionospheric, geomagnetic, radio propagation and general atmospheric studies, including greenhouse gas monitoring and ozone layer observations.

#### **Glaciology**

Heard Island has Australia's only permanently glaciated environment outside the Australian Antarctic Territory and affords opportunities for studies of highly dynamic glacial systems. The recorded glacial fluctuations on Heard Island provide a useful indicator of climate or volcanically-induced changes in this part of the Southern Ocean, for which there are few instrumental records. The rapid fluctuation provides an opportunity to use glacier advance and retreat as an indicator of short-term trends.

#### **Geology, geomorphology and soils**

Heard Island and the McDonald Islands, together with the Kerguelen Islands, represent the only surface evidence of the otherwise extensive submarine Kerguelen Plateau, which is an unusual platform for oceanic islands. The Island's geological history therefore contributes greatly to the understanding of the development of submarine plateaus. Sediments exposed on Heard Island contain a valuable record of past environments on the oceanic islands. The island's geological history therefore contributes greatly to the understanding of the development of submarine plateaus. Sediments exposed on Heard Island contain a valuable record of past environment on the oceanic platform, including evidence of warmer sea-surface temperatures and of terrestrial vegetation, including trees, significantly different from that of today.



*The volcanic outcrop of Rogers Head on Heard Island.*

The relatively rapid changes in the Territory's land form present opportunities to study geomorphological processes. These studies complement research into the adaptation of wildlife and vegetation to changing physical environment.

Big Ben, which is Australia's only active volcano, presents special opportunities for volcanological studies because of its unusual lava association and setting on a large submarine plateau. There is a potential for telemetering of volcanic eruptive activity, volume and variations in head flow. Recent evidence has confirmed that a large part of Big Ben has slumped to the southwest, creating an accurate escarpment and leaving a cavity that the modern volcano has done much to fill. This suggests that Big Ben is more dynamic than previously believed.

### **Oceanography**

Kerguelen Plateau is one of a number of major geographic features deflecting the path of the Antarctic Circumpolar Current. It is one of two locations (the other is Drake Passage) which allows the northward flow of Antarctic bottom water away from the Antarctic continent. Inter-annual variability has important implications for global climate variability. While most of the Antarctic Circumpolar Current is directed north of Isles Kerguelen, it appears that a significant portion of the variability is in the part of the current flowing past Heard Island. For these reasons, Heard Island is an important site for studying inter-annual variability of the Southern Ocean. This variability can be monitored indirectly by monitoring sea level variability with tide gauges. The development of a long-term high-resolution coastal tide gauge at Heard Island, geodetically controlled with

GPS, will provide important information on inter-annual variability of the Antarctic Circumpolar Current and ultimately on climate variability. The oceanographic conditions surrounding Heard Island strongly influence the distribution of biological species and productivity in the water column. More detailed studies will be required of these oceanographic issues if the biological parameters are to be well understood.

### **Cultural heritage**

The remains from several periods of human activity on Heard Island are of cultural significance. While there was similar activity on other subantarctic islands, remaining Heard Island sites are relatively undisturbed and present good opportunities for archaeological research into the early exploitation of the subantarctic and human activity on Heard Island over 150 years. The remains of the Australian station at Atlas Cove are physical evidence of the early Australian National Antarctic Research Expeditions to the subantarctic.

### **Recreation and tourism**

Heard Island presents opportunities for recreational visits and mountaineering in spectacular surroundings, and in some of the most challenging climbing conditions available anywhere. There are limited opportunities for other recreational uses of the Territory, notably by ocean going yachts. Heard Island's remoteness, superb wildlife and landscapes are potentially significant attractions for tourist ventures prepared to overcome the climatic and geographical difficulties.

### **Wilderness**

The outstanding wilderness values of Heard Island have the potential to inspire all people, whether or not they visit the Territory. These values include the

Territory's inaccessibility and remoteness from population centres, ensuring minimal human impacts on the environment and continuation of natural processes, regardless of short-term human uses.

**Economic values**

The natural and wilderness values of the Territory offer potential economic values through tourism. Current information indicates that the Territory's

potential for mining and fishing is low, although there are opportunities for a fishery within the 200-nautical-mile Australian Fishing Zone (excluding the 12 nautical mile territorial sea) in conjunction with one around Kerguelen Island. As set out in paragraph 1.23 of the plan, mining and fishing will not be permitted within the Territory (that is, to the 12 nautical mile offshore limit).

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## **METSERVICE SAYS GOODBYE TO CAMPBELL ISLAND**

The last MetService team of Mike Fraser (OIC), Adam Clarke, Tony Nissen, Peter Vyver, Gary Mitchell and Bob Taylor departed Campbell Island on October 15.

The departure follows extensive research by the MetService to determine whether the accuracy of their forecasts would be affected by an automated station replacing regular balloon reading by the MetService officers.

Meteorological information will continue be supplied by the automated station installed on the Island in 1990, backed up by a further station installed in October this year. The station will relay information hourly via satellite to the MetService's base in Wellington. Technicians will make annual visits to

maintain and calibrate the equipment.

A reunion of staff who had worked at the Campbell Island station, held in Invercargill on November 3, was very successful with over 100 people attending, said a member of the final team, Bob Taylor.

Mr Taylor said those attending the reunion came from all over New Zealand and included the leader of the very first Meteorological Station, Mr Leo Stanaway, now in his early 90s. It was fascinating to see Mr Stanaway's photos and how much the physical appearance of the Campbell Island had changed in the last 50 years, Mr Taylor said. It seemed appropriate that the last station OIC Mike Fraser also attended the reunion.

# GENERAL NEWS

## BRINGING THE WHITE CONTINENT CLOSER — ANTARCTICA ON THE INTERNET

As the world quickly embraces the global computer network Internet, those with an interest in Antarctica are benefitting from the fast developing technology.

On the Internet's World Wide Web in particular, Antarctica is being brought a bit closer with all kinds of fascinating information available.

From the comfort of your computer terminal you can look at a picture of Shackleton's ship *Endurance*, get up to date ozone measurements, browse the

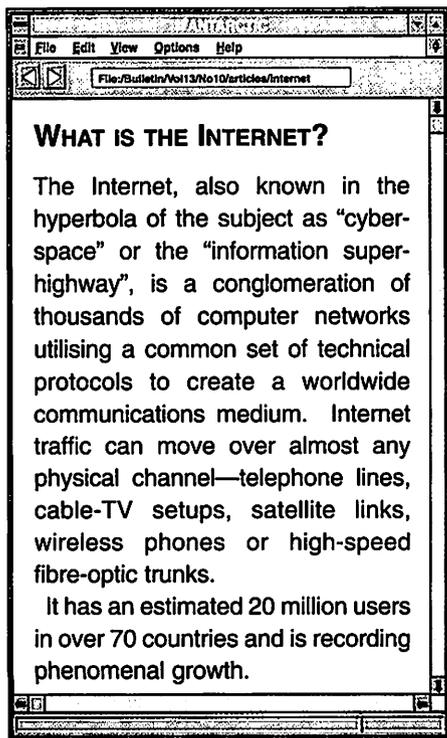
Antarctic Shop catalogue, get updates on various nations' scientific programs, read about the CRAMRA and much else.

The International Centre for Antarctic Information and Research (ICAIR), a recently established, independent, non-profit organisation established under New Zealand's Science Academy, The Royal Society of New Zealand, is leading the way in making Antarctica accessible online.

Their World Wide Web server "Gateway to Antarctica" provides an excellent starting point for those wanting to negotiate the resources available on the web. From the Gateway readers can access a enormous resource of information about the Antarctic environment, science, history, tourism, logistics and treaties. An educational resource designed by a Christchurch high school teacher and ICAIR can also be accessed through the gateway providing information and exercises for students.

ICAIR was formed to provide, according to their mission statement, "international leadership in the use of the latest information technologies to collect, analyse, distribute and coordinate scientific, environmental and educational information relating to Antarctica and the Southern Ocean".

With the basis for sound management of the Antarctic environment resting on reliable information it is ICAIR's goal to provide international leadership in the



coordination and provision of the information needed. In this way, ICAIR aims to make a significant contribution towards developing informed and timely responses to both environmental problems in Antarctica and also the global problems facing humanity.

ICAIR is financed by the work it conducts for a range of nations and organisations. One of their goals is to develop the Gateway to Antarctica (their World Wide Web server) into the most substantial and robust Internet source of information on Antarctica in all of the subject areas on the Home Page.

Gateway to Antarctica's URL, or World Wide Web address is <http://licair.iac.org.nzl>

**What can you do on the Internet?**

There are a host of services available on the Internet. Three of the more common services are:

**1. The World Wide Web**

The world wide web is a hypertext (ie text that reacts to the click of users' mouse and avoids the need for complex keyboard commands) based information service. More than eight million 'home' pages are available containing a vast array of text documents, graphics and sound media.

**2. E-Mail**

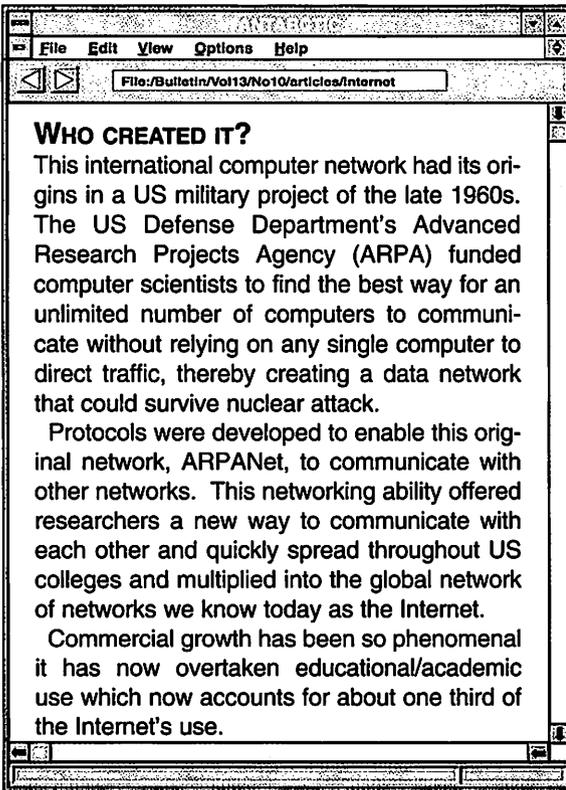
Electronic mail or "E-mail" is a messaging system which allows you to send communiqués and reports to users on the

Internet. With E-mail it is also possible to create group mailing lists where mail sent to one address will cause the information to be distributed to all members of the group. Mailing lists are a very useful way to disseminate textual information such as office memos and reports to a number of people at a time.

**3. Usenet**

Usenet newsgroups can be thought of as a bulletin board system where users posting to a certain group can inform all other readers of that newsgroup. Around 5900 usenet groups currently host discussions on subjects as diverse as libertarian economics, plutonium physics and the US TV show "Melrose Place".

*Adapted with permission from an article by Robin Major in MG Business, 13 November 1995.*



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## Interesting Antarctic World Wide Web Sites

Antarctica: A Resource for Teachers and Students

Address — <http://icair.iac.org.nz/education/index.html>

Australian Antarctic Division home page:

Address — <http://www.antdiv.gov.au/>

Computer Simulations of Various Locations In Antarctica

Address — <http://barsoom.mss.com/earth/antarctica/marypbs/marypbs.html>

Ozone Depletion over Antarctica

Address — <http://icair/iac.org.nz/ozone.index.html>

Welkom by Antartika — the South African National Antarctic Page

Address <http://www.puk.ac.za/fskdocs/ant.html>

## DISCOVERING ANTARCTICA

In a world first University of Canterbury students in Christchurch are being offered a multi-disciplinary course focusing on the Antarctic.

Although post-graduate courses on the continent exist, this is the first undergraduate course offered in the world.

18 different lecturers from a wide range of disciplines including geography, geology, physics, law, journalism, political science, plant and microbial science, zoology and sociology will be involved in the course. Several guest lecturers will also address the students including NZAP director Gillian Wratt, Colin Monteath and DOC's Hugh Logan.

The aim of the course, according to course coordinator Dr Peter Harper, is to give students a basic understanding of the Antarctic from a wide ranging perspective.

Topics covered range from the history of Antarctic exploration, Antarctica and the Law of the Sea, the impact of tourism,

to plate tectonics, Antarctica and global climate change and the Gondwana breakup.

The real challenge for lecturers in the fledgling course will be to pitch their lectures at the right level to students with a variety of scientific and liberal arts backgrounds. Dr Harper is confident that the lecturers will achieve this and is delighted at the calibre of academic staff involved. He will be attending every lecture himself (in addition to delivering a couple) and expects to learn a lot in the process.

What concerns Dr Harper most about next year's course is whether the University will be able to cope with the demand. As a result of marketing to secondary school students interest in the course is forecast to be very high. Although they have no way of knowing, the indications are that there will be around 400 enrolments, making it a large first year course. Enrolments will have to be monitored and the University may be

forced to add a second stream of lectures to cope with the demand.

Another exciting element in the creation of the Antarctic course is that it may well be a pre-cursor to a dedicated Antarctic school at the University. "The University will want to meet demand," says Dr Harper.

Certainly Christchurch's strong association with the ice and the location of the new Antarctic Institute there make the university a logical venue for a major Antarctic study base.

The course may be also modified into a paper suitable for overseas students to take during the University summer recess, says Dr Harper.

The course had its genesis in 1993 with Margaret Burrell and Malcolm Laird discerning a need for a course about the Antarctic. A meeting was convened under Jim Cole from the University's

geology department to discuss the concept. The meeting attracted a wide range of interest from all departments and Dr Harper was chosen to lead the course.

"University staff have been very supportive of this course from the beginning," says Dr Harper. "The University administration also showed interest rapidly approving a course whose time has come".

An ornithologist, Dr Harper has spent a considerable amount of time in Antarctica researching bird life in Antarctica. He has authored a book on Marine Birds.

Dr Harper spent two and a half years on an Antarctic research ship in the mid-1960s and again on an ice-breaker in the early 1980s. He has been a New Zealand delegate to International Survey on Antarctic Seabirds.

— *By Greg Williamson*

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## TOURISM

### ANTARCTIC FLIGHTS TO BE REPEATED

Qantas's into flights over Antarctica will continue this summer after the successes of last season's efforts.

A total of 2,128 passengers enjoyed flights over the continent running from 31 December 1994 to February 1995. The sightseeing was concentrated on the Transantarctic Mountains in Victoria Land and the coastline of Oates Land, with waypoints at Cape Adare, Cape Hallett, Cape Washington, Cape Hudson, Dumont d'Urville and the South Magnetic Pole.

In view of the history of Antarctic tourist flights, Qantas was understandably rigor-

ous in its preparation for last year's flights. These preparations included:

- a review of their own Antarctic flight procedures used during the 1970s;
- a detailed analysis of the factors involved in Air New Zealand's tragic Erebus crash and development of procedures to take account of them;
- undertaking a detailed analysis of the history of equipment failures.

This season's flights, each lasting around 3-4 hours will depart from Melbourne on November 26; December 10 and 31; January 13 and 26; and February 25.

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## ORIENT ANTARCTIC CRUISES



*A tourist ship off Scott Base. Photograph courtesy of NZAP.*

Orient Lines is again offering a series of cruises to the continent. Three different expeditions, including a partial circumnavigation of the continent, will be led by noted explorers and scientists during the 1995/96 austral summer season.

Orient's vessel the Marco Polo has an ice-strengthened hull and Zodiac landing craft.

Although the exact itinerary for each voyage depends on ice conditions, weather and wildlife, Orient is offering three basic cruises.

- Expedition Antarctica over 18 days: departing Buenos Aires on December 15, this cruise will visit Stanley and West Point in the Falkland Islands, and then Hope Bay, Deception Island, the Neumayer Channel, Port Lockroy

and north again to Cape Horn.

- Antarctic Peninsula over 11 days: departing Ushuaia, Argentina and visiting Hope Bay, Deception Island, Paradise Harbour, Port Lockroy and back to Ushuaia.
- Grand Antarctic Circumnavigation over 27 days: departing Punta Arenas and visiting Hope Bay, Paradise Harbour, Port Lockroy, through Lemaire Channel, around to Cape Evans and Cape Royds including a visit to McMurdo Station, to Cape Hallett and Cape Adare and then to Christchurch, New Zealand.

*Information for this article was kindly supplied by Budget Travel in Christchurch. For more information on the any of the above (including videos of the Orient cruises) call toll free on 0800 80 80 40 if in NZ.*

## DEEP FREEZE TURNS 40

For one week at the end of September Christchurch, New Zealand's Antarctic Gateway, celebrated 40 successful years of association between the US Deep Freeze Programme and the city.

"Visions of the Ice", an exhibition of striking black and white photographs

taken by US photographer Frank Kazukaitis between 1958 and 1963, was displayed at the International Antarctic Visitor Centre, while a series of archival films of early US involvement in Antarctica were shown on three nights at the Repertory Theatre.

On the 29 September a panel discussion, called "Reflections on a Frozen Continent", hosted by Airforce World at Wigram, drew a crowd of almost 200. Before the discussion began visitors were able to view some of the planes used by New Zealanders during the Trans Antarctic Expedition. The US-NZ panel included Dr Cornelius Sullivan, Director of NSF's Office of Polar Programmes, Ms Gillian Wratt, Director of the New Zealand Antarctic Programme, Erick Chiang, Head of NSF's Polar Research Support Section, Mr Baden Norris, Antarctic Curator at Canterbury Museum, and Commander Dick Bowers, retired, of the US Navy. The meeting was chaired by Dr Margaret Bradshaw, President of the New Zealand Antarctic Society.

Between them the panel represented a wealth of Antarctic experience and the topics discussed ranged from the future of science in Antarctica to recalling the first US Antarctic supply ships to visit New Zealand at Lyttleton on their way south. The following week Commander Bowers gave several informal talks about the establishment of McMurdo Base and South Pole station, recalling the very special early days more fully.

Celebrations continued with Antarctic Festival Day on Sunday 1 October, during which thousands of people took the opportunity to look behind the scenes at the International Antarctic Centre, viewing clothing and equipment used in Antarctica, the US aircraft used by Deep Freeze and the Air New Zealand workshops which maintain them. The Antarctic Centre Library was open to all, and the Antarctic Heritage Trust and the NZ Antarctic Society manned static dis-

plays. The highlight of the day was the Human Husky Race which left the city for the long run out to the Airport (International Antarctic Centre) at mid-day, following the annual Antarctic Church Service in Christchurch Cathedral. Three relay teams of "Human dogs" represented the US Antarctic Programme, NZ Antarctic Programme and the City of Christchurch, each pulling a sledge and collecting for the Antarctic Heritage Trust on the way. Despite gallant efforts from the two other teams, the City of Christchurch team won.

The 40th Anniversary celebrations ended with a Deep Freeze Ball on Monday 2 October. After cocktails in the Antarctic Visitor Centre, a large number of invited city and Antarctic guests were ushered through a white shrouded, spectrally-lit tunnel, complete with atmospheric dry ice which very successfully created the impression of walking through an ice cave, into a giant marquee. Here it was comfortable and warm, the floor covered by red carpet, with dining tables arranged around a wooden dance floor backed by plants, with music supplied by the New Zealand Army Band.

Master of Ceremonies, Erick Chiang, first called on Dr Cornelius Sullivan to introduce the American Ambassador, Mr Josiah Beeman. Mr Beeman emphasised the excellent relationship that had grown over the years between Christchurch and the US Antarctic Programme.

Mr Chiang then called on Ms Gillian Wratt to introduce the Right Honourable Jim Bolger, New Zealand Prime Minister, who in his reply also

emphasised the productive collaboration that exists between the US and NZ programmes. Mr Bolger took the opportunity to announce for the first time the establishment of a New Zealand

Antarctic Institute in 1996 which would combine the functions of both the Ross Dependency Research Committee and the New Zealand Antarctic Programme.

— *By Margaret Bradshaw*

## POLAR MEDALS UPDATE

*A Letter from Rear Admiral J A L Myres CB (Secretary, UK Polar Medal Assessment Committee)*

Dear Sir,

In your September issue you kindly published a note addressed to Polar Medalists which drew on information that I forwarded earlier in the year. I very much hope that by the time you publish this letter, I will have heard from most of the 40 or so New Zealanders who have been awarded the medal with whom I have not yet been in contact. I would also be very glad to hear from the families of those who may have died since their award, as well as from those who were awarded the medal before the present reign.

As a result of my research so far, I have made contact with almost half of all Silver Medalists (or their families) — as well as a few Bronze Medalists — including nearly 75% of the Australians. I am finding that there are significant errors in the official Medal Rolls which need to be amended. I would very much like to be sure that the details for New Zealand are correct also.

With regard to the curious matter of the inscription on “Elizabethan” medals, the classicists amongst you will have noted that “BRITT: OMN:” was mistranslated (by me!) as “Great Britain”. It should, of course, be “All of Britain”, but the effect is the same — it isn’t relevant to New Zealand, and the reversion to the old inscription between the mid-1970s and the early 1990s was inappropriate. I’m getting a feel for the reason, but I don’t suppose that the Royal Mint will verify this!

Finally — for those of you who have not yet made contact — please write direct to my home address from which I operate in retirement, as this will save letters having to be forwarded from the Ministry of Defence.

The Manor House  
Kennington  
Oxford OX1 5PH  
UNITED KINGDOM

## POLAR MEDAL ENQUIRY

Please fill in as completely as possible.

1. Your full name: \_\_\_\_\_

2. Your rank/style/title at the time of the award: \_\_\_\_\_

3. Your present rank/style/title: \_\_\_\_\_  
*(so that I can address you correctly)*

4. On your medal, what is the inscription around the Queens head?

(a) ELIZABETH II DEI GRA: BRIT:OMN:REGINA F:D:+      Tick

(b) ELIZABETH.II.DEI GRATIA.REGINA.F:D:+      Tick

(c) Other — please specify \_\_\_\_\_

5. Your name is engraved or stamped on the rim of the medal; please show in full how this has been done indicating with a slash (/) where your name moves from one face to another *(for example — though I do not have a Polar Medal!)*

JOHN / A.L. / MYRES OR JOHN / ANTONY / LOVELL / MYRES

6. Does the lettering on the rim appear to be engraved by hand or stamped with a machine? \_\_\_\_\_  
*(this is not particularly important, but I would be interested to know if you are able to distinguish which it is.)*

7. On the clasp, or clasps, which show the place and dates of your service, please indicate the exact wording *(including which letters are capitals or lower case):*

\_\_\_\_\_

8. Is the lettering on the clasp, or clasps, engraved or embossed (ie. raised)? \_\_\_\_\_  
*(in recent years, I believe all to have been engraved, but the lettering on some earlier clasps may have been raised)*

9. Any additional remarks you wish to make: \_\_\_\_\_

\_\_\_\_\_

10. Date/Year of announcement of your award: \_\_\_\_\_

Please send to:      Rear Admiral J.A.L.Myres, CB  
 The Manor House, Kennington,  
 Oxford OX1 5PH.  
 United Kingdom

*Many Thanks!*

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## ANTARCTIC OZONE HOLE REACHES MAXIMUM SIZE

The spring Ozone Hole over Antarctica developed exceptionally rapidly during September and is at least as large and intense as the record Holes of 1993 and 1994, according to scientists from the National Institute of Water and Atmospheric Science (NIWA).

The hole now covers about 25 million square kilometres — the whole Antarctic continent and the surrounding ocean as far as the Antarctic Circle. Ozone amounts near the South Pole are 100 Dobson Units (DU), representing a loss of 65% of the ozone compared to the normal amounts for October in the 1960s and 1970s. The hole is expected to last until early December.

Ozone is a gas which is formed when strong ultraviolet radiation reacts with oxygen. It exists at all levels of the stratosphere (15 to 509 kilometres from the earth's surface) but is thickest between 20 and 30 kilometres from the earth — thus it is called the ozone layer. One of the ozone layer's main purposes, as far as humans are concerned, is to shield us from excess ultraviolet (UV) rays from the sun.

The thickness of the ozone layer varies considerably. Though ozone is produced over the equator and moves towards the Poles, the layer is considerably thinner around the tropics. For this reason, and because the sun is directly overhead, if you move from either the South or North Pole to the equator you'll be exposed to a natural increase in ultraviolet radiation of about 5000 percent.

The reduced level of stratospheric ozone above Antarctica were first discovered in 1956 by a Cambridge meteorologist named Gordon Dobson, who devised the

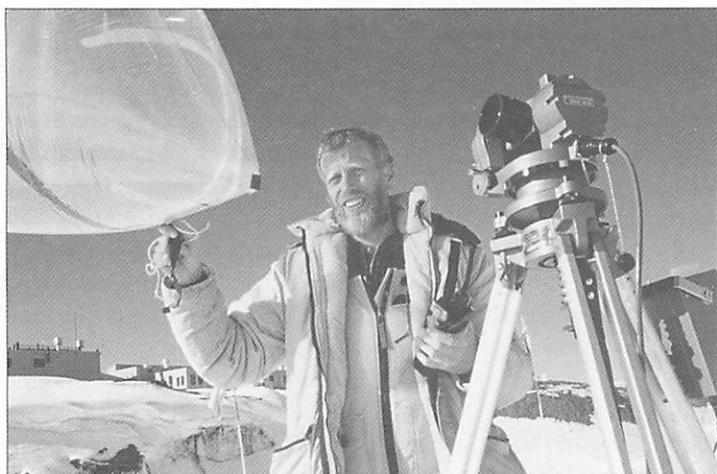
instruments necessary for measuring the hole and whose name is now given to the units which record the ozone's density. At first he thought the hole was an anomaly until he measured it again in 1957 and reported it as a natural annual event.

CFC molecules rise up unchanged through the atmosphere into the stratosphere, where they break down into chlorine. Chlorine destroys ozone. Chlorine also occurs naturally in the stratosphere but is substantially stopped from constantly attacking the ozone by the presence of nitrogen and water, which counteract its destructive action.

The short time of the year in which ozone thinning occurs is known as the Antarctic spring. Because of the extreme cold of the Antarctic winter, a vortex occurs which isolates a tube, or funnel of air over Antarctica. Within this vortex there is nothing to stop chlorine destroying ozone, because special clouds called Polar Stratospheric Clouds, also caused by the extremely cold conditions, deplete the stratosphere of nitrogen and water. The vortex also stops any ozone coming in from surrounding areas. Because chlorine needs energy (from the sun) to react against the ozone, the ozone-hole phenomenon begins with the start of Antarctic spring. Then, when the stratosphere warms and the vortex disappears, the ozone layer returns to normal.

Dr Stephen Wood, NIWA scientist at Scott Base, reported 130 DU on Wednesday 4 October, the lowest ever measured since readings began there in 1988.

Dr Wood said scientists expected ozone holes to develop each spring in Antarctica



*NIWA scientist Tom Clarkson releasing a meteorological balloon outside Scott Base.*

for several decades, because of the compounds from CFCs already released into the atmosphere.

Chlorine amounts in the atmosphere will peak within the next few days as the international agreement to phase out CFCs, the Montreal Protocol, comes fully into effect. However the recovery of earth's protective ozone layer to a natural state is still expected to take most of the next century, said Dr Wood.

Ozone depletion over Antarctica is triggered by cold spring temperatures and increasing spring sunlight, and the presence of chlorine pollutants. Fortunately the hole does not extend as far as New Zealand, which can expect to experience its normal annual ozone maximum of more than 350 DU.

The amount of ozone over the Antarctic in pre-ozone hole spring seasons was about 100 million tonnes distributed between about 15 and 30km above the continent. This layer (300 Dobson Units) would be only about 3mm thick if it could all be brought down to ground level. As a

direct result of human additions to the global atmosphere of as much as 1 million tonnes of CFCs annually, about 70 million tonnes of ozone are being destroyed over the Antarctic during each spring season. It is significant that the relatively small concentrations of human-produced chlorine compounds can

have such a striking effect on the atmosphere.

Ozone values have now reached the previous record minima. The World Meteorological Organisation, collating data from most of the ozone measuring stations in Antarctica (including Scott Base), and also from satellites, have confirmed that this season the extent of the Ozone Hole is as great as for any other year. It may now have reached its maximum extent, with an area (defined as where ozone amounts are less than 220 DU) of about 25 million square kilometres. The exceptional depletion early in the season suggests that total spring loss of ozone of this year may be the worst ever. The Hole will only gradually recover during late October and November.

#### **British concerns voiced**

The Antarctic ozone "hole" is still deepening, according to research by Dr Anna Jones and Jonathan Shanklin of the British Antarctic Survey (BAS). Springtime values of ozone recorded at Halley Research Station in Antarctica have fallen to less

than 40% of the values seen in the 1960s. New research shows that the decline is no longer restricted to the Antarctic spring but has extended into the summertime, increasing the amount of harmful ultra-violet radiation reaching the surface of Antarctica and its surrounding oceans.

The BAS research stations have measured ozone for nearly 40 years and have the longest record of ozone measurements in the Antarctic. There is evidence of some ozone destruction in the early 1970s, but no "hole" as such before the end of the decade. It is unlikely that the ozone hole will get much deeper because all of the ozone that is easily destroyed already dis-

appears each spring.

Anna Jones says: "It is only because of restrictions of the Montreal Protocol and its Amendments, controlling chlorine and bromine emissions that we can expect the Antarctic ozone hole to disappear. Even though these controls are coming into effect, the ozone hole is likely to appear for many decades."

Jonathan Shanklin says "When I'm out in the sunshine, especially in the Antarctic, I wear a hat and make sure that I'm protected by sun-blocking cream".

*The following is an extract from Ambassador Josiah Beeman's speech to the 40th anniversary celebrations.*

## US AMBASSADOR PRAISES CHRISTCHURCH CONNECTION

Since 1955, when Rear Admiral George Dufek selected Christchurch as the main support base for America's "Operation Deep Freeze", American and New Zealand scientists, explorers, and support personnel have shared a unique partnership — a partnership of those who brave the most hostile environment on Earth in pursuit of knowledge and understanding.

Admiral Dufek had many reasons for choosing Christchurch, some routinely practical. It is about as close as one can get to Antarctica — only 2,250 miles to McMurdo. It offered then and still offers now an international class runway long enough to handle the long range transport planes that are needed for that long flight south.

Most importantly. Christchurch also offered the most valuable commodity of all, the friendship and support of its people. In fact, the people of this city and this country have offered warm hospitality

and support to Antarctic explorers ever since Robert Scott and other explorers used New Zealand as their support base in the early 1900's and continuing through Admiral Richard Byrd's explorations beginning in 1928. It was only natural to continue that relationship with Operation Deep Freeze.

Scientists from all countries that signed the Antarctic Treaty in 1959 have carried out valuable research in geology, astronomy, biology, oceanography, and meteorology. They have relied on their "home base" here in Christchurch for all kinds of support, from the fresh food that has kept them healthy, to the books and videotapes that entertain them during that one very long night down there and the repair and replacement of sophisticated scientific equipment necessary for their research. Over the years, those performing vital work in Antarctica have always known that their friends here in Christchurch can be counted on to provide whatever is

needed for the success of their mission on the Ice.

One of the vital research projects that has made headlines around the world has been the work done analysing the "ozone hole" over Antarctica. New Zealand scientists have been important partners in this work, and the facilities here in Christchurch have not only supported the research on this phenomenon in Antarctica itself, but also the visit of the "ER-2" high altitude atmospheric research airplane that spent nine months here last year taking detailed measurements of the stratosphere. The measurements carried out by New Zealand scientists and their American counterparts were vital components in putting together a clearer picture of the level of damage to the ozone. Their important findings have been widely reported in the international news media.

Working in the harsh and unforgiving conditions of the Antarctic entails great

hardship, and sacrifice — sometimes the ultimate sacrifice, as was true in 1992 for two Kiwi support personnel, Terry Newport and Garth Varcoe, and one American colleague, Ben Milcour. We will always remember their sacrifice and honour their memory.

Over the years, our two countries have never wavered in our recognition of the importance of cooperation on the Antarctic Program. The Antarctic Program has remained a constant in the U.S. — New Zealand relationship. That is why it is especially rewarding for me to join in this celebration, and to add my congratulations on this important occasion.

Reflecting back on what we have achieved over the past four decades, I think I can safely predict that, as we explore the ice, our partnership will continue to be close, and that Americans will always consider Christchurch a home away from home, and a key symbol of our bilateral partnership in action.

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## PHILATELY

### POLAR STAMP ISSUES

- OCT 06 ST. HELENA — Christmas: 12p, 15p, 25p, 38p, 60p  
OCT 11 ASCENSION IS. — Christmas: 12p, 20p, 25p, 30p, 65p  
OCT 24 \*FALKLAND IS. — Tristar over Gypsy Cove 17p, Walruses & Cruise Ship 35p, Figas Islander 40p, Penguins & Land Rover 65p  
NOV 10 \*GREENLAND — Christmas: 4kr, 5kr  
NOV 21 TRISTAN DAICUNHA — Island Livestock: 10p, 20p, 35p, 60p  
NOV 22 RUSSIA — Russian Fleet Expeditions: Golovin Expedition to Kurile Is. 1811, Krusenbtern Expedition 1803-06, Wrangel Exploration in America 1829-35, Litke Exploration of Novaya Zemyla 1821-24; 4 x 250r  
NOV 23 \*BRITISH ANTARCTIC TERR — Antarctic Food Chain Crabeater Seals, Blue Whale, Wandering Albatross, Mackerel Ice Fish, Krill, Squid — 6 x 25p Pane (ICN #219, P33)

- DEC 01 \*FALKLAND IS. — South American Missionary Society: 5p, 17p, 40p, 65p  
 DEC 01 SOUTH GEORGIA & SOUTH SANDWICH IS. — Map of Jason Harbor 17p,  
*Castor* 1886 35p, *Hertha* 1884 40p, *Jason* 1881 65p (ICN #219, p22)  
 DEC 14 TONGA — Humpback Whale from 1977 Issue: 60s  
 DEC 15 ST. HELENA — Flowers 12p, 15p, 25p, 38p, 60p  
 “ CHILE — 30th Anniversary Institution Antarctic Chileno: 2 x 300p (ICN #217,  
 p112)  
 “ FALKLAND IS. Domestic Animals Horse 8p, Lamb 16p, Puppy & Kitten 34p,  
 CAT 34p, Dog 78p (ICN #217, p112)

## 1996

- JAN 02 \*T. A. A. F — Coat of Arms 50c, Olivine 1f, Fish 2.40F, Station Sodar 2.80f,  
 Andree & Edgar Dela rue 2.80f, Mont D’alsace 3.70f, Mission “Erebus” 4.30f,  
 Station Charcot 15f, Tamaris Adventure 25080f, “L’Heroine” MissionAux Iles  
 Caozet 27.30f, Seals 28f (ICN #218, p155)  
 JAN 03 \*FALKLAND IS. — Traditional Flowering Shrubs: 9p, 17p, 20p, 40p, 65p  
 JAN 10 ASCENSION IS. — Flowers: 20p, 25p, 30p, 65p  
 FEB 02 \*ST HELENA — Emergency Services: 12p, 25p, 53p, 60p  
 FEB 09 AUSTRALIA — Captain Cook’s *Endeavour* 45c, Recent *Endeavour* Replica  
 45c  
 Mar 07 \*ASCENSION IS. — Scenes from 1895 (5 values)  
 MAR 23 \*GREENLAND — 150th Anniversary of Ilinnarfissuaq: 2 Values  
 MAR 23 \*GREENLAND — 50th Anniversary of United Nations 1 Value  
 APR... \*MALDIVE IS. Killer Whale 1rf, Humpback Whale 8rf, Pane of 12 x 3rf Stamps  
 forming a Unified Design with 12 Species of Whales: s/s Sperm Whale 25rf  
 MAY \*FALKLAND IS. — 50th Anniversary of End of World War II: ? Values  
 MAY \*FALKLAND IS. BDT International: Ox & Cart 17p, Horse & Cart 35p,  
 Crawler & Sleigh 40p, Truck by Peat Bank 65p  
 JUN AUSTRALIA ANTARCTIC TERR. — Set Featuring Whales and Dolphins in  
 Antarctic Setting  
 SEP \*CANADA — Set of Stamps Depicting Canadian Arctic in Conjunction with  
 50th Anniversary of Arctic Institute of North America

# BOOK REVIEW

## THE ROSS OROGEN OF THE TRANSANTARCTIC MOUNTAINS

*By Edmund Stump, Cambridge University Press. 277 p.*

The Transantarctic Mountains stretch for 3500 kilometres across Antarctica and rise to 4000 metres. They are one of the world's great mountain ranges and contain most of the rock exposures in the Antarctic continent. Geologically speaking, the present range is relatively young, having started to form only 80 million years ago. Older mountain ranges have existed in the past and now form the ancient roots of the present Transantarctic Mountains. The "Ross Orogen" is the name given by geologists to the rocks and structures that make up this earlier mountain chain which was worn down by erosion more than 400 million years ago.

Edmund Stump's book is dedicated to this older phase of geological activity and reflects an involvement with Antarctic geology that spans more than 25 years, and which geographically stretches from northern Victoria Land to the Ellsworth Mountains. The two pages of expedition caches at the back of the book give a personal touch.

The book comprises eight chapters, with numbers two to seven describing the chain region by region, from northern Victoria Land to the Pensacola Mountains, bracketed by an introduc-

tion and a concluding synthesis. The descriptive chapters all follow a similar formula. Each starts with a history of discovery and exploration, followed by a description of the geology in which the scientific discoveries and development of ideas is treated chronologically. In the areas with which I am most familiar, the review appears to be very comprehensive and fair. This is not a book in which the author parades his hobby horses or promotes his own pet theories. Only in the final synthesis do the author's own views become more clearly expressed. The book is well printed with a generous and attractive format at slightly less than A4 size. It is well illustrated with maps, sections and numerous high quality black and white photographs. The book is primarily written for the geologist, and for those working in the Transantarctic Mountains, it provides a valuable and well referenced resource with nearly 600 cited publications. For the non-specialist, it goes some way to explain the complexity and fascination of mountain chains and the attraction of the pristine rock exposures of Antarctica.

*Reviewed by John Bradshaw, Associate Professor, Department of Geology, University of Canterbury, Christchurch, New Zealand.*

**The New Zealand Antarctic Society Inc.**, was formed in 1993. It comprises New Zealanders and overseas friends, many of whom have been to the Antarctic and all of whom are vitally interested in some phase of Antarctic exploration, history, development or research.

**The annual subscription entitles members to:** Antarctic, published each March, June, September and December. It is unique in Antarctic literature as it is the only periodical which provides regular and up to date news of the activities of all nations at work in the Antarctic and the subantarctic. It has a worldwide circulation. Newsletters for New Zealand members and an annual newsletter for overseas members. Regular meetings are held by the Auckland, Wellington, Canterbury and Otago branches.

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