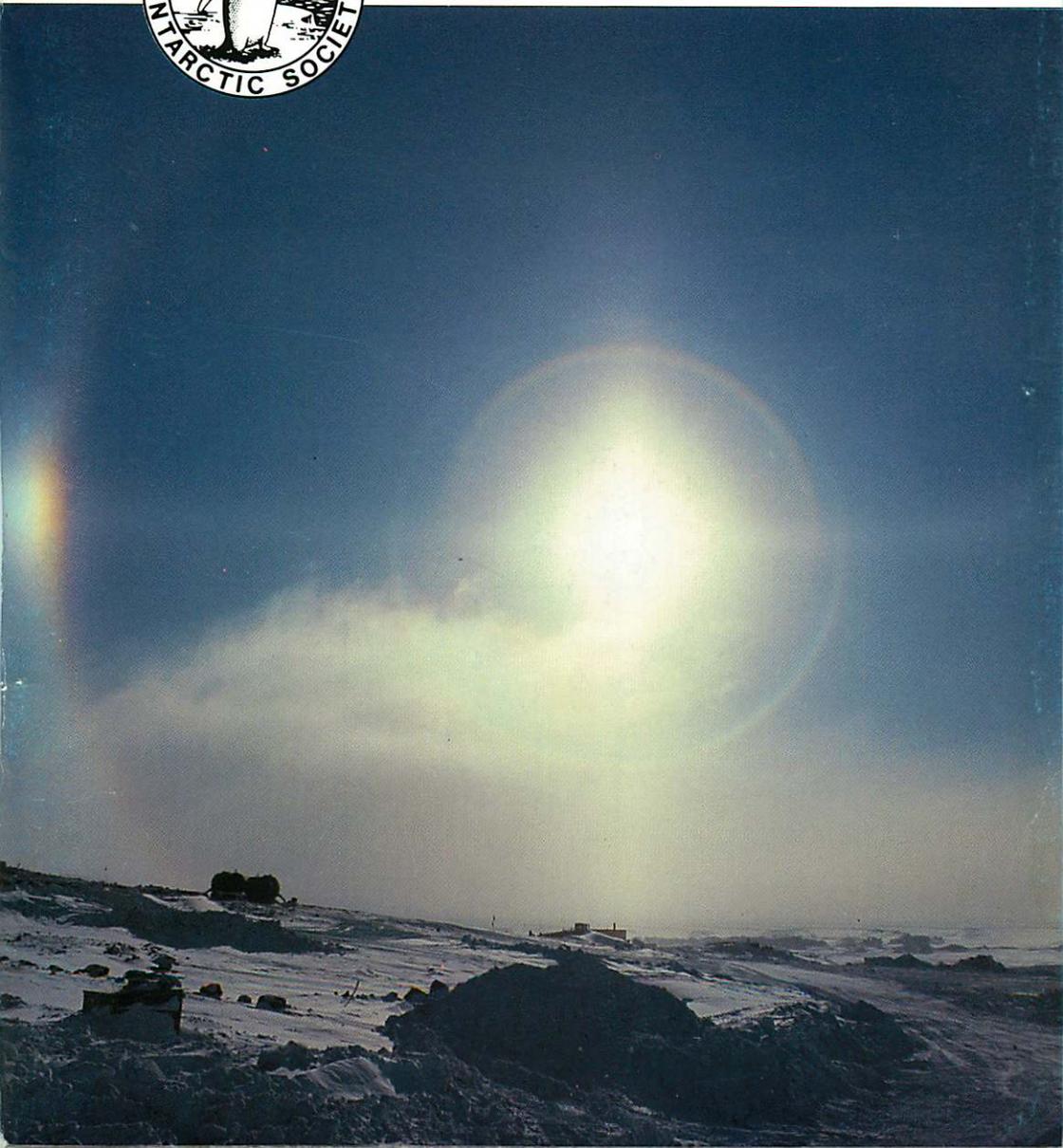


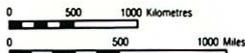
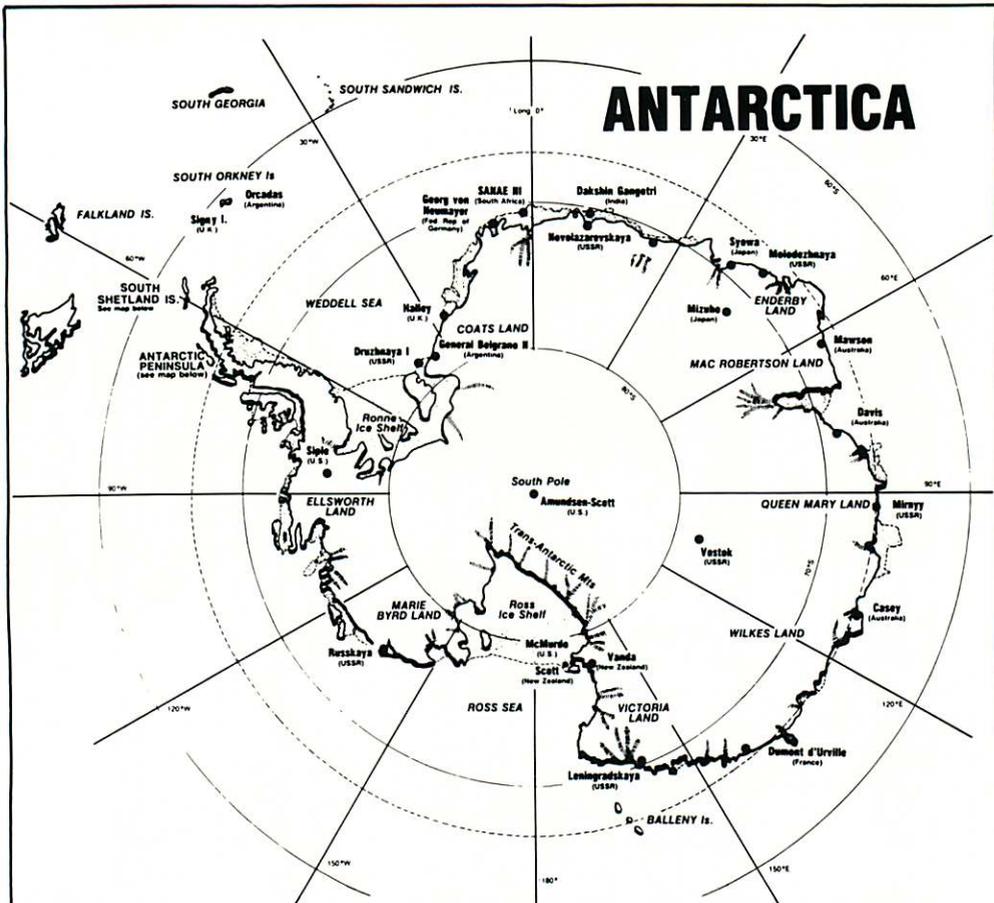
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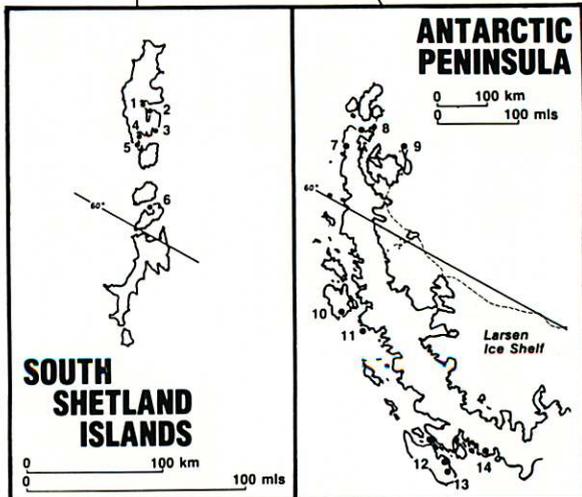
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- 2 Henry Arctowski POLAND
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- 14 General San Martín ARGENTINA



Antarctic

(successor to the "Antarctic News Bulletin")

Vol. 13 No. 2

Issue No. 146

August 1993



ANTARCTIC is published quarterly by the New Zealand Antarctic Society Inc., 1979

ISSN 0003-5327

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A Parhelion or 'mock sun' observed over Scott Base. Photo Mike Wing 1976

NZAP

New Zealand programme hosts international meeting

The New Zealand Antarctic Programme hosted this year's COMNAP, Council of Managers of National Antarctic Programmes, meeting in Christchurch. It was held from June 21 to 25 and attended by 47 delegates from 20 countries. The main topics discussed were tourism, oil spill prevention and response, Antarctic aviation safety, information exchange, environmental assessment and monitoring, alternative energy, and Glochant (Global Change and the Antarctic). COMNAP also provided participants with an opportunity for informal discussions with representatives of other nations. NZAP staff spent time particularly with USA, Italian, German and French representatives. The proposed drilling programme at Cape Roberts was also discussed.

In his opening address to the meeting during a social function on the Sunday night the Hon Phillip Burdon, the Minister for Trade Negotiations and Associate Minister of External Relations and Trade said, "The decision to hold the annual COMNAP Conference in New Zealand for the first time acknowledges the role and contribution this country makes to scientific and operational developments in Antarctica. The government appreciates this recognition.

"It is also pleasing to see the meeting held here at the International Antarctic Centre which has been developed by the Christchurch International Airport Company Limited. This excellent facility embodies the cooperative spirit which marks Antarctic activities. It currently services the New Zealand, American and Italian programmes. In future other nations may choose to base their operations here," said Mr Burdon.

Argentina, Australia, Brazil,

Canada, Chile, France, Germany, India, Italy, Japan, the Netherlands, New Zealand, Norway, Korea, Russia, South Africa, Spain, Sweden, the United Kingdom and the USA were the participating nations. (The New Zealand delegates were Gillian Wratt, director of the programme, Malcolm Macfarlane, Dave Geddes and Ron Rogers.)

The topics were discussed in dedicated working groups interspersed with plenary sessions.

In summary: A working group on **tourism** focussed on the operational issues of tourist management within the competence of the framework of COMNAP. Recommendations were developed for gathering information on procedures, employed by the various managers, interaction with tour operations and development of an Antarctic tourism database which is being negotiated internationally by ICAIR. (A pilot programme was demonstrated during

an open session of COMNAP.) **Oil spill prevention and response:** Papers entitled "Consideration of Methods for the Prevention and Response to Fuel spills at Inland Stations and Camps", and "State of the Art Review; Oil in Ice Recovery", produced by the Canadian Association of Petroleum Producers, were tabled. A fuel survey and a questionnaire on oil spill response resources was developed along with recommendations on ship safety. Updates to the Antarctic Flight Information Manual (AFIM), advance notification and the Antarctic flight plan were considered in the working group on **Antarctic aviation safety.** Another working group examined improvements to the format of the **exchange of information.** And yet another addressed issues on **Environmental Assessment and Monitoring** focussing mainly on Environmental Impact Assessment Guidelines raised by GOSEAC (Group of Specialists on Environmental Assessment and Conservation) and on the selection of representative sites for environmental monitoring for SCAR and COMNAP as requested by the XVII ATCM. The working group on **Alternative energy**

considered current technologies such as solar and wind and potential technologies such as hydro power, fuel cells, and methane from waste treatment. Global change in the Antarctic was dealt with in a plenary session where recommendations made by SCAR on the Global Change and the Antarctic Programme within IGBP were discussed. The three key recommendations which emerged were a voluntary contribution of \$US10,000 per national programme; call for nominations for a regional Research Co-ordinating Centre (RRCC), housing a full time co-ordinator for GLOCHANT; analysis and synthesis of data, modelling and data and information management. Seven GLOCHANT groups are to be established. They will focus on sea-ice, global palaeoenvironmental records from the Antarctic ice sheet and marine and land sediments; Antarctic mass balance and sea level; trace gases, aerosol particles and UV radiation in the Antarctic atmosphere, and biogeochemical cycles. There will also be groups concentrating on data co-ordination and numerical modelling.

Drilling programme proposed for Cape Roberts

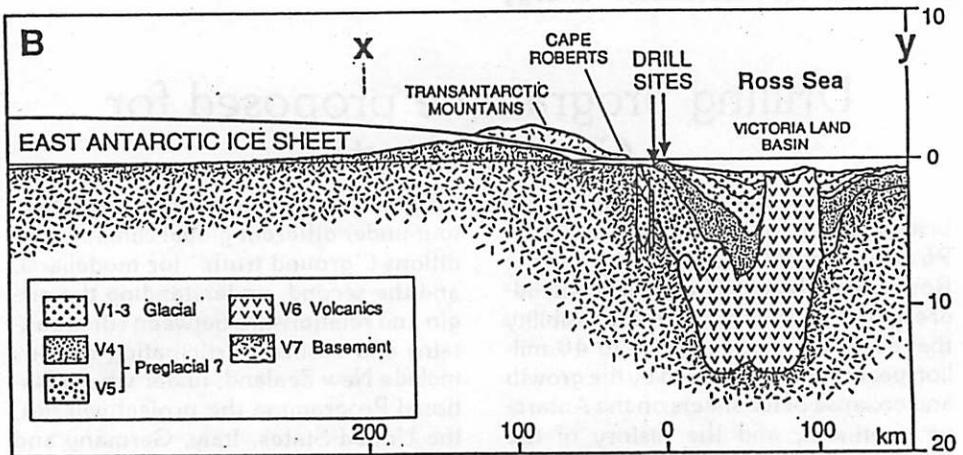
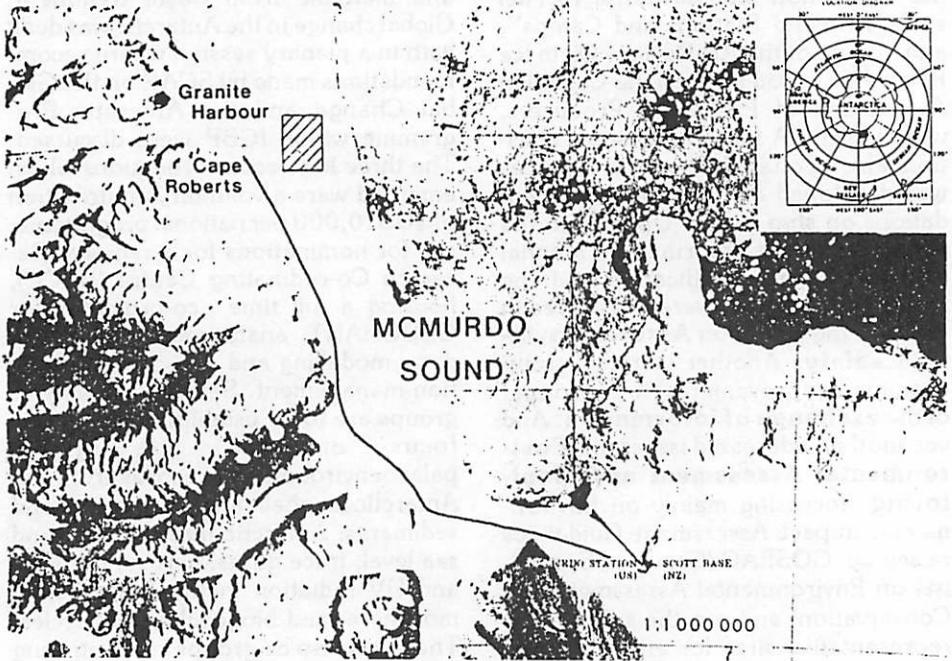
An international drilling project is being planned for the summers of 1995-96 and 1996-97 at Cape Roberts in the Ross Dependency. The project will address two main issues - the possibility that sea level changes prior to 40 million years ago were caused by the growth and collapse of ice sheets on the Antarctic continent, and the history of the West Antarctic Rift System. Each has implications extending beyond the Antarctic continent, the first in improved

understanding of the ice sheet behaviour under different global climatic conditions ("ground truth" for modellers), and the second, understanding the origin and relationship between rift mountains and basins. Participating nations include New Zealand, under whose National Programme the project will run, the United States, Italy, Germany and Japan.

Initiated by New Zealand the project is an extension of a series of drilling

programmes undertaken in western McMurdo Sound between 1974 and 1986. It is based on the discovery by

New Zealand, United States and Italian seismic surveys of deeply buried strata beneath the Ross Sea that are exposed



Location map and cross section of South Victoria Land and the Victoria Land basin, showing how the proposed drill holes off Cape Roberts would core the oldest strata in the basin. (Barrett and Davey, 1992)

at or near the sea floor off Cape Roberts, 125 km northwest of McMurdo Station and Scott Base. The strata are thought to represent the time period from 30 million to more than 100 million years ago which includes the early history of Antarctic ice and the formation of the Transantarctic Mountains.

The proposal is to drill from the fast ice, four holes each to 500 metres beneath the sea floor to obtain a continuous record of 1500+ metres of strata older than any previously drilled in the region.

A camp and equipment is likely to be placed at Cape Roberts early in 1995 and it is anticipated that drilling will start in October/November and continue over the summer. In the meantime the concept will be further developed, funding sought and design work begun. Next year (1994) it is hoped to complete the design work, purchase the equipment and prepare it for shipping to Cape Roberts early in 1995. It is currently planned to construct a drill site camp in September 1995 and drill a hole in October and another in November. In December, the equipment and camp will be winterised in preparation for a resumption of drilling in October and November of 1996. In January 1997 the equipment will be returned to New Zealand and later that year the camp will be dismantled and removed.

A workshop to develop the project was held at Victoria University in Wellington in May 1992, and included scientists interested in participating from Germany, Italy, Japan, New Zealand and the United States of America. Agreement was reached on several points a) that there should be an international steering committee comprising Dr Peter Barrett (Victoria University, Wellington, New Zealand) and Dr Fred Davey (Institute of Geophysics and

Nuclear Sciences, Wellington, New Zealand); Dr F. Tessensohn, (BGR Germany); Professor C. A. Ricci (University of Sienna, Italy), since replaced by Dr M.B. Cita (University of Milano); Professor P.N. Webb (Ohio State University, USA) and Dr Y. Yoshida (NIPR, Japan);

b) that the project should follow as closely as possible the plan and timetable set out in the report of the workshop (Royal Society of New Zealand Miscellaneous Report M23, 1992);

c) that the costs to each national programme should be in proportion to their scientific stake in the project and that the New Zealand Antarctic Programme should manage the programme in Antarctica.

Since the workshop there have been a number of meetings and discussions in various national and international fora that are leading to the submission of formal proposals in each country for funding the operation and core recovery. Further discussions were held at COMNAP and another meeting is planned in Washington in September. To date the non-science component of the project is estimated at US \$3.7 million.

Scott Base battered by mid-winter storm

Early in June Scott Base was battered by a storm lasting six days. At 6.30 am on the morning of Wednesday 2 June, 1993 the wind in the vicinity of the base, which had been blowing at 10-15 knots throughout the previous night, began increasing. By 9 a.m. it was blowing directly from the south and gusting at over 80 knots. For over an hour "condition one" had been declared at Scott Base confining staff to the shel-

ter of the buildings.

Throughout the day it blew steadily at over 60 knots but a gust at 1730 shook the anemograph off the scale. The speed was estimated to be 98 knots.

Until 0130 on the Thursday morning, when it reduced to 20 knots, the southerly averaged over 70 knots. It brought large amounts of snow and significantly reduced visibility. From 0800 however it increased again averaging over 40 knots until 1500 hours on the Thursday when it dropped slightly. It then continued to blow all day Friday, Saturday, Sunday and Monday with peak gusts recorded at 92 knots, then at 53, 65, 54 and 50.

Throughout the storm the doors on the south side of the base were packed with towels to prevent snow from entering and water dripped through some of the ventilators in the various buildings setting off the fire alarm in the Stage 6 Powerhouse.

After the storm staff examined the base. They found that although it had shaken a great deal, damage was not really apparent anywhere but a large amount of snow had accumulated around the buildings. Among the worst affected were the hangar (and the chippies area) where several cubic metres of snow had blown in. Considerable snow had also accumulated around the Powerhouse and Stage 3a areas of the new buildings. The incinerator room was partially filled with snow and the seawater supply and return line from the wet lab had been displaced but so long as it continues to work repairs will be left to the summer. The space under the garage was nearly choked in places and some two metres of snow now lay at the edge of the sea ice in front of the base. Fuel drums and some plywood building supplies have had to be recovered from the wider area but the bus

shelter survived! The flag was also observed to have frayed and is reported now to end at the last star.

Staff visited Arrival Heights on the Friday afternoon when the wind was averaging 30 knots; an empty container had blown away from the Telecom Earth Satellite Station and has to be located. At the skiff field however, the shelter wannigan is almost completely buried and will have to be relocated next summer. The A-frame required some minor excavation only.

Satellite photographs taken before and after the storm show a major break out of sea ice. Open water was now visible from Hut Point and the ice had broken out all the way along the Hut Point Peninsula and from behind Turtle Rock. Snow blanketing the sea ice was 450mm thick even 260 metres out from land. Closer in shore the ice was covered by even more snow. As of June 17 there had been no apparent increase in the ice thickness which is measured regularly.

The mid-winter swim and barbecue, planned for June 19, was however cancelled because of the ice conditions.

Two search and rescues took place during the storm (see page 76)

Mid-winter dinner at Scott Base

Forty guests from neighbouring McMurdo Station joined Scott Base staff for mid-winter dinner celebrated a little early on Saturday 12 June, 1993 beginning at 6 p.m. El Salmon de Avocarte, slender slices of juicy salmon draped over an appendage of avocado, was served as an entree. Four options were available for the main course, Royal Roast Boar, (crackling

cuts of prime pork); Spirit of New Zealand, (Luscious loins of lamb); Bosom de gobbler, (titillatingly tender turkey breasts); Fowl ala Callum (guaranteed to satisfy, choice chicken in pastry). Vegetable dishes included beef 'n broc in a wok (Cantonese chinese chowmein - not!); Peter's pumpkin surprise (deliciously charismatic casserole); Hoo Flung Dung's veges (succulent vegetable stirfry); and Spud supreme (sliced potatoes, smothered in seasoning).

The cold fare comprised Cousteau's celebre (chilled crustacean delights); Menagerie de mecca (Plateau of Mohammed's favourite meats); Kentucky coleslaw (a crispy cabbage collage from the colonel); Tommy arto's (tomatoes with tomatoes, with tomato topping); Naughty nunnies (selected cucumbers from the nunneries); Kiwi special salad (potato salad made the traditional way); Cookies favourite (salad of oblong white

things from chickens); and Lettuce un airmash, (fresh lettuce, tossed, thrown, crashed and then served to you!).

Desserts, described as "fattening but yummy things", included Pavlova pudding (whipped egg, baked into a crispy meringue); Cross dresser's delight (flamboyant flesh of favourite fruits); Napoleon's secret (hollow brandy things bursting full of cream); Profiteroles (God knows? Something the chef cooked up); Fungicidal dairy pie (chilled cheese cake); Mousse (large deer like animal from North America); and "Boys and berries" (succulent young lads dipped in jam).

Two Gisborne wines were served with the meal - a Chardonnay and a Cabernet Sauvignon, and tea, coffee and hot chocolate were available afterwards. The chef was reported to have been ably assisted by Scott Base staff four of whom waited on the guests.

Accolades for NZAPs

Student **Gary Wilson**, who is completing his PhD at Victoria University, has been awarded a Byrd Fellowship for 1993 -1994. The Fellowship is awarded to one student annually for research on any issue relating to the polar regions. It is in memory of Admiral Byrd who was a pioneer of polar aviation and reached both the South and North Poles. Between 1928 and 1956 he mounted five expeditions to the Antarctic using New Zealand as in interim base. Gary was selected from over 100 applicants to spend the year at Ohio State University.

Gary's Ph.D. is on "Ice induced sea level change in the late neogene" (a period from about 6 to about 2.5 million years ago). He, and other scientists working at Victoria University, have put forward evidence that over the last

several million years the Antarctic ice sheet has melted to a large extent and reformed several times. This differs from the conventional view which held that the ice sheet was relatively stable over time. The volatility of the ice sheet has an important bearing on current debates over the extent to which global warming could lead to rises in sea levels.

During his year at Ohio State, Gary will be continuing his research in this field and will combine several different approaches including new methods of dating old materials. His research is aimed at developing a composite reference section for the Late Neogene of the Western Ross Sea Region in Antarctica. This involves the integration of many different techniques and stratigraphic sections. New geochronological techniques of beryl-

lium -10 and k/Ar and Ar/Ar ash analysis will provide age control and calibration of sedimentary sequences of the Western Ross Sea Antarctic Margin. The basis for the stratigraphic control is drill cored strata from the McMurdo Sound area that record a regional picture of climatic evolution and allow newly directed interpretation of both drill core and outcrop data from the region. The resulting composite reference section will provide - a calibration of Antarctic Neogene biostratigraphy, a basis for interpretation of other Antarctic deposits, a correlation point for Antarctic data with other global data sets, and allow a more widespread acceptance of Antarctic data. This will show the importance of Antarctic climatic development in modelling Late Neogene cryospheric evolution.

Gary, who has made two trips to the Antarctic, one with the Americans and one with the New Zealand Programme will return to the ice for six weeks of this summer as part of his studies.

Roger Cooper, a Wellington Palaeontologist, has been awarded the degree of Doctor of Science which ranks higher than a PhD. His research has focussed on understanding New Zealand's earliest geological evolution. "New Zealand as we know it," he says, "is an amalgam of 13 or more separate fragments (terrane) that came together between 250 and 130 million years ago". Working with rocks from about that period and up to 400 million years ago has led him to compare New Zealand rocks with those of Australia and the Antarctic. New Zealand began as an arc of volcanic islands off the coast of Gondwana.

One study confirmed the hypothesis that New Zealand, south-east Australia and Northern Victoria Land in Antarc-

tica had together formed a single segment of Gondwana in Lower Paleozoic time. His explorations have revealed more than 300 new fossil sites in New Zealand alone; the evidence he collected helped him establish the two-terrane model for the Early Paleozoic period, a reinterpretation of the geological structure and evolution of west Nelson and Westland. His major achievements recognised by the award of the D Sc include the completion of a terrane analysis and revision of the early geological history of New Zealand, the development of new models for international correlation of fossils for the Ordovician period; descriptions of new faunas from the Cambrian period in the Antarctic and completion of a continent wide review of Antarctic bio stratigraphy. Dr Cooper is currently working with the Institute of Geological and Nuclear Sciences in Lower Hutt. He went south first in 1960-61 with VUWAE 5 and again in 1974 as leader of a two part expedition to North Victoria Land. Dr Coopers party concentrated mainly on the fossils while Dr Malcolm Laird, leader of the other party, worked on mapping and sediments. In 1981 Dr Cooper made a further brief visit for an aerial reconnaissance of North Victoria Land and in 1983 he returned again to continue the work begun in 1974.

On 3 June 1993 the Minister of External Relations and Trade (now Foreign Affairs and Trade) the Rt. Hon Don McKinnon, announced the award of the Polar Medal to **Margaret Bradshaw** of Christchurch.

Polar Medals are awarded by the Queen from time to time, under the terms of the Royal Warrant, in recognition of individual merit arising from enterprise and hardship, outstanding personal contribution in exploration, scientific research or general service on



polar expeditions (both in the Arctic and Antarctic) for no less than 12 months. The medal was first awarded for Arctic expedition service in 1818, and until 1904 was known as the Arctic Medal. In that year it became the Polar Medal, and first awards for Antarctic service were made to members of Scott's first expedition (1901-04). Medals are awarded on recommendations from the British and New Zealand Governments.

Margaret has spent over 416 days in the Antarctic spread over six different expeditions which she has either organised or lead. During her first visit in 1975 she spent four weeks in the Dry Valleys and the edge of the Polar Plateau in Southern Victoria Land. In 1976-77 she returned to the area for a further six weeks.

In 1979-80 she was the first woman to lead a deep field party in Antarctica spending three months in the Ohio Range area at 84deg S. She returned to the area as leader of a further expedition in 1983-84.

In 1988-89 she led a deep field party for three months work in the Darwin to Hatherton Glaciers area and in 1991-92 she spent a further three months as leader of another deep field party working from the Cook Mountains to Mount Fleming.

The mother of two and wife of John Bradshaw, now Associate Professor of Geology at Canterbury University, Margaret was born in Nottingham and graduated BSc Honours in Geology at London University in 1963. She spent three years as curator at the Dick Institute Museum in Kilmarnock, Scotland before coming to New Zealand in 1966. For the next six years she worked part-time with the Geology Department at the University of Canterbury before returning to Scotland to lecture at the University of St. Andrews. In November 1973 she began work at the Canterbury Museum increasing her commitment to becoming full-time Curator of Geology as well as Directors Deputy, a position she held for three years from 1984 until it was disestablished.

Margaret has published extensively and presented papers to a number of International symposia and conferences including two organised by SCAR.

Since 1992 she has been Assistant Director in charge of exhibits at Science Alive!, the Science Technology Centre in Christchurch.

In addition to her work commitments she has been a long time member of the Geological Society of New Zealand and held a range of offices with the New Zealand Antarctic Society including that of Acting President for a few months in 1991. She has also been closely involved with the Antarctic Heritage Trust.

The only other woman to be awarded the Polar Medal is Lady Virginia Twisleton-Wyckham Fiennes. Her award was announced in the London Gazette of 9 September 1986 and was made for her contribution to the Transglobe Expedition of 1980 for which she was radio operator.

Jim Wilson, the General Manager of Helicopters NZ, whose Head Office is in Nelson, is off to Saigon in

Vietnam in an attempt to secure an operating licence for the company in that country. The company already has a subsidiary called Lao Westcoast Helicopter Co operating in Vientiane in the Lao People's Democratic Republic. This new operation is an extension of business and will not affect the company's availability for Antarctic flying. The Company's chief pilot James Wilson has spent a number of seasons on the ice, both in the Arctic and the Antarctic. The Assistant General Manager, Andrew Brown, has also been south to provide similar logistic support and Keith Jolly, also from Helicopters New Zealand was one of the first two RNZAF pilots to fly helicopters in Antarctica "on loan" to the US Navy.

Mary Cox, who was base manager at Scott Base for four months during the summer of 1992-93, has been promoted to Wing Commander and is the first woman to reach this rank in the RNZAF.



Wing Commander Cox began her airforce career as a 17 year old typist with the WRNZAF at Wigram, signing up for three years but staying for four. She left for four years and rejoined in the 1978 as a Pilot Officer in the Air Staff Secretarial Branch of the Directorate of Officer Postings and Appoint-

ments. Eighteen months later she was posted to Ohakea as Personnel Officer and during this time she served in Malaysia and Singapore. She was the first woman to be deployed overseas with the RNZAF.

Other appointments held by Wing Commander Cox during her career with the airforce include positions at the RNZAF Staff College, three years at Wigram initially as Accountant Officer and then as a Staff Officer in Support Group Headquarters, two years with NZ Force Headquarters in South East Asia when she was again based in Singapore, Commanding Officer Administration Squadron at Ohakea and a staff appointment in Operations Group Headquarters. Mary Cox was also the first woman to serve as manager at Scott Base.

Antarctic Heritage Trust

Sir Robin Irvine, retiring Vice-Chancellor of the University of Otago, and **Mr John Ingram** C.B.E. of Auckland have joined the board of the Antarctic Heritage Trust.

Sir Robin has a distinguished University and academic record and was recently appointed chairman of the Ross Dependency Research Committee.

Mr Ingram has extensive commercial and community experience and is currently a director of the National Bank of New Zealand, a trustee of the World Wide Fund for Nature (New Zealand) and serves on the Council of the University of Auckland.

Paul Chaplin, Operations Manager at Scott Base during the summer of 1992-93 has been appointed Executive Officer of the Trust. He has replaced Major James Barker who resigned last January to pursue other interests.

Aged 47, Paul was educated at Shirley Boys High in Christchurch and has spent 20 years with Television New Zealand working in various capacities from operations to directing and more recently in resource management. For the four years up to 1989, when he left TVNZ, he was responsible for managing the establishment of the New Zealand Teletext Service. He then oversaw the transition of the Health Camp Movement to an autonomous service in anticipation of the changes occurring in the health sector. Paul has been active in outdoor recreational pursuits and participated in a number of aviation and maritime activities. He has had a long term interest in the Antarctic and its history.

A trust with charitable status has been formed in England and a public fundraising campaign will be launched

later this year. The Trust is chaired by Bryce Harland, former New Zealand High Commissioner to London and Mr John Hamilton MC is the secretary. Trustees include Mr Robin Byatt, former British High Commissioner to New Zealand, Sir Vivian Fuchs FRS, Dr Richard Laws CBE FRS, Dr David Drewry, Director of the British Antarctic Survey, and Dr John Heap CMG, Director of the Scott Polar Research Institute. The treasurer is Mr Peter Hetherington.

Winter staff CORRECTION

On page 299 of *Antarctic* Vol 12. No. 9, and on page nine of Vol 13.No.1 we included Pam Davies as a member of the team wintering at Scott Base in 1993. Pam returned to New Zealand last summer and her place was taken by Vivienne Taylor. *Antarctic* apologies for this error.

The closing of Vanda

This is the first of a series of articles covering the background and history of Vanda Station.

New Zealand's Vanda Station, which lies at 77deg32'S/160deg30'E, in the Wright Valley is likely to be removed. The station has an interesting background. When constructed it was situated 150 yards (137.16 metres) southwest of the lake after which it is named, and which occupies the lowest part of the valley. It was 30 feet (9.1 metres) above the lake level and 120 yards (109.7 metres) from the Onyx River which flows west from the Wilson Piedmont Glacier for 18 miles (28.8 km) into the lake which has no outlet. [1]

Monitoring of the lake, which lies adjacent to the station, has shown its levels to have fluctuated regularly dur-

ing many seasons since 1969 when it was 81.775 metres above sea level. Overall however the level has risen significantly and in 1992 it was 91.285 metres above sea level. Scientists consider that the rise could be attributable to global warming or it may be a natural long term fluctuation. Either way the laboratory is now 94.23 metres above sea level, while the bunk room is 94.80 and the mess lies at 95.88. This means that the lake is now only 2.95 metres (9.6 feet) from the station [2]. Buildings have been added or replaced over the years but they have remained mostly within the confines of the original site with only slight extensions.

The decision to remove Vanda Station is also being influenced by changes in the science programme which have created less demand for the station. It has not been permanently staffed during the summer since 1992. [3]

As early as 1965-66 the prospect of New Zealand involvement in a second base was being discussed by the Ross Dependency Research Committee. It followed an unofficial proposal [4] from the US to be jointly involved in the establishment of a temporary base in the Dry Valleys. Such a base would enable an eight man American, Japanese and New Zealand party to winter over in the area in 1966/67 in order to supplement their summer data and learn more of the Dry Valley phenomena. Russian scientists had worked with the Americans and Japanese for the preceding three seasons and it was New Zealand's ninth year of operations in the Valleys.

Wide interest

In a report recommending that the Minister approve participation in the project RDRC suggested that the great deal of the New Zealand work could not be completed without winter observations. [5] The reaction they had gleaned from the scientific organisations throughout New Zealand for a new station was reported to be most enthusiastic; the departments of the DSIR, Meteorological Service, Victoria and Canterbury Universities would pursue meteorological, glacial, lake temperature distribution and chemistry studies and soil analysis as well as undertaking further geological work. In addition auroral, seismological and other observations could be made and these made would supplement the programmes at Scott Base initiated during the Interna-

tional Geophysical Year and thus contribute to long term data collection. Moreover the new projects lent themselves admirably to international cooperation.

In *Antarctic* [6] Bob Thomson reported that "The dry valley region is about 60 miles west of Scott Base. Only the summer appearance of the valleys is known - there is no covering of ice or snow, glaciers end part way down the near sheer 6,000 feet sides, there are sand dunes 100 feet high, rivers flow and there are lakes with thickly frozen surfaces.

The name Vanda was given to the lake by a Victoria University of Wellington team in 1958-59, whose leader, Dr Colin Bull, had a dog of this name on the North Greenland expedition in which he participated. [7]

Winter mysteries

"No one knows exactly what happens in the valleys during the winter and over the short summer months..... The only life in the valleys is microscopic, collecting around the shores of the lakes and in streams from the snouts of the glaciers.This area has puzzled explorers and scientists," said Mr Thomson.

"The base and its environment," [8] he said, "will be a strict science area and to minimise interference to scientific recording equipment generators will not be installed. All equipment will be operated by batteries, recharged by wind-powered generators will small motor generators as a standby".

".....To go it alone"

In July 1966 however, the Na-

tional Science Foundation deferred their intention to participate following enhanced commitments in the Peninsula area [9] [10] and in 1968 they withdrew their proposal altogether. In the meantime, in December 1966 RDRC [11] had established a subcommittee comprising Bob Thomson, (Superintendent of Antarctic Division), Mr W.H. Ward, Dr J.F. Gabites and Professor R.H. Clark from Victoria University to report to the March 1967 meeting "on the possibility of New Zealand going it alone." Their brief covered investigation of the capital and running costs of the operation with particular regard to the logistics.

Air drop

In an appendix to the New Zealand Antarctic Programme Proposal to the Minister for 1967/68 they reported "that we have two well equipped huts that are not being used and that they could be transported using surface vehicles. Alternatively, they could probably be air-dropped by RNZAF Hercules aircraft from McMurdo during the period of scheduled RNZAF flights to Antarctica during October 1967. Discussions with RNZAF Operation's Group Officers, who have visited the Dry Valleys, indicate that no real problem exists in this method of transportation and they were keen to carry out an operation of this type in Antarctica. American assistance would only be required for carrying fragile equipment, supplies and personnel by helicopter. "....The buildings of the proposed station would consist of the hut at present at Cape Royds (previously used by Canterbury University biological parties which have now shifted their activity to a hut erected last year at Cape Bird), and the auroral radar hut previously

situated at Arrival Heights, but which was dismantled at the end of last summer season following the completion of this project. It is proposed to use the latter hut as the scientific laboratory. At present it is stored at Scott Base in readiness for transportation to the Dry Valley. The Royds hut is a complete living hut with full facilities required for 4-6 men. It is proposed to dismantle this hut in September 1967 and sledge the material back to Scott Base in readiness for transportation to the Dry Valley area."

Full programmes

"Full meteorological programmes would be undertaken by the New Zealand Meteorological Service. Geology, glaciology, lake chemistry, water balance of lakes and heat flow would be studied by Victoria University. An ionospheric receiver would be installed in due course but in the meantime geophysics Division of DSIR would conduct a seismology programme. Aurora, whistlers, VLF, lake chemistry and generalised heat transfer would be studied by the Physics and Engineering Laboratory of DSIR while soil studies surface and sub-surface temperatures would be the preserve of the Soil Bureau. The University of Canterbury would study geology. The ultimate continuous staffing of the base will lift the science content of New Zealand's Antarctic work, in proportion to support, to one of the highest for any of the nations participating in Antarctic exploration and research, RDRC was told.

Other benefits

"In addition to the benefits to New Zealand science programmes the huts would provide an ideal staging station

for geological and other field activities in the area throughout the summer period. Parties could operate with minimum logistic support and the programmes were ideally suited to international cooperation.

“...a modest establishment”

Economy was not only demanding a modest establishment created at minimum cost but also the use of voluntary labour. The committee reported that the remaining dismantling and re-erection of the huts could be undertaken by summer base staff whose efforts would be supplemented by personnel from Victoria University and the New Zealand Antarctic Society.

Small costs would be incurred through the construction of new foundations, extra tie-downs, new panel-jointing and a small amount of hardware.

Fuel for cooking and heating were included in the budget, which, with clothing and salaries of three men for one year totalled 6,327 pounds. The actual cost of transporting the buildings was not included but the recommendation was strong enough to be accepted and, with minor changes in the logistical arrangements, the project went ahead.

The main buildings of the station were assembled during October-November 1967 [12] on a site already chosen and surveyed by Bob Thomson and Bob Miller, later Sir Holmes Miller, earlier in the year. Ice conditions initially made it impossible to prepare the Royds hut for transportation, and so a new hut designed by Thomson, and the base leader Bill Webb, was built at Scott Base and was to serve as a stores hut at the new location.

Operations began early in October when Colin Clark, with the support of

13 R.N.Z.A.F. men flown in on October 12, worked long hours packing the 40,000 lbs of equipment and stores into special containers for parachuting to the base site. This material included the sections of two huts, electrical equipment, food, a Gnat motor vehicle-and a wheelbarrow. Everything was weighed before being packed because the weight factor for individual loads was of paramount importance. The pallets were loaded on to sledges and towed to Williams Field, where two hours were required to load the aircraft for each flight. On the 15th, prior to the operation, Bob Thomson, accompanied by Bill Webb and Wing Commander O'Conner flew a reconnaissance of the dropzone - the frozen surface of Lake Vanda. On the 16th "Operation Ice-cube" began.

All in five flights

Five flights were necessary, in what was described as the largest operation of its kind since the Americans had built Amundsen-Scott Station at the South Pole in 1956. It was the first internal support operation for an Antarctic project by the R.N.Z.A.F since the Antarctic flight was disbanded after the conclusion of the Commonwealth Trans-Antarctic Expedition in 1959.

Under the command of Wing Commander D.J. O'Conner, all flights left from Williams Field, four miles from Scott Base. Each of the runs was made down the valley with a sudden sharp descent from above the mountains to the required dropping height. By this time the aircraft was already halfway over the lake. For each drop, the pilot reduced speed to 130 mph which was considered to be as slow as the Hercules could safely be flown.

Nineteen containers, the largest

weighing 3,300lbs were used. A few items were damaged and the contents scattered, but a Gnat vehicle, deemed the most difficult portion of the cargo, was successfully landed, and was later used for hauling containers to the lake shore.

Recovery and construction

The recovery party led by Warwick Orchiston had been flown to the site on October 13 by U.S. helicopter, and had pitched their camp and set up their radio link with Scott Base. They described the exercise as "precision flying". Each load landed well inside the target perimeter, the accuracy being such that falling containers could well have damaged those already on the ground. Delays in flights from New Zealand now held up the arrival of the additional workers to complete the ground operation but the programme was returned to schedule with the assistance of two helicopter crews in recovering the items that had been scattered during landing.

Construction teams under the leadership of G.N. Reilly took three weeks to assemble the first two huts. Assistance was provided by two members of the Antarctic Society G.N. Hamilton of Christchurch and B.D. Norton of Wellington. (The Wellington and Canterbury branches of the Antarctic Society had been asked to nominate volunteers for this task and these men were chosen. Brian Norton was a member of the Canterbury Branch before coming to Wellington in 1964. A technical officer on the television side of the New Zealand Broadcasting corporation, he was ionosphere observer in the team on Campbell Island in 1951-52, when he was also responsible for the maintenance of the radio equipment. In his

early years he had been a keen member of the Canterbury Mountaineering Club. Neil Hamilton was a company director and qualified builder and joiner and member of several mountain clubs. He had climbed in Switzerland, Austria and Italy as well as in New Zealand, travelled in the Arctic and instructed in many climbing and ski schools in Canterbury and Otago. He had also built mountain huts and been associated with Deep Freeze since its inception.)

On February 15, with ice conditions now permitting, the third hut for the station was removed from Cape Royds. The operation was undertaken over two days. After six hours of dismantling the 420 square foot hut three hours were required to carry the prefabricated sections by helicopter to the *Burton Island*, standing off the Cape three-quarters of a mile away. Another three hours were needed for the icebreaker to carry the hut across McMurdo Sound to Wilson Piedmont Ice. Here the helicopter was again used to carry the hut sections to Hogback Hill behind Marble Point. The four-man working party, again led by W.J. Webb, now securely tied the dismantled structure down for the winter. The following season the hut was taken over 30 miles up the Wright Valley and re-erected at the site to become part of the new station.

Assessment

New Zealand Antarctic Programme administrators are now waiting the results of an Environmental Impact Assessment report which was due to be circulated in June for comments which were required by mid-July. Full recommendations regarding the removal of the station will then be made to the Ministers of Science and Technology

and of External Relations and Trade. It seems likely however that the accommodation and laboratory buildings will be relocated and much of the remainder of the station dismantled for probable return to New Zealand.

Analysis of soil samples obtained last summer by Dr's Doug Sheppard, Graeme Claridge and Iain Campbell from the area of the station is now complete and decisions regarding the possible removal and subsequent disposal of soil contaminated mainly by dirty water and minor fuel spills are also being made.

The hut at Butter Point may also be removed during the 1993/94 season and the accommodation wannigan at

Cape Royds is likely to be relocated further from the penguin colony.

Footnotes:

[1] *Antarctic*, December 1967 page 592ff

[2] Personal communication, NZAP

[3] Personal communication, NZAP

[4] RDRC papers 340, December 1965

[5] RDRC Programme Recommendations 1968/69, March 1969

[6] *Antarctic* March, 1967, page 449

[7] *Antarctic* December 1967 page 592

[8] *Antarctic*, March 1967, page 449ff

[9] RDRC papers 4 May, 1967 No. 392

[10] RDRC Minutes of 19 July, 1966

[11] RDRC Minutes, December 1966

[12] *Antarctic*, December 1967 page 592ff

Environmental Protection Bill is introduced

On 22 June, 1993 the Rt. Hon. Don McKinnon (Minister of External Relations and Trade) now Ministry of Foreign Affairs and Trade introduced the Antarctica (Environmental Protection) Bill to Parliament. This Bill implements the Protocol on Environmental Protection to the Antarctic Treaty that was opened for signature at Madrid on 4 October 1991. The obligations imposed by the Bill are in accordance with the requirements of the Protocol, and will enable New Zealand to ratify the Protocol.

Spain, was the first country to ratify and did so on 1 July 1992. This year Ecuador has ratified on 4 January 1993, France on 5 February 1993, Peru on 8 March 1993 and Norway on 16 June 1993.

The full title of the New Zealand Bill

is "An Act to provide for the comprehensive protection of the Antarctic environment and to recognise Antarctica as a natural reserve devoted to peace and science and to implement the Protocol on Environmental Protection to the Antarctic Treaty".

The components of the Bill cover Environmental Impact assessment detailing the purpose, the initial evaluation, draft comprehensive evaluation and final evaluation as well as exemptions and offences. In Part II Measures for the Conservation of Antarctic Fauna and Flora and Protected Areas are covered. Part III details the purpose and principles and practices of Waste Disposal and Part IV covers the Prevention of Marine Pollution. Part V embraces a number of miscellaneous provisions including emergencies, appointment of

inspectors, their powers and protection from proceedings, liabilities, derogation, regulations, amendments to other acts and revocations. The final 40 pages of the 65 page document covers the schedules to the bill.

Its principal features are:

> A ban on mineral resources activities in Antarctica.

> A requirement that, before an expedition departs for Antarctica, the organiser inform the Minister that the expedition is going, and whether or not an environmental evaluation of the proposed activities has been carried out. (This also applies to the annual New Zealand Antarctic Programme).

> A provision enabling the Minister to give direction in respect of activities in Antarctica and a requirement that environmental impact assessments be prepared in respect of activities in Antarctica other than those that have less than a minor or transitory effect on the environment.

> The establishment of a permit system for the purposes of conserving Antarctic fauna and flora and protecting specially designated areas.

> Rules to regulate waste disposal and to prevent marine pollution have also been included.

Once enshrined in legislation the bill will apply to all New Zealand citizens and people usually resident in this country, to members of expeditions to Antarctica which are organised in New Zealand or for which this country is the final point of departure for Antarctica and to people on board New Zealand ships or aircraft or other ships for which New Zealand is the final departure point for the continent.

The Mining Ban applies to everyone, regardless of nationality.

The Bill however largely does not apply to members of expeditions organ-

ised by the governments of other Contracting Parties. Similarly, special exclusions apply to people on board ships or aircraft operating in support of expeditions organised by the Governments of other Contracting Parties who are observers or exchange scientists. This is consistent with the position under the Antarctic Treaty. Consistent also with the Antarctica Act of 1960 (New Zealand), is the requirement that the consent of the Attorney General is necessary before proceedings are instituted against non-New Zealanders or before proceedings are instituted in respect of offences anywhere in Antarctica outside the Ross Dependency.

In introducing the document to Parliament the Minister stated that "The bill will set in place the Government's commitment to the protection of the Antarctic environment..... Its adoption in Madrid represented the culmination of lengthy, complex and difficult negotiation in which New Zealand had played a major part and it had restored to the treaty system the consensus on which consultative parties had always operated.

"The bill will enable New Zealand to ratify the protocol and in doing so, it will help us in urging the treaty parties that have not yet done so to ratify the protocol and to implement its provisions in their domestic law as soon as possible. It is important to note that the protocol complements and does not derogate from the Antarctic Treaty. The freedom of scientific research and the co-operation in scientific investigation that are provided for in the treaty are preserved and the protocol recognises the value of Antarctica as an area for the conduct of scientific research."

The Bill is currently under discussion by the Foreign Affairs and Defence select committee, submissions having

closed on August 6. However with New Zealand elections pending it is not likely

to appear on the legislative agenda again in 1993.

Science strategy released

In July, 1993 RDRC issued a five year scientific programme for New Zealand Antarctic Research. It identifies four priority potential research themes and looks ahead until 1997/98. The document is the result of wide consultation with the Antarctic science community and the interrelated themes are considered to be problems of global importance as well as being significant to New Zealand.

The illustrated glossy 16 page document comprises sections which briefly define the region and its global importance, the international context, the New Zealand Antarctic Programme, and scientific opportunity and challenge. It then goes on to cover human activities, climate processes, biodiversity, terrestrial evolution, the environment, and international links. This is followed by sections on Scott Base, Christchurch as a "Gateway to the Antarctic", logistic cooperation, and finally lists New Zealand's Antarctic agencies and RDRC's terms of reference. Sir Robin Irvine, Chairman of RDRC has written the foreword.

Development of the framework began in 1991 during major restructuring of New Zealand science organisations. At the time RDRC foresaw that national resources for supporting research projects on the continent were, and would remain, limited. It also believed that it was important to assure the New Zealand public that Antarctic research represented value for money.

The themes are:

Climate processes: The Antarctic con-

continent and the Southern Ocean that surrounds it have an extreme effect on global climate and on the climate of New Zealand. Research relating to this theme will focus on the atmospheric processes which drive climate, together with boundary layer modification by the continent, the ocean and the sea ice.

Human activities: Anthropogenic strain on the atmosphere, ocean and terrestrial environments of Antarctica in the next several decades, together with the inevitable consequence that New Zealand will be severely influenced by such effects, dictates that research in this theme is likely to grow.

Biodiversity: Over the next quinquennium New Zealand will develop its research in the Antarctic biological sciences, particularly relating physiological and cellular biology with the Antarctic environment. DNA-related studies are likely to increase.

Process oriented research will remain as the major approach to New Zealand life sciences research in Antarctica. International collaboration with the American, British, Australian and Italian programmes will remain a strong feature.

According to the document "It is anticipated, that an increased New Zealand commitment in freshwater and terrestrial ecosystem will follow from the recently funded US Long Term Ecological Research Programme in the Dry Valleys. A reference site on Ross Island for the international BIOTAS (Biological investigations of Terrestrial Antarc-

tic Systems) sponsored by SCAR is under consideration and, if this is approved, it will lead to increased terrestrial biology in the vicinity of Scott Base."

Terrestrial Evolution: Research in the next five years will focus on the geological evolution of the margin of Antarctica which juxtaposed New Zealand prior to the Gondwana breakup 80 million years ago. It will give a better understanding of the development of the New Zealand region.

Philosophically RDRC believe that New Zealand's Antarctic science programme should support the protection of the Antarctic environment, other national interests and international obligations by developing an understanding of the nature, evolution, environment and unique life forms of the Antarctic Continent and in particular, the Ross Dependency and its surrounding sea and they believe that the approach they have adopted to be sufficiently flexible to allow individual research projects to be fitted in depending on their relevance and merit.

Funding

Approximately 300 research teams in New Zealand's government-owned research companies, unities and private groups will receive a total of \$251 million in 1993/94 according to the announcement of decisions by the Foundation for Research, Science and Technology on 24 June, 1993.

A total of \$1,701,000 has been allocated to Antarctic Science. The distribution is: Two grants go to NIWAR, one of \$573,000 for Antarctic Atmospheric Research and another of \$182,000 for ecological work. Health and Forensic Sciences will receive a grant of \$51,000 for IEHPS

Chemistry of Antarctic waters. Geological and Nuclear Sciences have two allocations, comprising \$420,000 for Earth Science Programmes and \$132,000 for Sea ice studies. Landcare has \$125,000 for continued aerial photographic census of Adelie penguins. The Cawthron Institute in Nelson is to receive \$61,00 for soil pollutant dynamics and another \$31,000 for work on anaerobes. Land and Soil Consultancies will receive \$26,000 for continued studies of the properties of permafrost.

The allocations, are made by the Foundation, which administers the Public Good Science Fund (PGSF) on behalf of the government for research that is considered likely to benefit New Zealand but is unlikely to be funded by other groups such as industry.

70th Jubilee

On 30 July, 1923 an Order-in-Council established, defined and placed the Ross Dependency under New Zealand administration, thus providing New Zealand with an Antarctic territory.

RDRC awards announced

Two South Island students are the first recipients of the RDRC Science Awards established earlier this year to increase public awareness of New Zealand's Antarctic programme and encourage younger people in Antarctic science.

Lucette Dijkstra, a PhD student from Lincoln University and Micheal Williams, a Masters Student from the University of Otago will travel south this coming

season for Antarctic experience.

In announcing the awards Sir Robin Irvine, Chairman of RDRC said the proposals were innovative. "Ms Dijkstra's work will involve DNA fingerprinting to

determine the genetic base of an Antarctic green algae and Michael Williams is to run a survey of the internal wave structure under the shore fast ice of McMurdo Sound.

ANARE

Nine voyages south to support 1993/94 programme

Australia's 1993/94 summer Antarctic Programme will focus on research that will improve understanding of global change, protect the Antarctic environment and provide information of practical importance to Australia. Two vessels Australia's *Aurora Australis* and the chartered German ship *Icebird* will undertake nine voyages in support of the planned continental, sub-Antarctic and marine science programmes. Nearly 200 scientists and support staff are involved in the season's activities.

Major programmes planned for the continent this season comprise:

> A 2,200km traverse of the one million square kilometre drainage basin of the Lambert Glacier during which the eastern side of the system will be surveyed for the first time for ice movement, depth and snow accumulation. The Lambert Glacier is said to be the world's largest.

> New studies of the geology of the Casey region, as part of a wider investigation of the East Antarctic Shield, once connected to Australia in the supercontinent Gondwana; and

> continuing investigations of the ecology of emperor penguins and Weddell Seals.

> Studies of the ecology and molecular biology of Antarctic micro-organisms in the unique lakes of the Vestfold Hills around Davis Station will also be made.

Activities were scheduled to begin

with the Voyage 1 to be undertaken by *Aurora Australis* which was to depart from Hobart on August 7 to visit Macquarie Island and undertake a marine science cruise, returning to Hobart on October 11. Leader for this voyage is Dick Williams, assisted by Andrew McEldowney. The vessel will then resupply and depart the following day for the Mawson ice edge, arriving on October 27 before sailing on to Davis which she should reach by November 4. This second voyage will be led by Phil Gard with Guy Ratcliffe as deputy leader. By November 18 she should have returned to Hobart to prepare for Voyage 4, again leaving the following day and which will take her back to the Mawson and Davis ice edges and include a visit to Law Base returning to Hobart by December 29. Voyage 4 will be led by Rob Easter with Gordon Bain as deputy. A trainee, Rob Ferguson will assist them.

On 2 January 1994 she is again scheduled to depart Hobart this time on Voyage Seven of the season during which she will undertake marine science work on her way to Davis and Casey and between the stations returning to Hobart on February 25. Voyage 7 is to be led by Jo Jacka with Gerry Nash as deputy.

In the meantime the interim and remaining voyages will be undertaken by *Icebird*. On October 26 (Voyage 3) she is scheduled to leave Hobart for Macquarie Island and Casey returning to Hobart on November 23. This voyage will be led by John Brooks with Jenny Whittaker as deputy. Three days later she will leave again, this time to repeat the voyage returning to Hobart on 1 January 1994. This is Voyage 5 of the season and it will be led by Rod Ledingham with John Wilson as deputy and Dave Moser joining them as a trainee. The sixth voyage of the season will also be undertaken by *Icebird*. She should depart on January 1, arrive at Casey on January 11 and return on the 28. This voyage will be led by Sandra Potter with Pat Wilds as deputy and Phil Wood as trainee. During Voyage 8, scheduled to begin on January 28 *Icebird* will visit Mawson, Davis and Law Base, returning to Davis and Mawson on her way back to Hobart where she should arrive on 14 March 1994. Voyage 8 will sail under the leadership of Vince Restuccia, Pud Taylor as deputy and Dave O'Neill as trainee. The ninth and final voyage for the season will take *Icebird* to Macquarie Island leaving Hobart on March 14 and returning on the 23rd. Suzanne Stallman and David Harris will be leader and deputy-leader for this voyage.

In addition to supporting continental activities and work around Macquarie and Heard Islands, the marine

science component of the season's activities will include the third of a series of seven planned transects of the Southern Ocean between Tasmania and Antarctica, a crucial part of international oceanographic studies investigating the world's oceans and their part in global change.

Station leaders for 1994 are:

Davis: Michael Carr, a management training consultant of a firm of which he is principal.

Mawson: Bob Jones, a qualified veterinarian who has been Director of a regional laboratory and manager of Animal Health and Welfare for the Victorian Department of Agricultural and Rural Affairs. In 1992 he was station leader at Macquarie Island.

Casey: Angela Rhodes, a member of the Australian Defence force and currently a Squadron Leader in the RAAF.

Macquarie: Joan Russell, a project manager with the South Australian Government. In 1990 she was leader at Casey

1993 Winter personnel

Leaders at the Australian stations for the winter of 1993 have been:

Davis: Ian Jacobsen with 23 others including two women, a biologist and medical officer. Alan Grant is leader at Mawson with 31 other men. Nineteen expeditioners are wintering at Casey under the leadership of Graeme Armstrong. The party includes two women, a chef and a biologist. Fourteen expedition personnel are wintering at Macquarie under the leadership of Ian Jackson. Their party includes one woman biologist.

Marine Science cruises focus on Prydz Bay ocean transect

Prydz Bay and the waters of the Southern Ocean south of Tasmania were the focus of two major marine sciences cruises by Australia's *Aurora Australis* during 1992/93. They included the ship's first venture into Antarctic waters during the autumn formation of sea ice.

The first marine science voyage, in January and February 1993, took *Aurora Australis* into the nutrient-rich waters of Prydz Bay, where 25 scientists undertook a systematic study of the region as part of a large-scale investigation of the marine resources between Australia and Antarctica. A key study focused on the large-scale distribution of krill and zooplankton - small animals vital to the Southern Ocean food-chain with associated studies of other plants and animals, the sea floor and the ocean itself. Research work included:

- >a continuing large-scale hydro acoustic survey of the distribution and abundance of krill swarms in Prydz Bay;
- >assessment of the distribution, abundance and species composition of zooplankton;
- >experimental work on the vertical migration of *Pleuragramme*, the Antarctic "herring";
- >continuous measurement of carbon dioxide concentrations in the air and surface waters to ascertain variations in carbon dioxide sea-air exchange
- >measuring primary productivity by different size classes of phytoplankton and changes in the species composition, distribution and abundance of phytoplankton and protozoa (single-celled plants and animals at the base of

the marine food web);

- >a survey of bottom-living animals of Prydz Bay, with sampling from the bottom of the ocean floor;

- >geological coring and dredging in sediments on the floor of Prydz Bay for evidence of past oceanic climates; and
- >studies of the distribution and abundance of seabirds.

The voyage also saw deployment and recovery of krill cages - floating enclosures five metres wide by ten metres deep which, fitted with satellite transmitters, allow repeated sampling and measurement of growth rates of the captive krill population in a natural setting.

Live Antarctic krill were collected to stock the Antarctic Division's cold room aquarium at Kingston in Tasmania, where scientists have had unrivalled success in keeping krill alive in an artificial environment, with significant benefit to knowledge of krill biology.

Autumn cruise

The final voyage of the 1992-93 season saw *Aurora Australis* heading down to the ice edge in autumn, at the time when the sea ice is forming. The ship carried 36 scientists on a cooperative cruise involving the Antarctic Division, CSIRO, the Antarctic Cooperative Research Centre and the University of Tasmania. It involved multi-disciplinary studies of Southern Ocean waters between Tasmania and the Antarctic continent, and was *Aurora's* first venture into Antarctica's sea ice outside the normal spring-summer shipping season.

Oceanographers were examining the structure of the water masses between Hobart and the Antarctic continental shelf as part of the major international World Oceanographic Circulation Experiment (WOCE), which aims to investigate the role of ocean currents in driving the earth's climate and their potential role in any climate change.

Oceanographic and glaciological studies will support research into changes to the global environment. *Aurora* was to stop at 120 stations on a Tasmania-Antarctica transect during the nine-week cruise, when data on the ocean's temperature, salinity and nutrients were to be obtained down to a depth of four km in support of oceanographic and marine chemistry studies.

The Antarctic sea ice, which over winter increases to an area greater than that of Antarctica itself, strongly influences the global climate system, partly through its role in the interaction between ocean and atmosphere. Glaciologists on the cruise were to undertake a study of the process of ice formation, the thickness of ice and the amount of open water within the pack ice. Measuring the thickness of sea ice accurately over a large area has always been difficult. Scientists used a computerised torpedo (lost during the exercise, along with a CTD!) travelling under the sea ice, fitted with scientific instruments, to record the thickness of the ice above. This information will help them to determine whether the sea ice area is increasing or diminishing.

(The Sea Ice sub-programme had one weeks dedicated ship's time in the zone near 145deg E during which they sampled ice and snow cover at 22 different sites, retrieved cores and samples and undertook preliminary ship-board analysis of the crystal structure of the ice to help them develop a "life history"

of an ice floe. A transect from the ice edge as well as aerial photography from helicopters enabled them to examine latitudinal variations in ice conditions, their results highlighting regional differences in ice formation processes.

In addition to radar and radiometry programmes three drifting buoys were also deployed within the pack ice and will remain there for up to 18 months recording air temperature, pressure and water temperature at the surface and depths of up to 200 metres. The data as well as the buoy's position is being relayed hourly via ARGOS satellite system to Kingston where it will provide information on the dynamics of the sea ice zone.)

Marine biologists aboard *Aurora Australis* were to investigate the growth process of marine plants and animals beginning their winter phase, when they are looked at beneath the pack ice. Many scientists feel that the key to understanding the dynamics of the Antarctic climate and ecosystem is to be found in the processes that occur in winter, and these studies are the beginning of a series of experiments which will focus on this critical season. The cruise participants also sought data on abundance, distribution and population structure of krill in the region between 138deg E and 155 deg E where there has been substantial krill fishing in the past. Krill abundance calculations will help in establishing a precautionary catch limit for a krill fishery.

During the cruise, biologists were to examine the diving habits and movement patterns of crabeater seals, possibly the most numerous seals in the world which, because they are rarely found anywhere but on floating ice, are poorly understood. The programme includes taking blood samples to establish a reference which in future will help scien-

tists assess whether disease or toxicity have resulted from human intervention.

Other programmes included studies on the species composition, distribution and abundance of phytoplankton (tiny marine plants at the base of the marine food chain), and investigations into the role of the Southern Ocean in the uptake and release of atmospheric

carbon dioxide. [Reprinted, with minor adaptations, from *ANARE News*, Autumn 1993]

Footnote: According to the IASOS/ Antarctic CRC Newletter No. 6 of July 1993, the ship also made a high speed return to Hobart during the middle of the cruise to put a sick crew member into hospital.

GANOVEX VII

Next GANOVEX planned for four years time

In the summer of 1992/93, BGR, the Bundesanstalt für Geowissenschaften und Rohstoff in Hannover, (Geological Survey of Germany) conducted its 7th GANOVEX (German Antarctic North Victoria Land Expedition). As with the previous expeditions GANOVEX VII operated in the Ross Sea area of Antarctica and was divided into two legs in order to combine a maximum number of programmes into one austral summer season.

Led by Dr Norbert W. Roland from the Survey, the programme involved 35 scientists and included geological and geophysical field work in Northern Victoria Land, Marie Byrd Land in West Antarctica and in Oates Land in East Antarctica spanning a sector from 150deg W to 158deg E, areas about 2000 km apart. The major logistic support for the expedition was provided by *RV Polar Queen* an icebreaker/sealer from Bergen, Norway, which carried four Australian helicopters - three Squirrel AS 350B's and one Squirrel AS 350B2. The expedition also had access to six skidoos and Nansen sledges.

The purposes of GANOVEX VII

were to:

> Delineate more clearly the boundary between the "old" crustal parts of the Antarctic (the East Antarctic shield) and the "new" only about 500 million years old fold belt which coincides with the Transantarctic Mountains as they are today.

> To decipher the tectonic history, the evolution of the earth's crust below the Transantarctic Mountains and their rate of uplift. The Transantarctic Mountains present the most impressive uplifted graben (narrow block of crust) shoulder in the world; the uplift took place during the last 50 million years.

> To investigate in Marie Byrd Land the eastern, less prominent graben shoulder, and compare the crustal development with that of northern Victoria Land and to research reasons for the asymmetry of the Ross Sea Rift System.

The area is of particular interest because although the Antarctic Plate is surrounded by spreading ridges and is therefore free of compressional stress induced by other plates pushing against it, the continent started to split into two halves and to disintegrate in spite of, or

maybe because of, the lack of external compressional forces.

The 35 scientists came from 15 different organisations and institutions in seven countries. In addition to BGR personnel German scientists came from the Geology Departments of the Universities of Bremen, Frankfurt and Mainz, from the Landesamt für Geowissenschaften und Rohstoffe in Brandenburg, from the Mineralogy Department at the University of Würzburg and the Niedersächsisches Landesamt für Bodenforschung in Hannover. Others came from the Dipartimento Di Scienze Della Terra in Genova, the Istituto Nazionale di Geofisica in Rome, the Rijks Geologische Dienst in the Netherlands, the Institute for Crustal Studies at Santa Barbara in the USA and the United States Geological Survey, and from the University of Adelaide in Australia. Dr David Skinner from Institute of Geological and Nuclear Sciences in Lower Hutt, Wellington, New Zealand, participated for the third time.

Eight nations were also represented by work carried out. They included Austria, Australia, Germany, Italy, the Netherlands, New Zealand, Norway and the USA; some of this work fell within the framework of LIRA, Lithospheric Investigations in the Ross Sea Region, a cooperative research programme currently ongoing in the Ross Sea. GANOVEX VII also supported a camera team of the German Institute for the Scientific Film and the Italian Antarctic Program Italtantartide.

Support staff comprising an environmental officer, expedition doctors, field guides, helicopter pilots and mechanics, a radio operator, technician and electrician comprised 16, which, with a ships crew of 13, made a total of 64 participants.

Survival training was undertaken at

Mt Cook from November 18 to 24 and a two day workshop was held at the Antarctic Centre at Christchurch airport from 25 November 1992.

Expedition personnel then boarded the *RV Polar Queen* which had left Bremerhaven on 13 October, 1992. She sailed from Lyttelton at 11.30 hours on November 27. In order to achieve its objectives the expedition had planned to split into different groups some remaining aboard the vessel while others were to operate from BGR's Gondwana Station (74deg38'S, 168deg 13'E) in the Terra Nova Bay/Ross Sea, at the Lillie Marleen Hut (71deg12'S, 164deg31'E) in the Everest Range, or from various field camps.

The expedition encountered their first ice on December 1 north of Scott Island which they reached the following day. Journalists, cameramen, the expedition leader and a geologist from Mainz were landed for the first field programme of the season. Using satellite images to find open water they now made good progress but on December 4 they reached solid pack ice which they cleared within a day to more open water. On December 5 Cape Adare was visible at 60 nautical miles and at mid-night, just as the pack ice surrounding the Terra Nova Polinya was reached, Mt Melbourne became visible. At 2 p.m. on December 6 they arrived at Gondwana Station and after two days of unloading they moved to unload cargo at Baia Terra Nova for the Italians before sailing for Marie Byrd on December 8. Three days later they reached the area where they worked between December 11 and January 9 returning to Gondwana in two days and arriving there on January 11. The following day they set off for the Pennel Coast where work was planned in the Robertson Bay Terrane, using the Lillie Marleen Hut as

a base. Bad weather however was to make field work impossible. In the meantime the *Polar Queen* was heading north for Dunedin which she reached on January 29, leaving again on January 2 to evacuate the crew from the Lillie Marleen Hut and sail to the Oates Coast which she reached on January 9. In good weather the *Polar Queen* supported the completion of field work in the area until February 21 when she returned to the Pennel Coast. The two helicopters stationed in the meantime at Gondwana Station then joined the main body of the expedition and with four helicopters they carried out their scientific programmes, cleared two fuel depots at Lillie Marleen Hut and at Mt. Kelly, near the mouth of the Lillie Glacier. The vessel then moved on to Gondwana on March 2 arriving there the following day. On March 5 she sailed to Lyttelton arriving there at 0900 six days later. The *Polar Queen* then sailed for Bremerhaven which she reached on 26 April 1993.

At the completion of the field work the aeromagnetic programme had covered an area 48,550km square, with a total of 14,250 km of profiles. Two hundred and fifty gravity stations were measured, and 1200 km flown to measure ice thickness using helicopter born radar equipment. Heat flow measurements were obtained from three bore holes which were melted with a special equipment which allowed environmentally safe operation without antifreeze or oil lubricants. A total of 235 metres were drilled on blue ice. The geologists collected about seven tons of rock samples for further petrographic, petrological, geochemical and age dating work in their various laboratories.

No further GANOVEX activities are planned during the next four years, however the scientists will not be idle. During the summer of 1994/95 they will be working in the Shackleton Range as part of the EUROSHACK and in 1995/96 they will be participating in GEOMAUD in Queen Maud Land.

Future of Dutch research endangered by recession

The future for the Netherlands Antarctic Research programme from 1994 onward looks gloomy but preparations for the coming season are proceeding anyway. Just before the summer the Netherlands Antarctic Programme (NAAP) for the years to 2000 was presented to the government.

The proposal contained a substantial financial increase for logistics and partnerships with other countries. Plans for future cooperation are being discussed with German, British and Swedish scientists. However, the ministries financ-

ing the Antarctic Programme are apparently unable to secure the present funding level or to provide the additional funding needed to cover the costs for the use of the infrastructure of other countries. A final decision concerning the budget of 1.3million Fl for 1994 is expected this fall.

If the finance is available about 15 scientists will be working on South Georgia, Marion Island and at Signy and Davis Stations and on board the *Marion Dufresne*. Two other scientist will participate in the Swedish ITASE traverse

from the South Pole (see *Antarctic* Vol 13. No. 3) to Neumayer Station.

During the 1993 winter one Dutch scientist is over wintering at Signy.

South Africa

Construction of SANAE 4 to begin this season

South African antarctic activities for the 1993/94 summer season will be directed towards the building of a new base SANAE 4 at the Vesleskarvet outcrop, 71deg 40'S/2deg 51 min W, approximately 220 km from SANAE 3, which lies on the Fimbul Ice Shelf at 70deg 18' 36"S/02deg 24' 10"W and was erected in January-March 1979 for summer and winter operations.

The *mv SA Agulhas*, which has recently been refurbished, is scheduled to depart Cape Town on 1 December 1993 and return on 25 March 1994. She will carry building parts, supplies and equipment for the base. The two SA 330 Puma J helicopters on board the *mv SA Agulhas* will support the off loading of cargo at SANAE 3 and transporting to Vesleskarvet during the period from December 1993 to March 1994. They will also provide air support for a Swedish and Norwegian Antarctic Expedition operating between 70 deg S - 73 deg S and deg W to 2 deg E. (See *Antarctic* Vol 13 No. 3 for details).

Approximately 8000 cubic metres of building material and cargo will be traversed from SANAE 3 to the new base site at Vesleskarvet. The entire operation is expected to cost about 23 million Rand.

Four options for the design of the new base were considered by the South Africans. They were a sea base on an adapted used oil drill platform, a sea front base on hard rock in a natural bay, a new base at the existing SANAE 3 site on the permanent ice bank, and a new base on a rock outcrop on the conti-

ment. The environmental impact, health, the type of building and its proximity to planned research areas were all considered and the best option proved to be a rock outcrop on the continent.

Six major rock outcrops, or exposures in the Ahlmannryggen mountain range of the Queen Maud Land area were evaluated against the wide range of criteria and the only one that met all requirements was the Vesleskarvet rock outcrop. It is about 40km north of the Sarie Marais base, which is used during the summer months, and was first visited by South Africans in 1971/72, and subsequently by various geological field teams.

The surface of the outcrop is some 180,000 square metres and it is bordered on the one side by a precipice between 200 and 250 metres high. On the east and on the west, the ice surface is suitable for landing of fixed wing aircraft.

Preliminary investigations have indicated that it is unlikely that the outcrop supports any biological component which gives it special scientific, conservational or educational status.

Having agreed on the location an

extensive design process commenced and a comprehensive environmental assessment was scheduled to be available by the end of July 1993.

The new base has been designed by the engineering company Engelbrecht and van den Berg, working under the direction of a structural engineer Mr H.R. Stassen who has made six visits to Antarctica for maintenance and construction work. He was also responsible for the planning, design and construction of the present emergency base at SANAE 3.

It will consist of three double-storey buildings, each three meters high and resting on steel pillars. Each will be approximately 45 metres long and 15 metres wide and connected to the other buildings with passages so that the crew will not need to leave their protected environment. In total the base will be 155 metres long with a surface area of 2,000 square meters with 3,200 metres useable double interior space. A helicopter landing platform will extend the base by a further 20 metres.

The entire structure has been designed for easy construction under harsh conditions and will comprise steel frames which will be bolted together. An outside shell of fibre glass panels will be lined with insulation material 150 mm thick which will be used for the floors, walls and ceilings. These "shells" will be manufactured from a non-toxic inflammable material covered on both sides with fibre-glass and have an insulation capacity some 30 times greater than conventional 230 mm brick. The windows will comprise three glass panes with gas filled cavities to minimise heat loss. Tests conducted in a tunnel have subjected the structure to winds of up to 250 km/h and been used to determine the affect of snow depos-

its. The average temperature at the new location will be approximately 7 deg C lower than at SANAE 3. The expected summer temperature will be between minus 10 and 15 deg C, but during exceptional weather it may fluctuate from between plus 7 to minus 27. The average winter temperature should be approximately -35 but has been known to drop as low as -60 C.

The existing base SANAE 3, which was designed for 15 years use, was first occupied in 1979. It is built on a permanent ice bank but snow has progressively accumulated and it started to destruct in 1987. The base is now 20 metres below the surface. A full inspection will be made during the next take-over period and essential maintenance carried out to ensure that it will be safe and livable until the 1994/95 takeover when the new base should be commissioned providing the construction schedule can be maintained. Up to 80 persons will be accommodated at the new base during the take-over periods and 18 expedition members will live there on a full time basis.

Refurbishment of the South African Antarctic Programme's research and supply vessel *mv SA Agulhas* has recently been completed by Globe Engineering in Cape Town at a cost of about 17 million Rand. Work on the vessel began in April and has enhanced the vessel's capability as a polar supply ship and improved the oceanographic research facilities

The main large deck crane has been moved forward to facilitate easier cargo discharge, allowing for extending the passenger lounge forward by two metres. The new space has also been extended upwards to the next deck level to create a small upper lounge. Other improved passenger facilities include additional television viewing spaces and a

games/recreation room.

Ship's systems were also improved with new communications equipment, an integrated navigation management system and enhanced navigation and engineering facilities including bow and stern thrusters, roll damping and waste heat utilisation

On board scientific facilities have been improved, particularly for oceanographic and biological work. A new hydrological complex was constructed on the main deck adjoining the extended lounge area. It comprises wet, chemical and dry laboratories and is served by two new slipping winches and a telescopic gantry extending outboard by five metres. Vertical profiling to 6000 metres can now be undertaken via a CTD/Rosette, while small plankton nets can be deployed from the second winch to depths of up to 2000 metres. The winches and the winchman are housed in an enclosed space above the wet laboratory affording a clear view of the deck and sea surface.

Facilities for biological and geological sampling over the stern have also been improved. The poop deck has been extended aft by two metres and a large hydraulic "A" frame has been fitted to launch and retrieve gear. To facilitate landing gear well forward of the stern itself, a hydraulic powered hatch has been created at the aft end of the helicopter deck. The dredging/coring winch was relocated further aft and a new towing winch has been built. It holds 4,000 metres of conductor cable. The deck is now enclosed on both sides for better shelter. The two old laboratories were gutted and three additional spaces created, and the new complex now comprises a General Purpose/C14, wet and semi wet laboratories as well as others for geological and acoustics programmes.

The meteorological activities were consolidated in upgraded spaces on 02 deck. These include enhanced balloon room and gas storage facilities, a new laboratory and the resiting of some associated deck equipment to simplify balloon launching.

Two new structures for bird and mammal observation were built on the upper bridge deck and on the centre line. The former is an enclosed cubicle while the latter is open. Both have direct communications to the bridge.

New scientific equipment has been installed. These include a new CTD/Rosette system, underwater fluorometer, Thermosalinography equipment, an XBT system, satellite weather receiver and a quantitative acoustic system. To improve on board data collection and storage, a new data logging/distribution system was fitted. The 386 system hardware is now accommodated in an enlarged laboratory which doubles as a scientific instrument workshop. All standard navigation, meteorological and sea surface parameters can be sensed once per second and logged once per minute. Data is displayed on video screens in all scientific spaces and the bridge, users customising their displays with a keyboard. Underway mapping of parameters is also now available.

"Antarctic" thanks Richard Skinner for assistance with material for this article.

At COMNAP (see page 42) the **Italians** reported that they were planning to involve 350 people in their research programme for 1993/94. Eleven flights are scheduled from Christchurch to the Antarctic between October 11 and the end of November and three vessels, one carrying cargo, and others undertaking research and seismic programmes are expected to be involved.

BAS

1992/93 season reviewed

Four science cruises, 24 field parties and more construction was included in 1992-93 programme. Operations commenced on 16 September 1992 and concluded in May 1993 with the return of the last summer support personnel to the United Kingdom.

RRS James Clark Ross sailed from Grimsby on September 15. The holds and the whole of the after deck area were brimming with cargo and scientific equipment for the four science cruises planned for the season, three in the Antarctic and one in the tropics. The vessel departed Montevideo on October 9 and encountered icebergs at 42 deg S. the following day. A BBC film crew and cargo were put ashore at Bird Island and visited Husvik on South Georgia before being returned to Stanley on 19 October.

The first cruise was undertaken between October 21 and 18 December 1992 on behalf of the wider scientific community. It was the final, field-work phase of the UK's oceanographic Biogeochemical Ocean Flux Study and was part of a two-ship experiment with the *RRS Discovery*. The biogeochemical conditions and processes in relation to a seasonably-induced retreating ice margin in the Bellingshausen Sea were examined and the importance of this area of the Southern Ocean as a sink or source of CO₂ and other gases was investigated. The cruise was led by scientists at the Plymouth Marine Laboratory and included scientists from other nations as well as personnel from BAS and six British universities. In all it was the largest number of UK scientists to participate in a single oceanographic experiment in Antarctica.

As the vessel sailed from Stanley towards the Bellingshausen Sea, underway measurements were taken with the Undulating Oceanographic Recorder, which measures depth, conductivity, chlorophyll, dissolved oxygen, transmission, salinity, PAR and light intensity. On November 1 the vessel had to return to Stanley to land a medical casualty.

The ship reached the sea ice margin on November 11 at 66deg S. Heading through the ice she almost immediately encountered enhanced chlorophyll levels, suggesting an ice edge bloom, followed by a decline in concentrations implying pre-bloom conditions. The ship then stopped for five days in an area of full ice cover at 77deg. 15min S, where measurements were made on the physical and chemical conditions under the sea ice as well as a range of biogeochemical flux. Using a chainsaw BAS personnel cut through the one to two metre thick ice to allow access for divers, who were collecting under-ice samples and positioning incubation chambers to measure algal growth and respiration. Sea ice physics and krill distribution were also studied.

On November 18 the ship rendezvoused with *RRS Discovery* which by now was carrying a medical emergency and made a second high-speed passage back to Stanley to hospitalise the patient. During the return passage a gover-

nor on one of the main engines failed reducing the ship to just over half her available power. While she was out of the research area the ice edge retreated some 100 miles and she was able to return to her previous location without undue difficulty. Before the ship was moved to her new location, incubation rigs were deployed for a 24 hour period and other work such as krill swarm sampling was undertaken. On December 3 attempts to recover the two rigs were only half successful; one had simply disappeared. Sampling continued for the next three days.

A new governor was airlifted to Palmer Station for collection by the ship and with this unit fitted she made passage through heavy sea ice to Rothera, arriving on December 13. Cargo was offloaded, bulk aviation fuel pumped ashore and the vessel departed on December 14 for the Falkland Islands. During the stay at Stanley, the chief engineer John Donnelly was taken seriously ill and airlifted to Montevideo by the RAF on Christmas Day. In spite of the best attention available John died in hospital. Having been involved with the ship since its inception he will be missed.

Crew were changed over on December 31, scientific personnel for the next cruise embarked and the ship left the Falkland Islands on January 2. The 26 day cruise JCRO3 conducted by staff of the BAS Marine Life Sciences Division entailed investigation of the physical structure of the water column along a transect covering the shelf break to the north of South Georgia, and assessment of anticipated differences in ichthyoplankton and zooplankton distribution and species composition to either side of the shelf break. Much of the equipment used was new to the scientific staff and time was spent on

familiarisation. Other work included measurement of copepod egg production rates, larval and fish surveys and target fishing for krill using a multinet with new control and monitoring equipment.

The vessel returned to the Falkland Islands on January 28 and sailed again on February 3 on a marine geophysical cruise conducted by BAS staff. This cruise was divided into three sections. The Scotia Sea was the first and comprised coring, recording on 3.5 kHz and 10kHz sounders and some single channel seismic (SCS) work over areas of the Scotia Ridge; secondly, dredging for rock samples in the Bransfield Strait; then finally multi-channel seismic (MCS) in the Bellingshausen Sea around Peter I Is.

Survey work with the echo sounders and magnetometer preceded the first use of the winch and corer on February 4. It was followed by CTD deployment. Further coring operations were carried out on February 6, 7 and 8, but an additional attempt resulted in the loss of the corer when the kevlar parted near the core head. Repairs required the installation of a new core handling mechanism on the ship and this was undertaken in the calm waters of Rosita Harbour on South Georgia.

On February 17 a further failure of the Kevlar warp resulted in the loss of a second corer. Work continued until February 20. The second phase of the programme was carried out between February 24 and 26 and the third phase of operations started on March 2 with deployment of the MCS system continuously until March 6, followed by a magnetometer survey and dredging in the Bellingshausen Sea. With the conclusion of a further MCS survey conducted from March 11 - 13, all the objectives of the cruise had been met.

After the final magnetometer survey and SCS in the Bellingshausen Sea, the ship picked up two field parties and returned to Stanley, arriving on March 23 before heading to Montevideo, Ascension Island, Las Palmas and on to the UK.

RRS Bransfield.

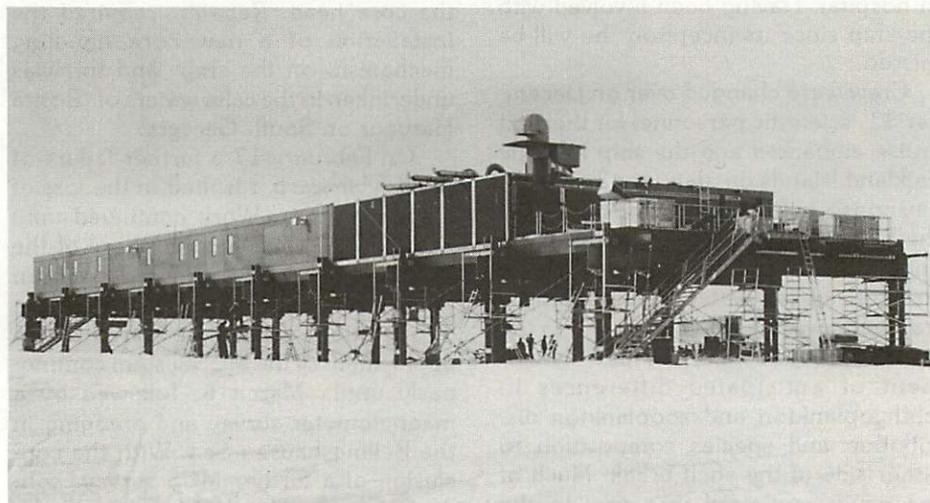
RRS Bransfield sailed from Grimsby on 1 October 1992 primarily to support further construction activity at Halley Research Station. The vessel sailed from Stanley on November 3 and while on passage to Damoy, oceanographic data buoys were recovered, serviced and re-deployed for a further year. Damoy was reached on November 7 and personnel and freight were off-loaded for collection by Twin Otter aircraft flying north from Rothera, and after a call at Faraday the vessel returned to Stanley to collect the second wave of Rothera personnel, as well as personnel for Signy Station.

The main relief operation at Signy was carried out between November 19 and 22 and after a second call at Damoy

the vessel headed to Faraday station, where it was intended to complete the station relief. Unfortunately ice conditions were quite severe, and personnel, hand-carrying some light cargo items, were disembarked on the opposite side of the island to complete their journey on foot.

After another brief call at Damoy the ship returned to Stanley to embark personnel for Halley and Signy. She sailed on December 4 reaching Halley on 21 with all the cargo necessary for the completion of the construction programme and the supplies for a further year. By December 30 these were unloaded.

Leaving Halley on New Year's Eve, *RRS Bransfield* visited Signy Station and then set course for Montevideo, where senior officers were exchanged and having loaded fresh provisions the ship departed again for Stanley arriving on January 21. Passengers flown in from the UK were embarked and fuel taken on board for the voyage to Signy, which this time was reached without any difficulty, and Halley. By now too,



The new Halley Base in summer and winter. BAS Photos.

the extensive station construction work had been successfully completed and with the large amounts of redundant materials from the old Halley IV Station loaded, the final personnel exchanges were carried out. The ship left Halley for another nine months of isolated existence. She returned to Stanley via Signy and started the final calls of the season, at Rothera (where the main relief was carried out and the base refueled), Faraday, Signy and South Georgia, finally reaching Grimsby on May 2.

Throughout the season, science programmes had also been conducted from *RRS Bransfield*. Air was sampled for trace gases, meteorological balloons were regularly launched and Very Low Frequency signals transmitted from the Northern Hemisphere were monitored as part of an ionospheric programme.

Air and Field Operations 1992-93

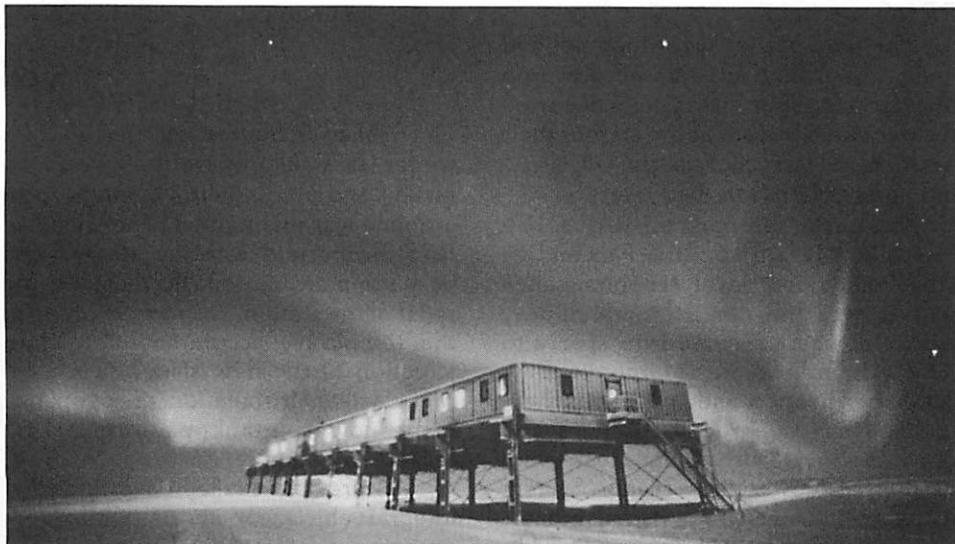
The annual ferry flight of the four BAS Twin Otter aircraft from the UK to Antarctica started on October 5. Hav-

ing reached Punta Arenas one aircraft flew to Rothera via the Falkland Islands while the other three went direct to Rothera on October 21. Two days later the aircraft had re-established the depot at Fossil Bluff on Alexander Island.

The 1992-93 season was the first full season of field operation using the 900 metre gravel runway at Rothera which was recently completed. The new runway facility offers wider operating weather windows and a record number of flight hours was achieved.

Field party deployments from Rothera began on November 19. One aircraft departed on November 20 to fly to Marie Byrd Land to support an international party of geologists from the United States, New Zealand and Britain. (see *Antarctic* Vol. 13. No. 1 page 2 ff) This aircraft remained with them until late December.

In early December five parties were deployed on the Ronne Ice Shelf and Rutford Ice Stream. A return flight to the Falkland Islands to collect engine spares for the *RRS James Clark Ross*



was also necessary. Once the ice core drilling team had been put-in on Beethoven Peninsula, Alexander Island on December 17, all 20 field parties had been deployed to their respective sites and the aircraft could then be committed to aerial survey tasks. All these activities were further enhanced by the delivery of bulk aviation fuel to the Rothera fuel tank farm by the *RRS James Clark Ross* on December 13. Prior to December 21 the survey aircraft was configured for aeromagnetism over the middle latitudes of the Antarctic Peninsula. Following the Christmas period, a programme of aerial photography began in the same area.

One aircraft was based at Halley from January 2 for a few weeks in support of the Upper Atmospheric Sciences Programme, undertaking work on the Automatic Geophysical Observatory (AG) Programme and the Polar Anglo-America Conjugate Experiment (PACE) Radars. (See *Antarctic* Vol. 12 No.'s 11 and 12 pages 383ff). This aircraft also undertook reconnaissance of sites for the positioning depots from *RRS Bransfield*.

The field parties were then uplifted and Fossil Bluff was closed down on March 3. The four Twin Otters departed Rothera on March 8 at the start of their northbound ferry flight to the UK, arriving at Chobham ten days later.

In early February an RAF C130 Hercules aircraft from the Falkland Islands made low level reconnaissance passes over the new Rothera runway during a mission to airdrop spares to the *HMS Endurance* in Marguerite Bay. *HMS Endurance* with two Lynx helicopters visited Faraday, Rothera and Signy Stations. During January the ship carried an Antarctic Treaty System Inspection team which visited numerous stations and tourist ships. In addi-

tion to assisting with the movement of staff and mail for BAS, *HMS Endurance* also gave valuable logistics support with helicopters to the geology projects in Marguerite Bay and in northern Peninsula areas. Hydrographic survey tasks undertaken by *HMS Endurance* included sea areas around Deception Island, Marguerite Bay, South Georgia and the South Sandwich Islands.

Activities at the stations

Faraday

A new reverse osmosis water-making plant was installed, replacing the desalination unit that had been operational for the last 13 years. Later in the season, a rubber liner was inserted within the steel skin of the small fuel tank to help prevent oil spillage. Building tasks included the construction of a platform to store wastes, the widening of all walkways and the construction of a concrete ramp onto the foreshore to ease cargo-movement. Towards the end of the season a micro VAX system was installed and commissioned to improve communications with headquarters.

Halley

Halley 5 Station enjoyed its first winter as a fully operational research facility and a complete scientific programme was maintained. The arrival of *RRS Bransfield* saw the start of the busy summer. Major tasks included the relief of the station, recommissioning of the temporary accommodation, construction of the new sledge based garage facility, installation of a replacement snow melt-tank, platform jacking and routine maintenance.

All previous Halley bases included integral vehicle workshop facilities, with access via ramps and tunnels. Halley V

as an above ground and elevated structure, posed very special problems. The garage needed to be an isolated structure, separated from any platform by at least 500 m in order to avoid drifting snow accumulation. A relocatable above ground workshop was the option chosen. The concept of a relocatable unit construction building with skis is not new, nevertheless the vehicle workshop is probably one of the largest ever of this concept and is certainly the finest to have been installed at Halley.

Signy

In contrast to last summer, the 1992-93 season at Signy was much warmer and sunshine hours were much higher. The good weather permitted a great deal of outside work to be undertaken. This included the construction of two mooring points along the foreshore for use by the *RRS James Clark Ross* when refuelling the station. Tonsberg House was given a thorough face-lift. A new wooden platform was built adjacent to the woodstore, to provide additional storage of compressed gas cylinders and a concrete plinth was constructed as an additional, general storage area. A new Volvo unit was installed in the generator shed. Inside the main analytical laboratory was given a new, sealed floor and the fume cupboards were completely overhauled.

Several new scientific projects were begun. The marine programme was again supported by extensive diving and boating activities. The routine data collection in the terrestrial, freshwater and marine environments was also continued as were the bird and seal population studies. The annual sea census in February recorded just over 9,000 fur seals on the island, slightly lower numbers than previous seasons.

Rothera

A successful and productive winter was followed by the busiest of summer seasons. Rothera supported 24 field parties, some as far as 800 miles from the station. Using the new runway the aircraft were able to fly some 1900 hours, representing a significant increase over skiway based operations. Among the construction projects undertaken at Rothera was the installation of an ARIES satellite receiver. A diving survey was completed at the wharf with the area being given a clean bill of health. Abundant marine life was observed.

Waste Management

The purchase in the UK of waste management equipment and the programme of on-site upgrading at the stations continued. The hydraulic drum crusher for Rothera was installed and between January and March 1993, approximately 1000 empty fuel drums were crushed, stored in two shipping containers and removed from Antarctica.

The site of Halley 4 was further cleaned. Working conditions were difficult as the ambient temperature inside the station was -18deg C. and the building was being slowly crushed by overlying ice and snow. However, all remaining hazardous wastes, fuel, general contents and most fixtures and fittings were removed. Those left could not be safely removed.

de Havilland DHC-7

The conversion in Canada of a de Havilland DHC-7 (Dash-7) aircraft for BAS Antarctic use has continued. Delivery of the aircraft is anticipated in August 1993 and proving flights in the Antarctic are expected during the sec-

ond half of the 1993-94 season. The inauguration of the Dash-7 facility will provide an intercontinental air link enabling the carriage of passengers and some limited cargo direct into Rothera

from either the Falkland Islands or South America. The aircraft is configured to allow the carriage of up to 16 passengers or the equivalent in terms of cargo.

USAP

Summer flooding feared after winter storm at McMurdo

Twenty five buildings at McMurdo Station were damaged in the severe storm which battered the area from June 3 to 8. Fractures have appeared in the ice pier and snow accumulation is so excessive around the station that summer flooding is feared. Two search and rescue missions were undertaken during the storm but no casualties were sustained. Scott Base also suffered. (See page 45)

Condition 1 was declared at McMurdo Station at 10 a.m. on Wednesday June 2 and remained in force until Thursday at 5.30 a.m. when Condition 2 was declared but the situation was still borderline. All non-essential personnel had by then returned to their quarters but a crew of two at the Williams Field power plant were preparing equipment and facilities for the mid-winter airdrop scheduled for Saturday 5 June and Monday 7 June. During the morning of the first day of the storm a van carrying three people set out for Williams Field to relieve the pair but veered from the route and became stranded. By 10.20 a.m. eight members of the Search and Rescue team (six US and two New Zealanders) left Scott Base in Hagglands H26 to locate the vehicle. At best visibility was 20 feet. Two hours later the van was found some 3 km along the road and about 150 feet from the flag

line. The party returned to Scott Base and then went on to McMurdo. In the meantime five members of the SAR team had remained at Scott Base in case of further emergency.

By the Thursday morning concern was mounting for the team at Williams Field as the last contact made with them had been at 10.30 on the Wednesday night. From 6.30 on the Thursday morning senior personnel from both programmes were discussing the situation and at 8 a.m. on the Thursday another search and rescue team left Scott Base. In worse visibility than the day before they set off for Williams Field using GPS navigation. They had seen it just a few feet away. It took them another four hours to find building 44, a berthing area, where the pair were thought to have been since the Wednesday night.

The sides of the building were completely drifted up with snow and they had to use the escape hatch on the roof to enter. The building was cold and empty.

With part of the team now roped to the Hagglands and walking in front of it they finally located the Power plant and again made access through the escape hatch on the roof. The two operators were safe and well inside. They had been in Building 44 the previous day

but the generator stopped and the power went off. During a lull in the storm they had crossed to the Power Plant but after restarting the generator they had been unable to return to Building 44. The Search and Rescue Team stayed for the night and on Friday morning set lines between the two buildings before returning to Base during the afternoon.

In the meantime McMurdo Station continued to sustain damage. During the Wednesday night T-Site the transmitter building on a plateau on Crater Hill lost a 10 x 20 feet section of its roof over the electronics room and most of its windows. Considerable snow was accumulating in the area. The two operators based there spent the night in the foyer and in the room accommodating the stand-by generator which meant they had heat and power. A tracked vehicle was sent to bring them back to McMurdo Station on the Thursday afternoon. The officer-in-charge reported that winds were gusting over 60 knots in the area and several of the antennas had been damaged. A small module located at T-Site had also been blown up against one of the antennas causing damage to both pieces of equipment. Communications between McMurdo and Scott Base were now difficult and restricted to Crater Hill Channel 4 for the next 64 hours. The high frequency communication facility used to maintain contact with the South Pole was also lost until a small portable set could be established and made operational.

Building number 165, the MAC Centre which provides office accommodation for the US Navy personnel and others continued to be buffeted by very high winds. One leg of the upper industrial electrical power distribution feeder lines was lost feeder and later all the upper industrial power lines went as well. Crews were sent out to repair the

lines and to restart the furnaces.

Approximately 25 buildings were by then reported to have been affected and several were without heat. Herman Nelson heaters were brought into service in the some of the critical areas. A large section of the roof of building 155 went and the Paint Barn, building 177, appeared ready to collapse but was secured when snow was bermed around it. Condition 1 was again declared but all six wind indicators were lost and the wind speeds could no longer be read.

The weather station at Black Island, where the anemometer had indicated winds in excess of 80 knots, was also by now out of action. Around McMurdo almost every vehicle was reported to be filled with snow in both the passenger and engine compartments. Staff were able only to keep emergency vehicles cooperating.

Much of the sea ice out was blown out of McMurdo Sound; and even in mid-July there was open water north of Hut Point.

In the ensuing weeks many of the buildings at McMurdo have been repaired with temporary ropes installed on the T-site and the ISS Galley. Heat has been slowly brought up in the Transmitter building while personnel continue to suck or blow snow off the structure to prevent moisture damage to the electronics components which were completely covered.

Midwinter air drop

The 14th annual mid-winter airdrop over McMurdo Sound and the South Pole took place in two flights on June 6 and 8. The U.S. Airforce C-141B Starlifter cargo aircraft was accompanied by a KC-10 Extender aerial refuelling tanker on both flights.

Cargo handlers and riggers from the U.S. Army and Air Force and the New Zealand Army prepared 25,628 kg (56,500 pounds), of supplies and equipment for the 237 personnel at McMurdo Station, 28 at South Pole and ten at Scott Base.

All up the cargo comprised 10,300 lbs (4,672 kg) of fresh fruit and vegetables; 19,400 lbs (8,800 kg) of mail and assorted items which weighed 27,000lbs (or 12,247 kg). Among the items scheduled for US program personnel were computer disks, repair parts, videotapes and dart boards. Scott Base received a new supply of library books, air sampling cylinders, field safety gear, general spare parts including light bulbs. A cake was also sent. Seventy five dozen eggs were among the cargo dropped at the South Pole.

A total of 28 personnel including five pilots, three navigators, three flight engineers and 12 load masters were among those involved in the mission which flew under the command of Colonel David J. Semon. Majors Troy Miller and John Agonti commanded the KC-10 extender.

Two flights

The first flight which departed from Christchurch at 0515 on 6 June, took on 47,000lbs of fuel at 0840 and a further 21000 at 1010. By 1106 it was over McMurdo where 21,054 lbs of cargo were dropped and by 1325 it had reached South Pole where a further 11,183 lbs of cargo was off loaded. It then returned to Christchurch arriving sat 2045. The second flight, on June 8, left Christchurch 1030, took on 50,000lbs of fuel at 1325 and a further 16,000lbs at 1445. It reached McMurdo at 1529 and dropped 42,854 lbs of cargo before returning to Christchurch

where it arrived at 2054.

New runway pressed into service

US air operations in the McMurdo Sound area entered a new phase early this year when on 8 February 1993, a wheeled LC-130 took off for the first time from a newly completed compacted-snow runway known as "Pegasus", named for an aircraft which crashed nearby some years ago.

The need for a new runway concept has arisen because at the end of each summer season some 1,500 US and other personnel need to return to McMurdo and subsequently leave the continent over a five week period at a when time the LC 130 Hercules are required to lift fuel and supplies to South Pole Station. The conflicting demands have resulted in some USAP personnel returning to both New Zealand and to Australia on ships associated with the US and other programs.

Located ten kilometres from McMurdo Station, the Pegasus runway is approximately 1,830 metres long and 91 metres wide. Unlike Williams Field, which is constructed on ten metres of compacted snow, the Pegasus runway is built on more than 30 metres of hard glacier ice. The rougher surface of Williams Field requires aircraft to be fitted with skis. The strip is traditionally brought into service in late December when the sea ice runway used for the early season operations becomes too soft for landing the wheeled C-5, C-141 and C-130's. When fitted with skis the weight of the C-141's and C-130's on which they are used, reduces their cargo carrying capacity. With Pegasus as an alternative the larger capacity wheeled

aircraft may to be used throughout the season freeing ski equipped aircraft for inland operations. In the long run winter flights may also be possible.

Planning for the runway and site selection began during the summer of 1990-91 under the direction of engineers from the U.S. Army's Cold Regions Research and Engineering Laboratory. During the 1991-2 summer, US engineers, assisted by experts from the Russian Antarctic program, began building the new runway. With construction completed in October 1992, a three phase test programme was suc-

cessfully concluded on 6 February 1993, two days before the first flight from the site.

The first flight carried 33 passengers, 12 more than would have been possible had it departed from Williams Field. Airplanes using the new runway will be able to carry 3,630 kilograms more in cargo and passengers and overall what would normally take four lights from Williams field will take only three from Pegasus and additionally reduce flight time between McMurdo Station and Christchurch, New Zealand

Sub-antarctic

Early beginning to Australian operations

Aurora Australis was scheduled to depart Hobart on Saturday 7 August for a 12,000km voyage during which she will deploy scientists for a summer programme on Macquarie Island and undertake a survey of fish stocks around Heard Island. This region has attracted attention as a potential commercial fishing ground. During the survey scientists will assess the fishery stock and examine the biology of the more important species.

The cruise is part of a multi-year programme which will eventually yield data through a full season's cycle. Information from the research will assist with future assessment and the management of a commercial fishery, should it be established. (See *Antarctic* Vol. 13 No. 1 page 23 ff).

Activity on Big Ben

Three reports made to Australia's Antarctic Division in Hobart between De-

cember 1992 and March this year indicate increased activity on Big Ben, the 2570 metre volcano on Heard Island. Heard Island is Australia's highest mountain outside the Australian Antarctic Territory, and its only active volcano. Its unique features are the basis of its nomination for World Heritage status.

Heard Island and Iles Kerguelen form the only exposed parts of the Kerguelen Plateau, the world's largest submarine plateau, which began as a series of abundant lava flows about 115 million years ago as the Indian Ocean came into being.

Volcanic activity has been an intermittent feature of the region over that long interval but Big Ben, the current active volcano on Heard Island, has a history going back a few hundred thousand years.

The first of the three reports of possible activity came from Rod Ledingham on board the cruise ship *Kapitan Klebnikov*. He indicated that

the shape of the top of the island had changed since his last visit in the mid-1980's and that there appeared to be two new lava flows on the south western flanks of the high part of the volcano.

A few days later, Attila Vrana (ANARE field leader, Heard Island), reported that there had been an earthquake on 18 December 1992, large enough to be easily felt. This may have been related to an eruption.

About a month later, Ken Green, biologist on Heard Island, reported that pumice was littering the beaches, suggesting a possible submarine eruption, different from that which produced lava on the flanks of Big Ben. He also referred to the smell of sulphur gases, suggesting that volcanic activity was perhaps continuing.

The information on the pumice was passed to Ian Marchant (Voyage Leader, *Icebird*), who was asked to keep a lookout for its source. Pumice, krill and penguin feathers clogged the ship's water intakes which had to be cleared to allow it to proceed, but they were unable to determine the source of the pumice. One evening during the ship's time at Heard Island the expeditioners had a clear view of the mountain revealing some fireworks, showing that there is an active lava lake on Big Ben.

In spite of the indications of increased volcanic activity on the island during the summer of 1992/93 many questions, such as the time of eruption and possible lines between the eruption and earthquakes and the source of the pumice, still remain to be answered. Dr Ken Muirhead, Australian Geological Survey Organisation, AGSO, has searched Australian records, particularly the Mawson seismological records, for evidence of the December 18 earthquake but had found none by June 1993. He was to check with the French

on Iles Kerguelen for possible evidence.

Icebird, now in the area of Heard Island is experiencing extremely bad conditions and it is unlikely further activity will be observed in the near future.

Auckland Island rabbits destroyed

A four person Department of Conservation team arrived back in Bluff on Saturday May 8 aboard the *Marine Countess* after completing a 12 week-long operation to eradicate rabbits on Enderby and Rose Islands in the Auckland group.

Led by Nick Torr of DOC in Te Anau, the party comprising Wayne Costelloe, also from the Department and part-time workers for DOC Murray Blake from Whitianga and Gary Aburn from the West Coast, were landed on Enderby Island from the *Frontier Spirit* on 9 February, 1993. Their food, supplies, aviation fuel, several tons of poison and a specially trained Pointer dog followed a few days later on the *Marine Countess*, a fishing vessel with a large deck capacity, which normally operates out of Bluff for Campbelltown Seafoods.

The rabbits were French Blues, originally released late last century as food for castaways, but which had reached an estimated population of 6,000 on the 700 hectare Enderby Island alone. The Island is a major breeding ground of the Hookers' Sealion and researchers estimated that as many as ten percent of these endangered animals were dying each year after being trapped in rabbit burrows. The Island also supports unique megaherbs, burrowing petrels and rare Auckland Island teals.

This was the third season in which a specially trained dog was used in New Zealand's subantarctic. Previously dogs were taken to Campbell and the Auckland Islands for locating endangered species. Such animals are highly trained and strictly managed and the reasons for taking them south are rigidly in accordance with the agreed procedures detailed in the islands' management plan.

This season's operation follows two trials undertaken during the late

autumn and early winters of 1991 and 1992 to ensure that the bait, the bulk of which was dropped during two visits by a Squirrel helicopter normally based in Southland, was not attractive to any other natural inhabitants of the Islands. For the last three weeks that the eradication team were on Enderby no rabbits were sighted and the vegetation began to show significant signs of recovery. Further visits will be made during the next two years to ensure that no rabbits have survived.

The last Antarctic whaling bases

R.K. Headland *Scott Polar Research Institute, Cambridge*

On 27 February 1992 a deed of relinquishment was exchanged in London between Christian Salvesen & Company and the Government of South Georgia and the South Sandwich Islands. This resulted in the last five leases of the sites of the whaling stations of the Antarctic reverting to the public ownership (those for Grytviken, Husvik, Stromness, Leith and Prince Olav Harbour). These were the last leases of sites for shore whaling stations in Antarctic regions.

Leases for whaling station sites have been left on South Georgia (nine sites, seven of which were used), the South Orkney Islands (Signy Island), South Shetland Islands (Deception Island), Iles Kerguelen (Port Jeanne d'Arc), and Campbell Island, although the last was a very brief small operation. The first Antarctic whaling lease, beginning on 1 January 1906, was for 500 acres (about 200 hectares) at Grytviken let by the Falkland Islands Dependencies Government to the Compania Argentina de Pesca (Buenos Aires) which was man-

aged by Captain C.A. Larsen of Sandefjord, Norway. All the other leases originated during the subsequent decade. There have been various changes of leases for many of these sites and several earlier reversions to the relevant governments. The last major changes were in 1979 when Christian Salvesen and Company (Britain) purchased the leases for Grytviken and Husvik, on South Georgia, from Albion Star (Gibraltar), the successor of Compania Argentina de Pesca. Salveson thus acquired the leases to the best five harbours on South Georgia. They were held against the eventuality of restarting whaling or commencement of other commercial operations from the island (Headland 1984). An attempt to sell material for salvage from these stations led to very complicated and quite unanticipated consequences when the island was invaded by Argentine forces in 1982 (Perkins 1986).

Prince Olav Harbour had ceased whaling in 1931, some equipment had been salvaged and the station became

derelict; much of the material at Husvik had also been salvaged by 1960. By 1965 the three last operation stations had been closed, but left preserved and secured to enable their reopening should Antarctic shore whaling resume. Large depots of fuels, lubricants, other hydrocarbons, a wide variety of hazardous industrial chemicals and similar materials, and many other stores were left. These abandoned whaling stations suffered from insufficient maintenance in a severe climate, much vandalism and theft, fires, and the consequences of a small war. Some of the stored substances, in deteriorating containers, had become an increasingly serious potential source of major environmental contamination. Arrangements to remedy this, and to make the sites safer, were

made and implemented during the 1990-91 austral summer by a contractor engaged by the Government and Salvesens. After receiving a report of an inspection of the results the Government of South Georgia and the South Sandwich Islands (effective successor to the Falkland Islands Dependencies Government) agreed that the lessee could be relieved of the responsibility for them and could surrender the leases. Thus a period of 85 years of Antarctic history came to its end.

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Discovery update

RRS Discovery has now been moved to her final resting place in a berth adjacent to new facilities at Discovery Point where a 6.3 million pound visitor centre has been erected on the waterfront between the bridges of the River Tay in Dundee. The 29,000 square foot complex comprises over 12,000 feet of exhibition space and conference areas. Incorporated is the vessel restored to her 1924 specifications and displays depicting other aspects of her history. H.R.H. the Duke of Edinburgh officially opened the new complex on 1 July, 1993.

The building has been constructed by Discovery Quay Development Limited, a joint venture company comprising GA Properties of Glasgow, Scottish Enterprise Tayside and the National Leasing and Finance Company. The architects for the structure were Michael Laird Partnership from Edinburgh. The

finished building has been leased by Scottish Enterprise to Dundee Industrial Heritage Trust for a token annual sum. The Trust has completed the interior of the building, whose facilities have been designed for visitors, staff, volunteers and local firms who support, maintain and restore the historic vessel. They include maintenance workshops for ongoing restoration, school and education points, reception and meeting facilities, a shop and retail store, tourist information, a temporary and changing exhibition area, an auditorium and induction loop for presentations and shows, function and meeting rooms with servery, office and staff accommodation, a volunteer and friends room and a visitors car and coach park.

Restoration of *Discovery* began seven years ago after she was moved from St. Katherine's Dock in London to Victoria Dock in Dundee where much of

the work on the vessel was undertaken. Then on a day in September 1992 with a specially low tide she was floated down river to Discovery Quay.

In preparation for the move her two main and one mizzen masts, yards and rigging were taken down and her funnel lowered so that she could safely clear the Tay Bridge. Three tugs were used for the short trip, which was undertaken in good weather and without mishap. On arrival she was dry-docked, and her hull below the waterline was cleaned and checked. Seven tons of mussels were removed but no problems were found. She was repainted, anti-fouling was applied and the dock again filled with water.

New masts were then installed. They replaced the main masts and the mizzen masts which were wooden and clad with steel tubes, and the foremast, which although original, was found to be rotten. Four years ago three giant Douglas firs, suitable for masts, had been identified in the forests of Invernesshire, cut down, seasoned and shaped to form the new masts. These were transported from a mill in Macduff, where they had been seasoned, to Dundee earlier this year by Brown and Tawse, using their special vehicle known as a trombone. The longest section of the masts is 85 feet and the journey by road took the expected four hours.

In the meantime the new lower masts, some old and replacement spars were being treated with preservative and recoated ready to go back onto the ship. The rigging has been serviced and reworked in a shed at the old Robb Caledon ship yard.

Installation of the new masts began in April. Cranes were used to lift them into place on the ship and a squad of men from Spencer Rigging in Cowes on the Isle of Wight, who look after the

rigging on traditional, large and historic ships, took about three weeks to complete the job. The old masts may form part of a quayside exhibition alongside the ship.

In 1992 all the ship's services were renewed for safety and convenience. The ship had been refitted in 1924 at Vospers and since then various owners had added bits and pieces. Using the original wiring plans and drawings consultant engineers Hull and Kirwood provided new specifications for quoting and the contract for the work, co-ordinated by Professional Project Management, was let to McGill Electrical Limited of Dundee. The existing installations and wiring were stripped out and replaced with modern materials in a manner similar to the original. Further work was then undertaken on the engine and boiler room. Napier and Company undertook the design phase, Brown and Tawse supplied steel for the decks and Jackson Steel Structures undertook the fabrication. The engine and boiler rooms have been restored complete with an imitation engine and boiler. New computer controlled bilge pumps, plumbing security and alarm systems have been fitted.

One coal bunker has been restored and the other made into a classroom. The forward holds are being outfitted with boxes of foods, the galley restoration updated and the crew space fitted out with bunks, stove, a solid table and forms.

The shore based displays, designed by Event Communications, tell the story of the ship's history in a variety of exciting, unusual and innovative ways. Visitors arriving at Discovery Point are greeted at the entrance with a light hearted visual introduction to Dundee provided by a comic figure Desperate Dan, from The Dandy, one of D.C. Thomson & Co Ltd's comics created in

Dundee.

The next exhibit is entitled: "Safe return doubtful. Wanted: A ship with special features for a hazardous polar voyage." Sir Clements Markham, Commander Robert Falcon Scott RN, and other key figures outline their requirements, in an audio visual on a central screen, for the first British ship designed for scientific research and exploration.

Next is an exhibit giving the specifications of the ship, showing how it differed from others in details such as the thickness of wood for ice work, and the use of auxiliary steam engine to increase manoeuvrability. A small working model has been built. The area also contains a description of the ship's stores and their location on the vessel. Details are given of the large working compass and special magnetic laboratory as well as the magnetic free area which was required for scientific experiments. Panmure Yard where *Discovery* was built has been reconstructed and models of the ship trace its construction.

These areas are followed by a reconstruction of the ship as she is about to be launched with the dignitaries on the platform giving speeches. Here the visitor becomes a member of the crowd watching the launch.

An auditorium provides the centrepiece of the exhibition allowing visitors to experience the sights and sounds of the Antarctic through an audio visual display. A video recreates *Discovery's* rescue from the ice by the *Morning* and the *Terra Nova*. There are details too of the Southern and Western Journeys which have been created with models to show how the work done then relates to the work continued in Antarctica today. The Southern Journey exhibi-

tion encompasses images of the work done by Bernacchi, Wilson, Hodgson and Ferrar on the 1901-04 exhibition as well as Scott's own records of the trip.

Another section entitled "The Forgotten Years" covers the story of the ship after her return from Antarctica during the First World War when she was used to carry materials to Russia, before being sold to the Hudson Bay Company to carry out a Whaling Research Programme. It also includes details of her voyage as far as Montevideo to rescue Shackleton after the *Aurora* broke up and covers her refit for the Discovery Programme of Research into Antarctic whaling stocks

Visitors then move out to the quayside where mock stores and related props are on show and board the vessel which has been set up to emulate loading to leave for the Antarctic for the 1929 BANZARE Expedition, led by Sir Douglas Mawson.

Extensive areas of the ship have now been opened up for display. More recently these have included the engine room, the coal bunkers, the stores, the boilers, the crew's mess deck and the laboratory and wardroom as it was in 1929-31. Models of the crew have also been placed around the ship.

Once off the vessel, visitors move into an area representing Antarctica today and featuring a genuine part of an iceberg and a current film of Antarctica showing the spectacular landscape. Finally there is a much expanded shop with a range of souvenirs.

Discovery Point is financially supported by the Scottish Enterprise at Tayside, City of Dundee District Council, Scottish Tourist Board and many benefactors. Education services are provided in association with Tay-

side Regional Council. From July 1993 it is open Monday to Saturday each week from 10 a.m. until 5 and on Sundays from 11 a.m until 5 p.m. From

November 1 until March 27 it closes at 4 p.m. It is also closed on Christmas Day and January and 1 and 2.

"Antarctic experience" in Auckland

In late May Kelly Tarlton's Underwater World began a new project; the creation of an "Antarctic Experience". Preliminary site preparations have been completed. Structural work is now underway and the overall development is on schedule. The concept was the responsibility of Logan Brewer and the development is being managed by Arrow International. The "Experience" will begin on December 26.

Kelly Tarlton's first opened in 25 January 1985. Until recently it has comprised two large marine aquariums through which there is a large acrylic tunnel containing a moving walkway for visitors. Each aquarium contains about a million gallons of sea-water and an extensive selection of live specimens. In addition there are many smaller displays, a gift shop and cafe.

The complex is wholly owned by Helicopter Line Limited and funding for the new development is being drawn through their credit lines. Some \$10 million is being spent on the "Experience" but with repairs to the adjacent roadway and associated works the total project cost is more likely to be about \$12 million.

The "Antarctic Experience" will cover approximately 25,000 square metres and is to be accommodated in a building being constructed adjacent to Underwater World. A new entrance will be created and the current entrance will become a dedicated exit. Visitors will pay one price and proceed first through the Antarctic Experience and then into

the Underwater World.

The project has been two years in the planning. Mr Logan Brewer, who was responsible for the development of the concepts used in New Zealand Expo sites at Brisbane and Seville, was asked to create an "experience" which would be unique and special, credible, enlightening - fruitful and educational. It was to be an experience which immerses people in the qualities of the region, have an element of thrill and adventure but be sensitive to environmental and conservation issues.

The result will comprise a queuing area to be heavily scened with memorabilia from the early days on the ice. Video monitors installed here will brief people on the region they are about to go through. The next section contains replicated portions of Scott's 1911 hut including the bunk and sleeping areas, photographic laboratory, a pianola, biscuit tins, bottles and equipment. The living area, including the table, replicates Christmas Day for the expedition.

Visitors will then board one of seven vehicles modelled on the Hagglands. Each is able to carry nine people. They will start on an eight to ten minute ride which will take them through a simulated whiteout, through an ice cave and further area containing snow and ice and lit according to the austral season. Here Kelly Tarlton's hopes to have live penguins. (Technical approval has been obtained from the Ministry of Agriculture and Fisheries but they are waiting on final details before advancing this

aspect of the project.) The temperature in this area will be maintained at -7deg C but the vehicles will be heated!

The "experience" will then feature an animated recreation of a whale taking a seal from the ice and at this stage the vehicle will drop a few centimetres. This has been designed to simulate a drop through the ice and provide visitors with a "beneath the ice experience". A 30 foot video will show actual footage. It was shot by the Television New Zealand Natural History Unit.

Visitors will enter a further display area where the six main points of the Antarctic Treaty have been summarised and are being promoted. A futuristic

model of Scott Base in the year 2000 is being prepared. Next is a large area of static but interactive displays which are CD-Rom based. Information can be accessed through touch screens and keyboards. This is a technologically advanced part of the exhibit but it will also contain a tank of live Antarctic fish. This completes the experience and visitors can then proceed to the Underwater World.

Craig Thorburn, the head curator at Kelly Tarlton's and Helen Duder, the education officer are both travelling to the Antarctic this season. Scientists from the University of Auckland have been part of the advisory team.

Winter Stations in the Antarctic

R.K. Headland Scott Polar Research Institute

Of several feasible graphical analyses presenting aspects of the history of Antarctic science, a histogram showing the number of stations operating during austral winters gives a concise and efficient idea of its advance (following figure). For this purpose Antarctic regions may be separated into two parts; the peri-Antarctic islands and Antarctica - the continent. The combination corresponds to the area of interest of the Scientific Committee on Antarctic Research although the parts are distinguished on the histogram.

On the peri-Antarctic islands winter scientific stations have operated on Ile Amsterdam, Auckland Islands, Campbell Island, Iles Crozet, Gough Island, Heard Island, Iles Kerguelen, Macquarie Island, Prince Edward Islands, South Georgia, South Orkney Islands, South Sandwich Islands and South Shetland Islands.

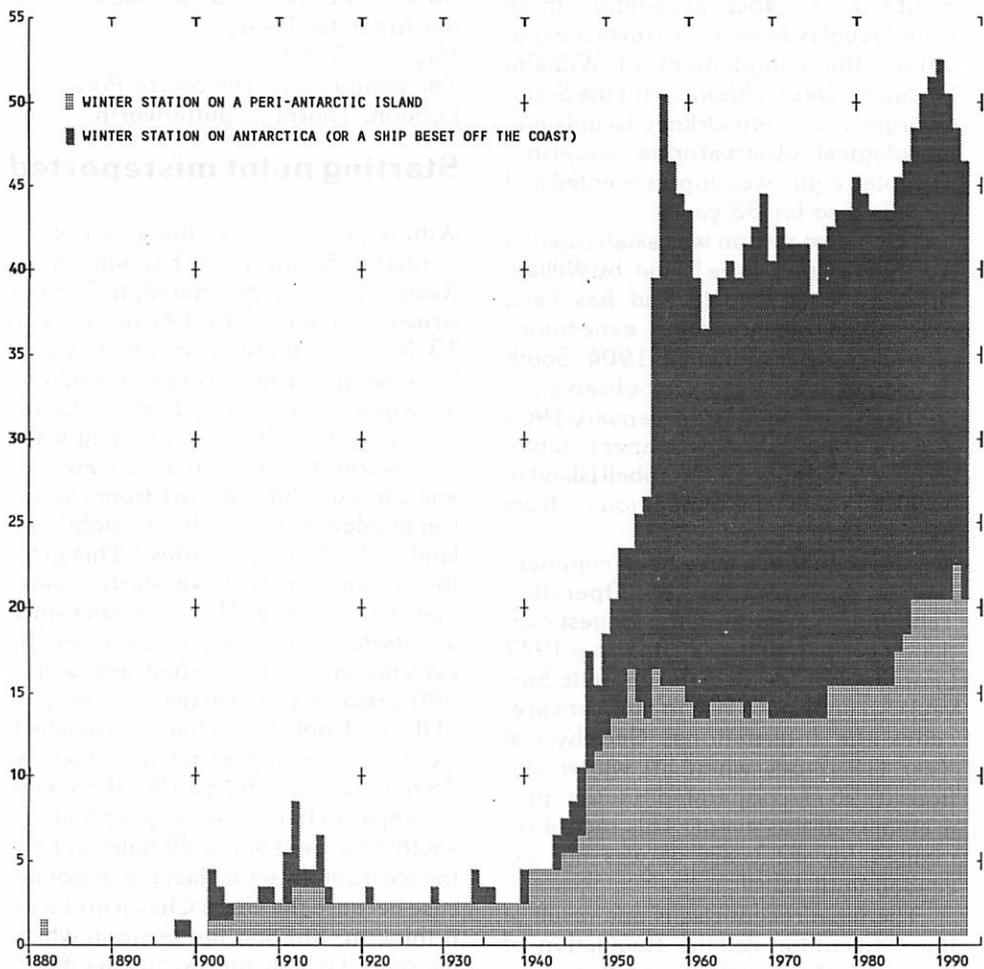
The problem of distinguishing a scientific station from the various other stations (whaling, sealing, pastoral and others) may be resolved by considering the presence of a meteorological observatory, recording data throughout the year to be the minimum criterion. Most stations were used to conduct a much greater range of scientific research for all or part of their existence.

Some aspects of the histogram are appropriate for comment. The first winter station, in 1883, was at Royal Bay, South Georgia; the German contingent of the first International Polar Year.

Ships beset in the pack ice included (as continental stations for they were generally closer to Antarctica than to the islands). They included *Belgica* (1899), *Gauss* (1901), *Deutschland* (1911), and *Endurance* (1915). *Aurora* (1908) was not included as no systematic observations were possible

Scott Polar Research Institute

ANTARCTIC WINTER SCIENTIFIC STATIONS



[<WINTER-TAB> 20 - V - 1993 R. K. Headland]

during the exceptional conditions endured.

The 1912 winter, referred to by J.G. Hayes (1932) as the *Annus Mirabilis*, had two parties from Captain Scott's *Terra Nova* expedition, three from Douglas Mawson's *Aurora* expedition, the complement of Wilhelm Filchner's *Deutschland*, with the South Georgia and South Orkney Islands meteorological observatories wintering. The total, eight, was unprecedented and remained so for 33 years.

The oldest station was established in April 1903, on Laurie Island, by William Bruce, aboard *Scotia* and has been maintained by Argentine expeditions after its transfer to them in 1904. South Georgia's meteorological observation has been continuous from January 1905 and the third oldest permanent station is that established on Campbell Island in 1941 by the 'Cape Expeditions' from New Zealand.

Although there have been continental stations from 1943 ('Operation Tabarin' from Britain), the longest continuously operating one dates from 1947 ('Faraday' of the British Antarctic Survey). An enormous rise in numbers precedes the International Geophysical Year (1957-58) when 50 winter stations (1957) cooperated in the programmes of this event. This record remained for 32 years; it was not exceeded until 1989.

The most recent rise is one result of the Convention on the Regulation of Antarctic Mineral Resource Activities. After this convention was completed and the Protocol on Environmental Protection prepared, any importance of acquiring this status diminished, and other problems (often financial) have led to further reduction in the numbers of stations from a maximum of 52 in 1990 (32 continental and 20 insular).

During the 1993 austral winter, 46 stations were open in Antarctic regions which were operated by 17 countries. Twenty were on the peri-Antarctic islands and 26 on the continent. Of these, 36 were in regions under the aegis of the Antarctic Treaty.

Hayes, J.G. 1932

The conquest of the South Pole
London, Thornton Butterworth.

Starting point misreported

With regard to the starting point of the Pentland South Pole Expedition: A Reader quoting Sir Ranulph Fiennes writes: "On page 31 (of *Antarctic* Vol. 13 No. 1) there is an error, which because, it is a serious one, I would be most grateful if you could ask the Editor to put right in a fairly prominent way.

Antarctic reported that Fiennes and Stroud "did not start from the extreme edge of the shelf but slightly inland." Sir Ranulph writes "This gives the impression that we started more than a mile inland! This is not true since we started within a few yards of the extreme edge of the shelf and within 500 yards of a very active looking part of the ice front. The actual spot at which we started was not as givenit was at 78deg15minS/42deg00 W. If you look on maps or charts it will appear that this southing puts us some 20 miles in from the ice front. In actual fact that is not the case because the Giant Chasm broke off (I think in '86) and the position where we started is now the existing ice front.

"You can see why, historically speaking, the above is very important to us."

Antarctic apologises for the error but confirms that the original information was received in good faith. The editor appreciates the opportunity to publish a correction.

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