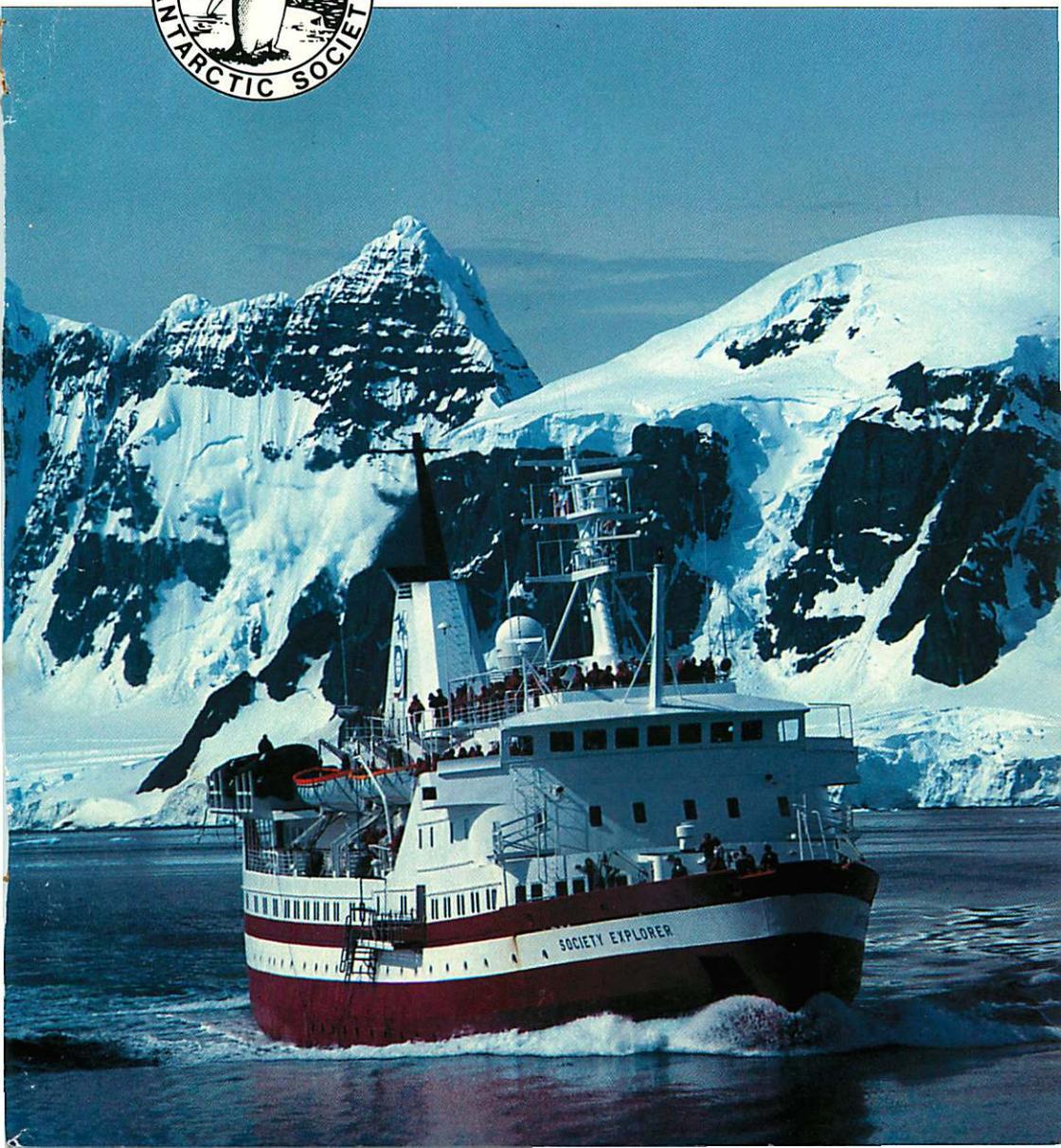


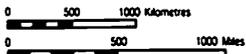
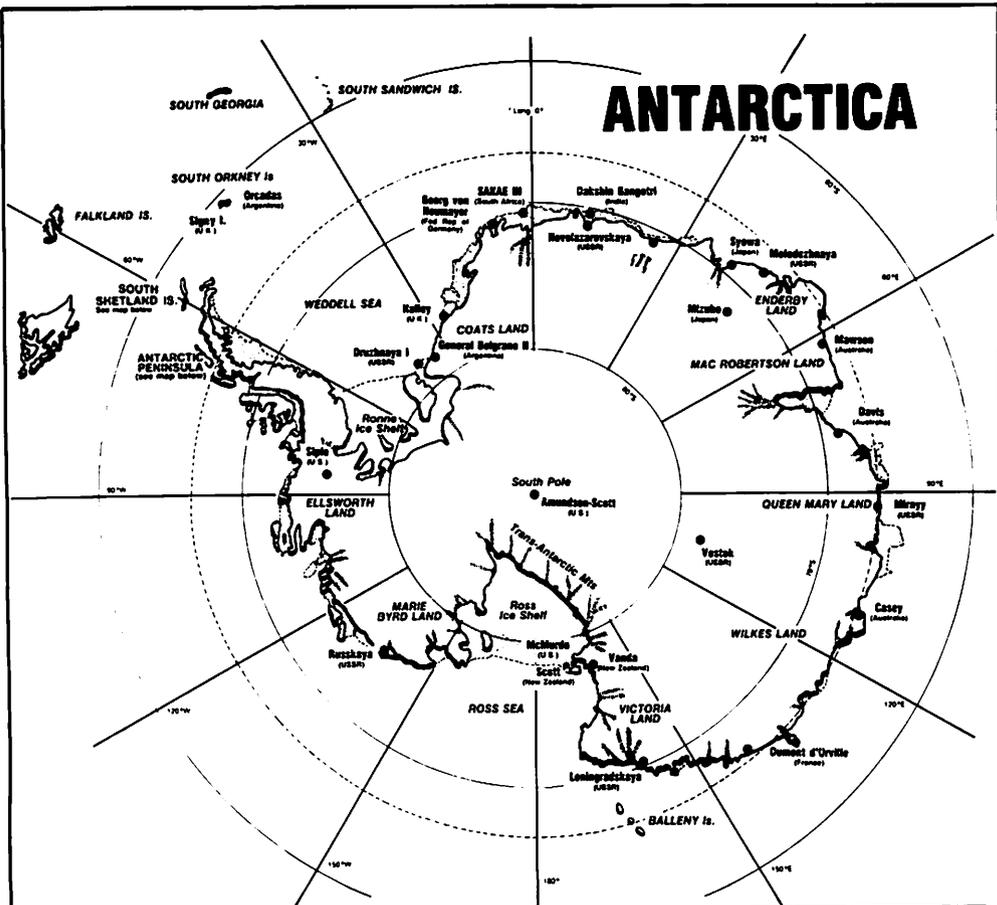
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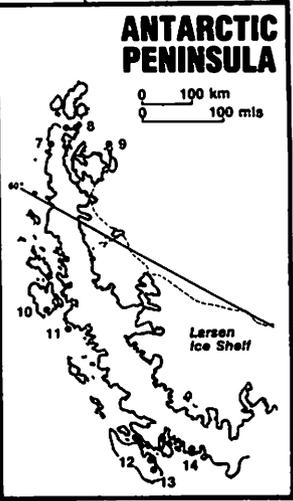


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- 13 Teniente Carvajal CHILE
- 14 General San Martin ARGENTINA



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Cover: *Frontier Spirit in the Beagle Channel.* Photo: Colin Monteath

NZAP

Excellent weather and international co-operation influence successful New Zealand programme

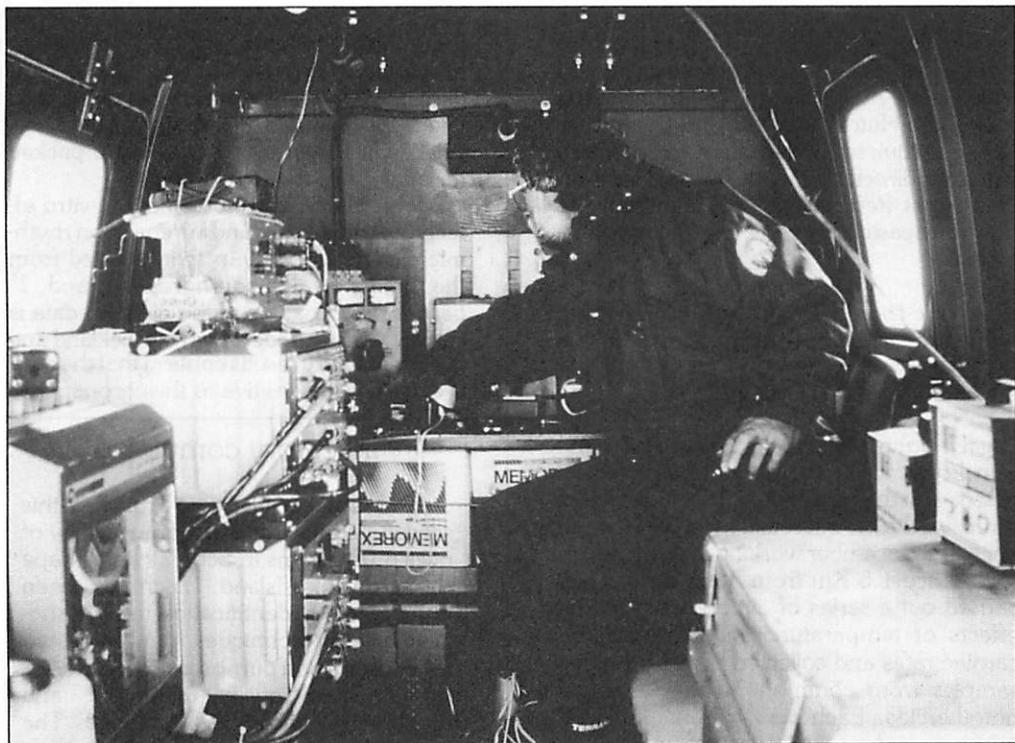
A total of 34 science projects are being undertaken as part of the New Zealand Antarctic Programme this season. It began on 2 October, 1992 with the first of an estimated 188 flights bound for McMurdo Sound to support summer activities. Earlier flights had taken scientists working on ozone depletion south to make spring measurements; base and programme personnel were also on board to help prepare for the season's activities. Scientists from Italy, USA, the United Kingdom, Sweden and Australia are involved in this summer's programme which is scheduled to conclude on February 20 when the last flights will leave Antarctica and a party of ten to manage Scott base for the winter.

Among the projects completed before Christmas was a seismic reflection and wide-angle reflection experiment carried out along a ten kilometre line perpendicular to the Hut Point Peninsula. (This project was originally scheduled to be undertaken in the Wilkes Basin but logistic constraints due to a curtailment of Hercules hours after a mishap resulted in rescheduling. See Vol 13. No.1).

The objective of the revised project was to delineate the sedimentary sequences under the Peninsula in order to define the late Cenozoic glacial and volcanic history of the region. The survey included imaging the base of the volcanic layer and the Cenozoic sediments beneath the volcanics. The group comprised Bruno Marino from the Osservatorio Geofisico Sperimentale in Trieste, Dr Stephen Bannister, Dr Fred Davey and Hugh Stevens from the Institute of Geological and Nuclear Sciences in Kelburn, Wellington. They were assisted in the field by Bill King of Christchurch and Mike Collins from Christchurch. Their pre-

liminary results show a steeply westward-dipping sedimentary sequence more than one kilometre thick lying five kilometres east of the Peninsula. Interpretation of the base of the volcanic layer is underway and the results will assist planning for possible stratigraphic drilling of the Cenozoic sediments.

Previously collected geological and geophysical data suggest that Ross Island is emplaced onto presumed late Mesozoic and Tertiary sedimentary sequences lying within the southernmost extent of the Victoria Land Basin. Marine geophysical studies have demonstrated that this basin, which extends from McMurdo Sound to Cape Washington, contains two major sequences of sediments, an older unit of late Mesozoic - early Cenozoic age presumed to be related to rifting associated with the breakup of Gondwana, and a younger late Cenozoic unit associated with the uplift of the Transantarctic Mountains and the rifting and downwarping of the Victoria Land basin.



The profile that was obtained this season covered a line eight kilometres across the ice shelf and three kilometres across the Peninsula and was at first surveyed by Kevin Taylor from the Department of Survey and Land Information in Gisborne with assistance from Jo Straaker.

In order to obtain their seismic data the party used some 3.6 kilometres of seismic cable cut into 12 300 metre long sections. The cables were laid on the ground and at 50 metre intervals along the array a string of six 15 Hz geophones was plugged in. Shots comprising four kilograms of explosive were fired every 100 metres. Each of the charges was placed at a depth of 15 - 18 metres in shot holes drilled by equipment built at the Institute of Geological and Nuclear Sciences at Gracefield near Wellington and used in the field by Hugh Stevens, Fred Davey and Mike Collins. As each shot was fired the reflections were recorded on magnetic tape by a DFS-V seismograph installed in the

Dr Bruno Marino from the Osservatorio Geofisco Sperimentale monitors the results of the seismic programme from the back of the New Zealand Antarctic Programme Haggglunds in the Hut Point Peninsula area. Photo: Dr Stephen Bannister.

back of a Haggglunds. After 12 shots the array was moved so that the party covered about 1.2km of the area each day. In addition to the normal incident reflection shots they fired three wide-angle shots positioned to give information on the distribution of seismic velocity with depth. Following the seismic survey a series of gravity measurements were made at positions approximately half a kilometre apart.

Now back in New Zealand processing of the data has begun. It involves stacking subsets of the traces from the different shot records to form an image of the structure beneath the ice.

Previous data collected from around Ross Island indicates that it is probably underlain

by a layer of sediments, which could be as thick as 10 km. They may range in age from late Mesozoic to late Cenozoic. Preliminary work clearly shows sediments dipping to the east of the Hutt Point Peninsula but further work is required to clarify the sedimentary structure directly beneath the volcanics on Hutt Point Peninsula. The data from the gravity measurements is also being interpreted.

Antarctic thanks Dr Steve Bannister for assistance with this article.

Fish studies

Dr John Macdonald, Stuart Ryan and Tim Lowe from the School of Biological Sciences at the University of Auckland spent three weeks in Antarctica from 16 November to 11 December working in a fish hut on the sea ice 1.5 Km from Scott Base. They carried out a series of experiments on the effects of temperature and adrenalin on cardiac rates and collected over 600 tissue samples from common McMurdo Sound nototheniids. Each was frozen in liquid nitrogen and packed for return to New Zealand. They are being analysed for phosphorylated nucleotides, cortisol and stress-related peptides. Each member of the team had a different project.

Stuart Ryan completed the sampling phase of five experiments designed to characterise production of stress-induced compounds ubiquitin and cortisol in the nototheniid fish *Pagothenia borchgrevinki*. Several fish at a time were subjected to the stress of confinement and elevated temperatures for periods varying between 0 and 48 hours. At the end of each time interval fish were killed and samples of blood and other tissues were quick frozen in liquid nitrogen. The analytical phase of the programme is now underway and the results of the ubiquitin concentrations should be available shortly. Tim Lowe froze muscle samples from resting and exercised *p. borchgrevinki* and *Trematomus bernacchii* in liquid nitrogen. Preliminary results show a surprisingly low level of high energy phosphates in both

species. Samples of haemoglobin were collected for investigation of multiple haemoglobins by isoelectric focussing. Heart, gills, muscle and liver samples were also taken for study of lactate dehydrogenase, isoenzymes. Red blood cells were packed for analysis of the Root effect.

John Macdonald studied the in-vitro effects of temperature and adrenalin on rhythmic electrical activity in atria isolated from the hearts of *P. borchgrevinki* and *T. bernacchii*. Analysis of the digitised data is currently being undertaken in Auckland and the preliminary results confirm that the atria is extremely insensitive to the chronotropic

Inventory completed

The Antarctic Heritage Trust has, this season, completed a major inventory of over 6,000 items in Scott's Hut at Cape Evans on Ross Island. Each has been numbered for identification using standard museum techniques, and assessed for conservation purposes. Possible deterioration can now be monitored and conservation priorities established. The items include a large volume of food, as well as clothing, science and field equipment. Next season a similar programme may be undertaken at Shackleton's Hut at Cape Royds where, this summer, the party replaced some battens on the roof and window shutters as well as completing a preliminary conservation assessment to determine the time needed to complete an inventory there. They also identified items exclusive to the hut. A similar exercise was undertaken at Hut Point where some basic maintenance was also completed.

David Woodings, the registrar at the Waikato Museum of Art and History in Hamilton, led the conservation effort with assistance from Susan Harrison of the Trust. Lyn Campbell from the McDougall Art Gallery in Christchurch undertook the conservation assessment. John Charles from Arthur's Pass near Christchurch was the party leader. They travelled south on 13 December 1992 for three weeks.

(rate increasing) effects of adrenalin. The low adrenalin sensitivity now appears to be a unique feature of Antarctic fish.

Ice studies: fatigue,

Working on two-metre thick first-year ice about two kilometres off the end of the Erebus Ice Tongue was a party of four comprising Dr Tim Haskell, Matthew Jury, and Simon Gibson from Industrial Research Ltd., in Lower Hutt near Wellington and Dr Patricia Langhorne from the University of Otago in Dunedin.

They were cutting cantilever beams some 10 to 20 metres in length with a chain saw digger and subjecting them to hydraulic pressures to measure fatigue and acoustic emission. The specially designed hydraulic frame resembling an uncovered polar tent was bolted to the stable ice each side of the beam and a hydraulic ram was attached between the apex of the frame and the free end of the beam and motivated. During the process Dr Langhorne measured the acoustic emission from the beam as it was exercised and finally broken.

Preliminary results indicated that the larger the load the fewer cycles it took to break the beam. This is in keeping with other materials subject to this standard method of measuring fatigue. The party had problems with temperatures changing rapidly particularly as the last 10 degrees before melting when significant softening occurred; of the 20 beams cut some 12 to 13 produced useful unique data.

Using high speed data acquisition equipment Dr Langhorne measured the acoustic emission from the hinged end of the beam which was fixed to the ice plate as it was subject to stress. Her preliminary results indicated that the greater emission equated to the amount of stress. The inaudible high frequency sound was caused by the ice crystals sliding over each other.

The work has implications for understanding the failure mechanisms in ice especially due to the action of sea wave energy. It will also provide information which can be used to assess the reliability of sea ice roads

and runways.

energy transfer, and

Studying the nature of the energy transfer between the ocean and the ice was the objective of another group of scientists this season. The party comprising Dr Murray Poulter and Murray Smith from NIWAR's Atmospheric Division in Wellington and Phillip Rottier and Colin Fox from the University of Otago were in Antarctica from 20 November to 11 December.

All but six days of their time was spent in the field where they established a camp at Backdoor Bay at Cape Royds and travelled out to the ice edge some 25 kilometres away to perform their experiments. They used the NIWAR microwave radar mounted on a tower close to the edge to estimate the ocean wave characteristics, and installed a line of strain gauges back from the edge to measure ice coupled waves. During the course of their field work they repositioned the equipment several times as the ice broke out. Some good data sets were obtained in both southerly or offshore and northerly wind conditions. Preliminary analysis of this information is now being undertaken and they hope to be able to compare the first data sets within the next few weeks.

light transmission

Working at a site some two kilometres south of Tent Island Drs Bob Buckley from the New Zealand Institute of Industrial Research and Joe Trodahl, from Victoria University, both in Wellington conducted a series of optical experiments on the sea ice between 23 and 31 October 1992.

This season their work consisted of introducing a brief pulse of light into the ice and measuring the shape of the pulse emerging from the ice at a specified distance from its source. They used a pulsed dye laser pumped by a nitrogen laser to inject a 3 nanosecond pulse of monochromatic light into the ice and a fast photo detector driving a digital storage oscilloscope to determine the intensity of the light emerging from the

surface usually some 100-500 mm away. The emergent pulse showed a long tail extending out to more than 50 nanoseconds after the arrival of the first light at the detector, due to the very long random-walk paths taken by the light in such turbid material as ice. The pulse straggling gave the scientists a direct measure of the path length distribution and of the density of bubbles and brine pockets in the ice which scatter the light.

This work is of importance because the optical properties of sea ice exert an influence over the energy balance of the Earth's polar regions and over the availability of light for photosynthesis in the sub-ice algal layer which provides a significant fraction of the primary production in these regions. Sea ice is known to be a very complex material, in which optical properties are dominated by the depth dependent scattering of light by bubbles and brine inclusions and by the wavelength dependent absorption of the ice itself. Such complexity makes it difficult to predict the transmission of light through the sea ice.

The two scientists began their work in 1985 when they set up an experiment aimed at separately determining the effects of scattering and its depth dependence. In so doing they measured the spreading in space of a beam of light introduced at a point on the surface and made a major advance in understanding the scattering of light in natural sea ice. In 1990 they complemented their initial experiment by measuring the spreading in time of a very brief pulse of light introduced at a point on the surface. From this they acquired data which gave a direct measurement of path lengths of light on random walks through the ice and which can be compared with predictions based on the structure of sea ice. This years work was important to confirm their measurements and look for differences between seasons and sites. They also completed a series of ice characterisation experiments to help interpret their optical data. This was undertaken in conjunction with Dr Pat Langhorne from the University of Otago.

Coring programme

Some scientists from Victoria University had a bonus trip to Antarctica this season. Alex Pyne, accompanied by John Carter, Emily Gee and Bruce Anderson from the University and John Grube, a plant operator from the New Zealand Army, set out in early November with a specially designed and built vibracorer with which they hoped to obtain cores from sea floor of the area from the Mackay Glacier to the ice edge. This is a continuation of an ongoing project designed to help them determine the timing of the retreats of the edge of the Antarctic ice sheet across the continental shelf since the last glacial maximum some 20,000 years ago.

Although their equipment performed almost according to plan the seafloor was too unstable for them to obtain their cores and the ice cover at the drill sites off Cape Roberts was too thick for the full project to be undertaken. The meteorological equipment at Cape Roberts and the tide gauge were serviced, the data down loaded and the party returned to New Zealand.

Then, unexpectedly, during the last week of January, the US Coastguard icebreaker Polar Star was in McMurdo with a week to spare. The US Antarctic program offered it to the New Zealand Antarctic Programme which contacted the University on Thursday, January 28. A proposal was prepared and accepted on the following day and on the Sunday Alex Pyne and Stuart Henry flew south to join the ship. By the Monday they were utilising the 3.5 kHz echo sounder and GPS navigation system to profile a series of lines offshore from Cape Roberts in order to build a detailed bathymetry map of potential drill sites and to determine the nature of the sea floor in that area. They also profiled a section of Granite Harbour and immediately offshore from the Nordenskjöld Ice Tongue where the sediments may be representative of the last Holocene ice expansion and retreat.

In a total of five days at sea over 400 nautical miles of track was obtained, some

through open water but much of it was through 8 and 10/10ths pack and some fast ice.

Others in the shipboard party included Dave Comber, the Senior New Zealand Representative in Antarctica; Paul Chaplin, Operations Manager; Brian Green the electrician, Mike Mahon the technician, Dave Milne, who has been in charge of stores and cargo and Greg Harris, a mechanic all from Scott Base. This team contributed to the maintenance of a 24 hour log which was of considerable assistance to the science programme.

Xenolith sampling

Direct sampling of the earth's deep lithosphere, comprising lower crust and upper mantle, was undertaken again this season by Dr John Gamble accompanied by Richard Wyszczanski and Johnathan Broker all of Victoria University.

In Antarctica during November and early December they visited a number of xenolith bearing volcanic cones Half Moon Crater, Sulphur Cones and Turtle Rock all in the Hut Point Peninsula area, south of Mt. Aurora on Black Island, Foster Crater in the Koettlitz Glacier region and Mount Bird in the Cinder Hill area. The samples obtained greatly add to their existing collection and will be used to develop models of lithospheric structure and processes and to make comparisons with Marie Byrd Land.

Their project is an extension of the International WAVE (West Antarctic Volcano Exploration) programme of research which was undertaken during the seasons of 1989/90 and 1990/91. The aim has been to collect comprehensive xenolith suites from the environs of Ross Island and the foothills of the Transantarctic Mountains so that these can be compared to their extensive collections from the volcanoes of Marie Byrd Land made during the WAVE programme.

According to the party the preliminary their observations suggest that the transition from the lower crust to the upper mantle, beneath the Ross Sea and the foothills of

the Transantarctic Mountains is a complex zone of interleaving lithologies extending over many kilometres of vertical section. The processes influencing this section are also complicated, involving both fluid and melt transfer from the underlying convecting mantle and associated thermal effects. The lower crust clearly acts as a major physical barrier to melts ascending from the hot convecting interior of the earth. Their observations suggest that this barrier may intercept and impose fractionation paths on the melts thereby adding to the growth of the crust by the process of underplating. The evolved melts are themselves more Fe-rich (and dense) and the fractionation products they leave behind are also dense, possibly more dense than the underlying depleted mantle, leading to a circuit of downwarping, extension and basin formation.

The subsequent laboratory study of the samples will be largely geochemical, involving major and trace element analyses of whole rock and mineral separates and detailed electron microprobe analysis of selected samples. Physical properties (density and seismic velocity) will be measured on selected samples. They propose to link their chemical and physical observations and measurements to test existing models of asymmetric extension at the Ross Sea margin and to apply the data to more general models of sedimentary basin formation.

Ozone

Alan Thomson from NIWAR's Atmospheric Division at Lauder in Otago, Central Otago, flew south on WINFLY to install a high resolution Fourier transform spectrometer in the Arrival Heights Laboratory. He operated the equipment successfully though the spring returning to New Zealand in October. The project is being conducted in co-operation with the University of Denver and will enable the scientists to retrieve data on some trace gases with greater accuracy than previously. Changes in stratospheric hydrochloric acid during the year will be measured. Alan returned to the

Antarctic during January/February 1993 to train the new technician Mike Mahon who will operate the two FTIR systems and check the JY spectrometer for nitrogen dioxide and ozone measurements prior to the start of the new autumn winter period.

Processing of the data from the programme is now well underway. Of particular interest in the ozone depletion question are results showing perturbed stratospheric chemistry involving nitrogen and chlorine compounds. These changes are occurring on aerosols in the atmosphere and have been accelerated by the presence of the Mount Pinatubo volcanic aerosols in the Antarctic atmosphere.

Next season the team hope to deploy a new diode array spectrometer to monitor seasonal changes in stratospheric chlorine.

Penguin count

Scientists from Landcare in Nelson continued to monitor the Ross Island penguin colonies this summer. Bruce Thomas, Kerry Barton and Brian Karl flew south on November 22 and three days later undertook the first of a series of census flights. Under the captaincy of Brian Coulter and with Jo Stevens, as co-pilot and Rob Stuart as loader the party flew by helicopter to the colonies to Cape Crozier East to collect data to compare the breeding status of the birds at Cape Royds where during the next five days. they counted the number of penguins present in the rookery, occupying nests, with eggs or no eggs and chicks. Some 3,516 breeding pairs were present; this is an increase of nine percent over last year.

On December 1 they were aboard a dedicated science C-130 flight, piloted by Tony Davies with a crew of six and were able to photograph ten of the rookeries along the coast of North Victoria Land but missed three because of the weather.

In mid January Kerry Barton returned to Antarctica with Peter Wilson and they flew

Continued on page 403

Christmas at Scott Base.....

Twenty-nine New Zealanders and visitors to Scott Base at Christmas time enjoyed a four course Christmas dinner. It began with an entree of smoked salmon and avocado mouse, followed by options comprising glazed ham with mustard and fruit sauce, turkey breast with apricot and cashewnut stuffing; roast lamb with trimmings or a seafood platter.

Vegetable accompaniments included honey-glazed carrots, minted peas, broccoli, buttered new potatoes or a selection of salads. Desserts, comprised Christmas pudding with brandy sauce, pavlova with Kiwifruit, pecan pie, trifle or fresh fruit salad. The meal concluded with coffee, cheeseboard, mince pies and chocolates. Two wines a Torless Riesling 1991, and a Torless Ruapuna Pinot Noir 1991 accompanied the meal and Methode Champenoise Montana Lindaur Sec was available. Artillery Port was served at the end of the meal.

Twenty five New Zealand Antarctic personnel spent Christmas in the field.

Television crew

A joint film crew from the BBC and TVNZ Natural History Units left Christchurch on Tuesday 5 January for Scott Base to continue filming the documentary series "Life in the Freezer." The series is to be presented by Sir David Attenborough who traveled south with the party which comprised Alastair Fothergill, the producer and originator of the series who has recently been appointed head of the BBC Natural History Unit, Hugh Maynard, BBC cameraman and soundman Erol Samuelson from TVNZ in Dunedin.

Logistic and other support for the project is being provided jointly by the New Zealand and US Antarctic Pro-

grammes; the crew will visit the South Pole, the Dry Valleys and the historic sites around Ross Island.

Due for release in the UK during November 1993 the documentary series in-

cludes footage from many locations on the Antarctic Peninsula and South Georgia and at Australia's Mawson Base. Filming began in 1991.

New Zealand and France negotiating joint logistics agreement

Discussions held before Christmas between the Right Honourable Don McKinnon representing the Government of New Zealand and M. Louis Le Pensec, the French Minister for Overseas Territories on South Pacific issues also included the Antarctic. As a result the following statement has been issued:

"Noting that New Zealand and France have an explicit commitment to the protection of the Antarctic environment, recognising that the signature of the Protocol on Environmental Protection to the Antarctic Treaty by all Consultative Parties represents an historic achievement and recalling the Environmental principles of the Protocol which require, among other things, that activities in the Antarctic Treaty area be planned and conducted so as to limit adverse impacts on the Antarctic environment and dependent and associated ecosystems;

Recalling that New Zealand has been one of the most important gateways to Antarctica and that New Zealand welcomes the use of the facilities in Christchurch by expeditions to the continent;

New Zealand and France welcome the opportunity to develop their Antarctic co-operation as bringing a further positive dimension to their bilateral relationship and, accordingly, express the wish to encourage this cooperation during the establishment of the "Concordia" scientific

station at Dome C by France and Italy, for which a draft Comprehensive Environmental Evaluation has been submitted to the Antarctic Treaty Parties and for which a final Comprehensive Environmental Evaluation is being elaborated taking full account of the observations made by the Antarctic Treaty Parties and Non-Governmental Organisations.

In view of the interest France expresses in using the Christchurch airport facilities, New Zealand notes that a specific request for an initial flight in support of France's Antarctic programme at Terre Adelie in the French Antarctic Territory will be made shortly. It envisages considering any specific request favourably and looks forward to further discussions about a flight programme.

To this end New Zealand and France will begin work next month on a bilateral agreement on Antarctic co-operation. This will include discussion on environmental aspects including with reference to France's draft Environmental Evaluation on the impact of the construction and operation of Concordia station."

23 December, 1992

There has been little further development but a planned proving flight by a French Hercules from Christchurch to Dumont d'Urville in February has been cancelled because of the diversion of suitable aircraft to international peace-keeping duties. Technical discussions were however

scheduled to take place in Christchurch between Andre Cutullic from the Sofreavia Services in France, which is contracted by TAAF to co-ordinate flying activities in

support of the French Antarctic programme, and other interested parties in Christchurch. The outcome of these discussions is not yet available.

Brazilian Antarctic activities for 1992-93

A ship, two helicopters and seven Hercules flights have been arranged to support Brazilian Antarctic operations in 1992-93. The vessel the *Barao de Teffe* is owned by the Brazilian Navy and was constructed at Aalborg Vaerft S/A Denmark in 1957. Ice strengthened for Antarctic operations, she carries 96 passengers and crew and can remain at sea for 60 days. She has a gross tonnage of 2182 tons, is powered by a Burnmeisiter and Wainstype 735, VHF 62, 1800 Hp engine giving a cruising speed of 8 knots. The *Barao de Teffe* is 82.11 metres in length, 13.72 metres wide and has a draught of 6.26 metres. In charge of the vessel for the 1992-93 operations is Captain Alberto Cardoso Bloisl. Ninety six passengers and crew can be carried and for this season she was due to leave Rio de Janeiro on 9 November 1992 for Rio Grande in Basil where she will be resupplied. The expedition leader is Captain Antonio Carios Monteiro.

The vessel was then to proceed to Elephant Island to deploy a scientific party comprising four biologists and three physicians. The biological programmes comprised sea and land bird studies and work on the dynamics of the zooplankton communities in the South-Occidental Ocean. (The physics programmes have not been specified but may be shipborne with some Island deployment.)

Over the years the Brazilians have erected two refuges on the Elephant Island. They are Engenheiro Wiltgen which was established in the summer of 1984/85 and

is located at 61deg 04min S and 055deg21min W and the Emilio Goeldi built in the 1988/89 summer at 61deg05minS/055deg 20'W.

The vessel then proceeded to King George Island where she was scheduled to arrive on 30 November and support activities there for just over two weeks. In addition to resupplying the station, Commandante Ferraz she was to deploy a summer party led by Commander Jose Francisco Vasconcellos Gomes. Seven others were required for base operations and there was a maintenance crew of 12.

A diver, and two mountaineers were to support field operations. Programmes at the station focus on meteorology, atmospheric and biological sciences. Earth science programmes are also undertaken and some 31 scientists and technicians have been involved. The station, which lies at 62deg 05'S/058deg23.5'W, was built on the Keller Peninsula in 1984 and is used for summer and winter operation.

Leaving Commandante Ferraz on 18 December the *Barao de Teffe* returned to Elephant Island and then proceeded to Robert Island where a temporary field camp was established to support programmes being undertaken by three earth scientists aided by one mountaineer. They were focussing on a geological and stratigraphic correlation of the tertiary volcano-sedimentary sequences of Robert and Greenwich Islands. Then it was back to King George by January 11 remaining there until 21, when she was to proceed to Ushuaia for five

further days resupply until the end of January.

On her return voyage the vessel retrieved the party deployed at Robert Island and went on to King George Island for the last time in the season before returning to Montevideo via Penguin and Elephant Islands. She was then scheduled to proceed to Rio Grande in Brazil at the end of March and Rio de Janeiro by 4 April 1993. Throughout the season additional logistic support was provided by two shipboard Squirrel Helicopters.

Seven C-130 Hercules support flights are scheduled to fly between Rio de Janeiro, Brazil and Ten Marsh Chilean Base King George Island. Two were planned for December 1992, and the remainder spread

over January, February, May, July and October of 1993. The planes belonging to the Brazilian Airforce are under the command of Lieutenant Colonel Edvard Rodrigues Vleira and come from the First Transportation Squadron.

When summer activities conclude a party of eight are scheduled to remain at Comandante Ferraz station for the winter. They comprise the office-in-charge Captain Commander Francisco de Paula Costa Filho, an assistant, medical officer, engine technician, radio operator, electrician, electronic technician and cook. Two physicists and three electronic technicians are involved in the winter scientific programme. In all the scientists come from 16 different Brazilian universities and institutes.

Ninth Chinare

Expedition to supply both bases and undertake a marine science programme.

The Ninth Chinese Antarctic Research expedition comprises 104 expeditioners from 64 government organisations, research institutes and universities. Among them are 58 scientists of different disciplines. They departed from Qingdao in China on 30 October 1992 aboard the research vessel *JIDI* and after resupply in Wellington and a brief visit to Christchurch they sailed southeast along the ice edge to the Great Wall Station to off load personnel, supplies and equipment. They were then scheduled to resupply at Punta Arenas and sail eastward along the edge across the Southern Atlantic and part of the Southern Indian oceans to Zhongshan Station at the tip of Prydzs Bay. After completing further personnel change over, base resupply and

a marine science programme the vessel was to return to China before the end of February 1993 via Fremantle and Singapore. By this time she will have covered some 25,000 nautical miles in 161 days of the expedition's duration.

China's involvement in Antarctic research began in the 1979/80 season when two scientists joined ANARE at Casey Station. Since then her scientists have cooperated with others of many nations including New Zealand when in 1982 the government accepted four to undertake cooperative research on marine and terrestrial biology, and geology and geochemistry in the dry valleys.

China now has two year round stations in the Antarctic, the Great Wall Station on

King George Island in West Antarctica and Zhongshan Station on the East side of the continent in Australian territory. Dong Zhaoqian, Director, Polar Research Institute of China, chief scientist and expedition leader for the ninth Chinese expedition explains that the "development of Chinese antarctic activities has undergone three periods, the preparation between 1980 and 1984, station establishment between 1985 and 1989 and scientific research since 1990.

PRIC established

In 1989 the Polar Research Institute of China (PRIC) was established in the central zone of the Pudong development in Shanghai. It is now the centre of polar scientific research under the direct control of the Chinese Antarctic Administration (CAA). A recent publication describes the role of the institute as being involved in the "comprehensive study of subjects with great scientific value for global environment and humanity, investigation of resource potential in the Polar, especially Antarctic regions, working out and coordinating long-term and annual plans for polar research expeditions, studying and preserving polar samples, collecting and managing data, editing and polar research cooperation, being in charge of development and conveying the equipment and instruments for Chinese polar expeditions etc...."

The Institute comprises three research departments consisting of polar glaciology, low temperature ecology and comprehensive sciences (upper atmosphere physics, geology and geophysics). Within the institute's science building is a Low Temperature laboratory of some 200 square metres capable of providing a range of temperatures to meet the needs of different experiments. There is also a room with high purity conditions available for the specific analysis and measurement of Antarctic samples. Advanced instrumentation already installed

at the institute or due includes scanning electron microscopes (SEM), a corpuscle analyser, a strain gauge, two kinds of mass spectrometers, an atomic spectrometer, an X-fluorometer, and a computer system. The Institute also has a library comprising an extensive collection of polar publications and has a publishing unit producing its own journals. China's Antarctic archives are also accommodated within the building complex.

CIPR acts as the home base for China's polar expeditions; it has its own training grounds and equipment stores. Its staff of 150, includes about 100 scientists. The director Dong Zhaoqian is also the Vice-chairman of Chinese National SCAR committee and a Vice president of SCAR. In China he is assisted by two deputies, Professors Yan Qide and Fan Runping.

Programmes

At the two Antarctic stations and from the resupply vessel *JIDI* working in the southern ocean the actual Chinese Antarctic programmes cover a wide range of research and meteorology, biology, glaciology, geology, geophysics, upper-atmosphere physics, physical and chemical oceanography. During the current season they are undertaking 39 scientific projects as part of a five year Research Programme. Broadly they are encompassed by studies entitled the "Evolution of Climate and Environment since the Late Pleistocene, the background of the contemporary environment.", "Ecosystem in the Fildes Peninsula, on King George Island"; "Interaction and Influence between Antarctica and the World", "The structure, formation, evolution and geodynamics of the Antarctic lithosphere" and the "General behaviour of the Solar Terrestrial System." The marine science program comprises 11 projects including "Krill biology and ecology", Water masses and circulation, and chemical oceanography. This is being carried out in the

Scotia Sea and in the Prydz Bay region of Antarctica from the *JIDI* currently being captained by Wei Wunling.

It is the *JIDI*'s sixth voyage to Antarctica in support of Chinese operations. The vessel is of the Finlandia class, with a classification of IA and was built in 1985. She is 152 metres long, is 20 metres wide, has a gross tonnage of 8760 tons and a maximum speed of 15.1 knots but she

cruises more economically at 14 knots. Her cruising a radius is 25,000 nautical miles and she can stay at sea for 100 days. Five winches are used to assist programmes and unloading and she carries two medium sized motorboats to support her other operations. At Zhongshan the Chinese will charter a helicopter from the Australians to enhance their logistic support for the season.

Netherlands

International co-operation, a key feature of Netherlands programme

Twenty nine Dutch scientists are scheduled to travel south between October 1992 and September 1993 as part of four other national programmes.

Fifteen of the scientists were involved in Antarctic Voyage six of *RV Polarstern*, scheduled for completion on 29 November 1992. Two others joined voyage seven undertaking the Summer Weddell Gyre Study due to end on 22 January 1993. (See "Antarctic" Volume 12 No. 10 pages 340 to 342). Two others participated in GANOVEX VII (see Antarctic Vol 12 No 9 pages.....). Field work was undertaken by a party of three other scientists working with the British on South Georgia, while two others spent the summer at Signy Station, where one will winter over during 1993. Three others have gone south the Swedish expedition to work from the WASA station in the Vestfjella area and two more are working with the Australians from Davis Station.

The programme for 1992/93 is very much in keeping with that organised in earlier years whereby they make use of the

existing infrastructure share costs and minimise impact.; the logistics supporting continuation of the current programme involving cooperation between the German Alfred Wegener Institute for Polar and Marine Research; and the Bundesantalt fur Geowissenschaften und Rohstoffe, the British Antarctic Survey, the Australian Antarctic Division and the Swedish Polar Research Institute. Scientists have also been participating in programmes conducted at Polands Arctowski Station on King George Island. The first such expedition took place on 1 December 1990 until 2 February 1991 but further plans are being developed.

The Netherlands, is due to its geographical position, vulnerable to the projected effects of global warming such as the rise of the sea level; the Antarctic, the southern oceans and sub-antarctic islands are critical areas for the study of global processes. Dutch interest in Antarctica increased during the 1970's and 1980's partly as a result of the growing awareness of environmental problems and the special significance of the

Antarctic for the earth's biosphere and ecosystem.

In 1976 the Dutch Lower House stressed the desirability of conducting research in the Antarctic and the Minister of Education and Science commissioned a report by the Netherlands Council of Oceanic Research (now known as the Netherlands Marine Research Foundation) which showed that Dutch scientists were keen to undertake research in the Antarctic. In 1982 the Lower House supported the Thomassen policy document which argued in favour of increasing Antarctic research and implementing a national programme. In the same year the Netherlands Council of Oceanic Research (NRZ) was invited to submit proposals for such a programme. In 1983 the Council proposed that the Dutch research activities be focussed on glaciology, atmos-

pheric studies, geology, oceanography and biology and a national committee, the Netherlands Committee on Antarctic Research (CAS) was established to co-ordinate the research programme.

In 1989 the Netherlands government decided to allocate funds for expanding the programme from then until 1994. As a result the Netherlands applied for Consultative Party status within the Antarctic Treaty and were admitted as a consultative member on 28 November, 1990. In the meantime they also became a full member of SCAR. And, at the Royal Netherlands Academy of Sciences and Letters (KNAW), a special SCAR committee has been established to co-ordinate the task of national delegates to SCAR and provide the organisation with current information on Dutch scientific activities in Antarctica.

New Director for Chilean Antarctic Institute

Chile's Antarctic Institute has a new director. He is Mr Oscar Pinochet de la Barra, one of the best known experts on Antarctica in Chile and the Antarctic Treaty System. A diplomat by profession, he has been Ambassador of Chile in the Soviet Union from 1968 to 1970 and in Japan from 1971 to 1973. He is a member of the Chilean Society of History and Geography, the Scientific Society of Chile, the Society of Writers of Chile and the international Union of the History of Sciences and has published 22 books on history, politics, literature and poetry.

Ship in distress

Rescuers in Hobart feared for the safety of 23 people on board *L'Astrolabe*, the French supply vessel. When sailing between Dumont D'Urville and Hobart the distress signal was accidentally set off in rough weather. Detected by satellite beacon the ship was located and observed by an aircraft, despatched to search for it about 800 nautical miles south of Hobart sailing safely towards its destination. The incident occurred on 3 February, 1993.

Ukraine claims base in the Antarctic

The Ukraine wants to conduct its own scientific studies in Antarctica according to press reports issued by Reuters in December. It is claiming Bellingshausen, one of the five former Soviet Union's research stations to which no more than five percent of the total Russian Antarctic effort is directed. The Ukrainians say that Kiev funded up to 15 percent of the cost of Soviet Union's research there and their scientists had been directly involved.

BAS: special features;

PACE- Anglo-American Conjugate Experiment

The British Antarctic Survey, together with the Applied Physics Laboratory (APL) of the John Hopkins University in the USA, operate a unique experiment which encompasses the auroral regions in both hemispheres. The experiment, known as the Polar Anglo-American Conjugate Experiment (PACE), involves two sophisticated High Frequency (HF) radars, one sited in Labrador, Canada, looking at the Arctic

ionosphere, and the other at Halley Research Station in Antarctica, viewing the Antarctic ionosphere. The fields of view of the two radars are at either end of the same geomagnetic field lines and hence are said to be "conjugate" (see figure one).

The PACE radars operate in a manner similar to surveillance over-the-horizon radars.

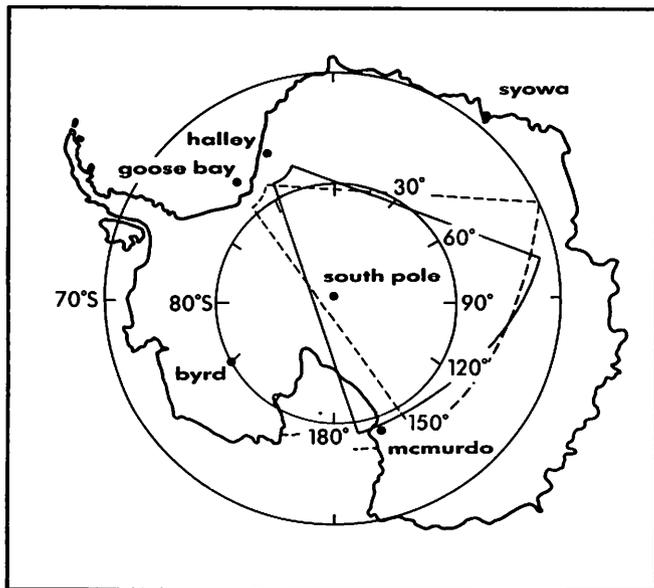


Figure one: Field of view of the PACE radars with the Goose Bay radar mapped into the Southern Hemisphere.

A narrow pencil beam of radiation is formed using the aerial array (figure two). This is stepped through 16 adjacent positions in azimuth. Pulses transmitted in this beam are scattered by irregularities in the ionosphere and received back at the transmitting site. The maximum radar range is about 3,000km, giving a field of view in the polar ionosphere of four million Km². This area can be surveyed every 80 seconds, giving a combination of spatial and temporal resolution not attainable with any other technique.

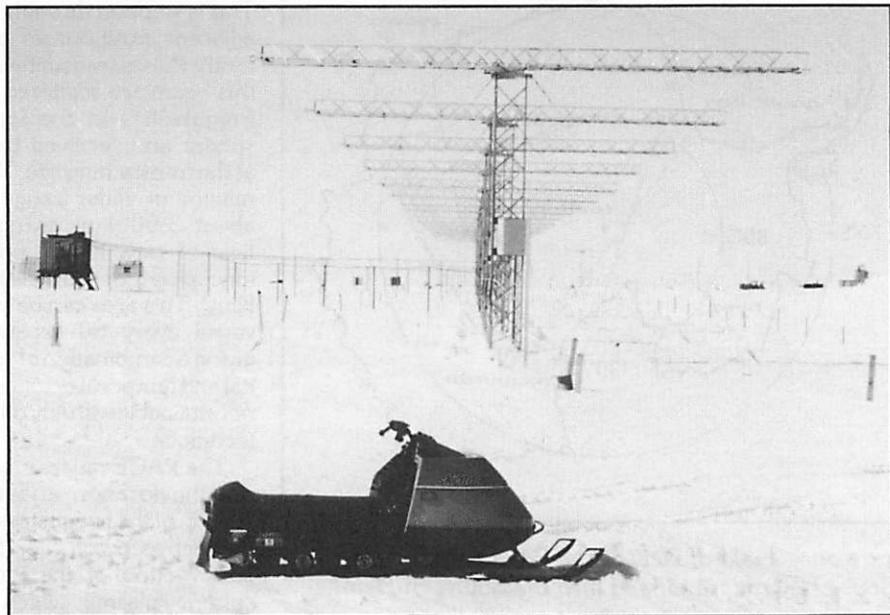
The PACE radars measure the location and the motion of the irregularities, and act as tracers for the bulk motion of the ionospheric plasma which is driven mainly by electric

fields generated by the interaction of the solar wind and geomagnetic field. Therefore they offer unique windows on geospace processes, and can be used very effectively to study the energetics and dynamics of geospace. For example, the bulk motion of the polar ionosphere (known as convection) is strongly influenced by the magnetic field carried from the sun by the solar wind. The PACE radar data have been used to show that ionospheric convection responds to changes in the solar wind magnetic field on a time scale of a few minutes. Up to a billion watts is dissipated in the upper atmosphere through this process. Therefore the PACE radars can play an important role in understanding and quantifying energy flow through the geospace. Other "firsts" for the Antarctic PACE radar have been the mapping of the occurrence of irregularities and the derivation of average ionospheric motions in

the southern polar region. These results show some significant differences from corresponding measurements in the Northern Hemisphere.

The two PACE radars have also observed the occurrence of isolated patches of irregularities near noon, moving away from the radars at high speed. Poleward convecting patches have been the subject of intense study in the Arctic, but the physics behind their formation is not fully understood. This is the first time they have been observed to form simultaneously in both hemispheres, and evidence from the Halley PACE radar strongly suggests that their generation is associated with the interaction between the solar wind and the magnetosphere. This is not just an esoteric point because such patches can severely disrupt satellite-ground communication systems.

Figure two. PACE aerials at Halley.



The Whistlers

Radio Wave Generation and propagation in Geospace

The Space surrounding the Earth, Geospace, is mostly filled by hot rarefied gas which is partially or completely ionised plasma, a prolific generator of natural radio waves.

The whole of geospace is permeated by a rich variety of radio waves, both naturally and artificially generated (figure one).

Because they interact strongly with the fast-moving electrically-charged particles of the plasma, study of their generation and propagation is a powerful tool in the investigation of the physical processes which control the behaviour of geospace.

While many types of radio wave cannot reach the ground from geospace, those that do, yield important information about the dynamics of the plasma through which they have traveled, and the complex process by which energy from the sun is coupled into the upper atmosphere. Since these processes are largely controlled by the Earth's magnetic field, the polar regions where the field is most intense, are ideal for this research.

Radio wave studies constitute a major component of the British Antarctic Survey's geospace research effort, most par-

ticularly from the new facilities at Halley Research Station. (See Antarctic Vol. 12 No 8).

Radio waves with low frequencies, that is less than 30 kHz, have an unusual property: they can travel out thousands of kilometres into geospace along the earth's curved magnetic field, moving from one hemisphere to the other. This is because VLF wave frequencies are lower than two important natural resonance frequencies at the geospace plasma, known as the plasma frequency and the electron gyrofrequency. An important class of VLF

very low frequency) wave is the whistler, which originates in the electromagnetic pulse radiated in a lightning discharge; whistlers received at Halley come from thunderstorms near the

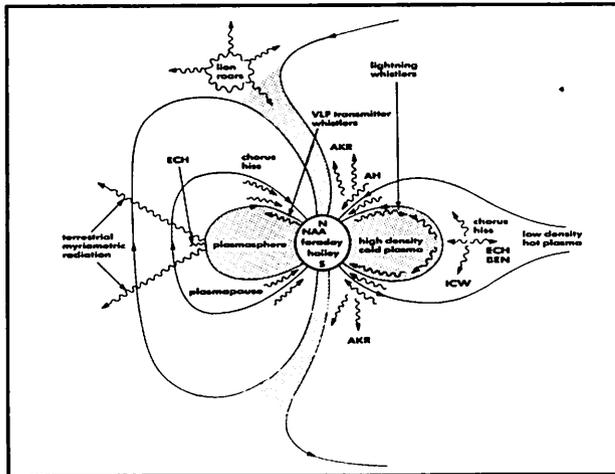


Figure One: Geospace showing the multitude of different types of radiowave which inhabit it

eastern seaboard of North America.

Figure two shows the spectrogram (frequency-time-intensity plot) of a whistler event received at Halley; the curved traces are the dispersed signals which

have traveled on multiple paths from the same northern hemisphere lightning discharge.

A careful analysis of events like this, using modern signal processing techniques now available at Halley and at BAS headquarters in Cambridge, can provide much information about the structure and dynamics of the plasma through which the signals have passed, such as its response to solar disturbances affecting the interaction between the solar wind and the earth's environment.

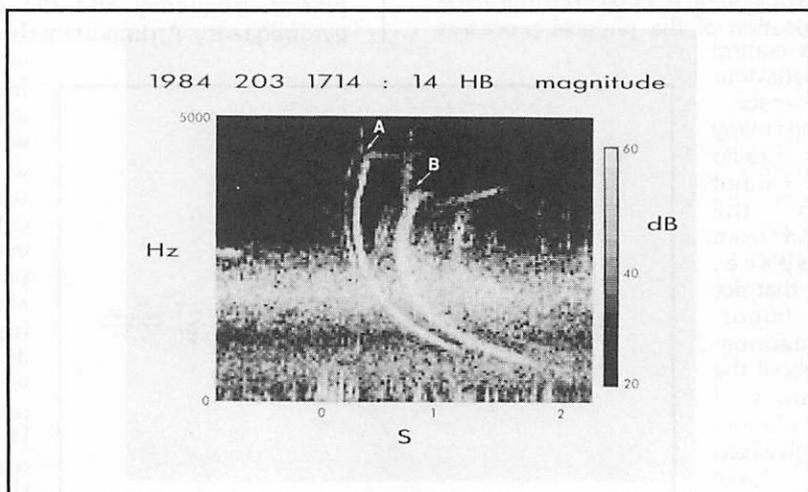
Figure two also shows an example of an emission triggered by the whistler high above the Earth. The triggering process is poorly understood, but its study can help progress in the theory of plasma physics.

Whistlers and triggered emissions often cause pulses of high energy electrons, normally trapped in the radiation belts, to be precipitated down into the atmosphere.

This research is not only important for understanding and predicting how geospace behaves, but also for assessing the effect of VLF radiation from man-made sources such as transmitters and electrical power lines on the natural plasma environment. It also has more practical applications, in for example, the fields of radio communications and navigation.

Figure two: A spectrogram of a whistler and triggered emission received at Halley.

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The Biscoe goes to a new owner

The RRS *John Biscoe*, which completed 32 years of service for the British Antarctic Survey last year, was formally handed to its new owners on 30 September 1992. She has been bought by the Fayza Shipping Company Ltd of Limassol, Cyprus who own and operate a fleet of small bulk general cargo vessels, variously registered in Syria, Honduras and St. Vincent and Grenadines. BAS staff understand that the *John Biscoe* will be registered under a new name in Honduras, but this name was not available at the time of publication.

BAS

Environmental management

Increasing attention is being focused on the environmental impact of human activities in Antarctica. In this article, reproduced from NERC News of October 1992, Dr John Shears, Environmental Officer with NERC's British Antarctic Survey, describes the British approach.

In 1991, the Antarctic Treaty nations agreed the Protocol on Environmental Protection. This sets out new, tough and mandatory regulations to ensure the comprehensive protection of the Antarctic environment. Implementing these new regulations is neither cheap nor simple, and has significant effects on how the British Antarctic Survey (BAS) organises its scientific programmes in Antarctica.

Environment issues were not on the agenda when the original Antarctic Treaty came into force in 1961. Since that time environmental issues have received ever increasing attention from scientists and policy makers. Antarctica has long been recognised as an indicator of global health. Environmental Law in Antarctica

The signing of the Convention on the Regulation of Antarctic Mineral Resources Activities (CRAMRA) in 1988 brought Antarctic environmental matters to public attention. The convention, had it been ratified, would have allowed mineral prospecting and exploitation, tough under strict regulation. Several nations, led by Australia and France, declined to ratify the convention, and proposed an environmental convention with a permanent ban on minerals exploitation. An alternative tabled by the UK, found broad support from other European and American countries. It recommended a Protocol on Environmental Protection to deal with general principles and minerals.

Separate Annexes would regulate specific environmental issues of concern. Scientific research was acknowledged as the most important human endeavour in Antarctica. This modified proposal was finally agreed on 4 October 1991 and signed by nearly all the Consultative Parties.

Environmental management within BAS

The high environmental standards operated by BAS were strengthened in advance of the new requirements by establishing a Committee on Environmental Management and Conservation in 1989. An Environmental Officer was appointed to co-ordinate Antarctic Environmental Policy in 1990 and is implementing as a top priority the provisions of the Protocol notably environmental impact assessment and waste management, at all BAS stations and on board all BAS vessels,

Environmental Impact Assessment (EIA)

BAS is at the forefront of the practical application of EIA in Antarctica. All new proposals must detail likely environmental impact resulting both from construction and from operational use.

The new airstrip at Rothera Point, Adelaide Island, built between 1990 and 1991, was the first major capital project (undertaken by BAS) in Antarctica to receive a comprehensive Environmental Impact Assessment. The airstrip, vital to the support and safety of deep field science, was sited on a barren gravel isthmus without seal or penguin colonies. Even so, BAS invited an independent observer from Wildlife Link to report on the environmental management of the project and to inspect the completed airstrip.

The proposed redevelopment of the research station on Signy Island in the South Orkneys Islands, is the latest major capital project to undergo an EIA. This was circulated to all Antarctic Treaty signatories and to environmental groups. An observer from Wildlife Link has already visited the station to assess its present impact.

Waste Disposal

It is now BAS policy that all waste from its research stations and ships, other than sewage or domestic wastes, should be removed from Antarctica. Incinerators are not being used at the stations because of the possibility of significant local envi-

ronmental impact and instead, waste compacting and baling equipment has been installed. Non-hazardous waste is taken to the Falkland Islands where it is disposed of safely by incineration or as landfill. Hazardous waste is returned to the UK for proper disposal. Recycling is now a feature of BAS waste disposal; cans, refrigerants and gas cylinders are being recycled and other schemes are being explored. Guidance and advice on waste disposal practice in the Antarctic are contained in the BAS Waste Management Handbook. BAS also prepares an annual Antarctic waste audit management plan that is circulated to all other Antarctic Treaty countries.

Recently, there has been increasing concern about the possible adverse environmental impacts of abandoned scientific bases. The clean-up of abandoned British bases is an integral part of BAS environmental policy. BAS has undertaken a survey of all British bases. Abandoned bases where environmental hazards are known to exist are being visited and accessible waste material removed.

The Future

Antarctica is an unparalleled natural

The major provisions of the Environmental Protocol are:

- > Antarctica is designated as a "natural reserve devoted to peace and science";
- > A ban on all mining for at least 50 years, except for scientific minerals' research
- > Prior environmental research of ALL human activities;
- > Increased international co-operation in the planning and conduct activities;
- > The establishment of the committee for Environmental Protection to advise the Consultative Parties on the implementation of the Protocol.

Five annexes have been agreed:

- Environmental Impact Assessment (EIA); Waste disposal;
- The prevention of marine pollution; The conservation of flora and fauna;
- Specially protected areas and management

laboratory for scientific research into important problems of global and regional relevance. However, unless it can be protected and preserved from pollution and significant future disturbance, scientists will find that

this unique laboratory becomes increasingly contaminated and unusable. Concern for the Antarctic environment at BAS has been translated into action to improve environmental policy and practice.

USAP

ERBE, SPASE, MICE and AMANDA contribute to Pole Program

Summer operations at the Amundsen-Scott South Pole Station commenced on 23 October 1992 and concluded on 12 February 1993 when it was left to the management of the winter base and science staff. Over 176 return flights were made to the pole station from McMurdo Sound over the summer period in support of resupply, building and science programs. Scientific programs continue to focus on upper atmosphere studies mainly concentrating on astrophysics, monitoring of long term-changes. Seismicity is also important. Studies of cosmic microwave background radiation (CMBR) were again conducted during the season some 6,000 feet from the station. Undertaken by two teams this program was led by Drs Mark Dragovan and Jeff Patterson. The structural foundation and enclosure for a new microwave telescope (ASTRO) was completed and is now ready for the installation next summer.

The station's main water supply was replaced and a water well utilising waste heat to produce potable water was installed in place of the surface snow melter. Upgrading of the infrastructure of South Pole Station to correct safety and health deficiencies continued; this will also ensure maximum life of the existing facilities. An augmented LC-130 flight delivered the construction materials for the new science facilities and the new emergency generators which are to be installed in the 1993-94 season. Long term plans are being made for the phased replacement of South Pole Station's infrastructure systems.

Magnetics programmes

Magnetometers installed at sites in both polar regions have provided measurements on the magnitude and direction of variations in the Earth's magnetic field. The variations are of particular interest to scientists and so magnetometers have been installed at conjugate sites in the northern and southern hemispheres, specifically at McMurdo and the South Pole Stations in Antarctica at Iqualuit in the North West Territories of Canada and in Sondre Stomfjord, Greenland.

From these systems, data can be gath-

ered on the coupling of the interplanetary medium into the magnetospheric cusp region and on the causes and propagation of low-frequency hydromagnetic waves in the magnetosphere. Because of the unique climatic conditions at the South Pole, additional optical measurements can be made and correlated with particle precipitation and hydro-magnetic-wave phenomena recorded by the magnetometers. This year the equipment at both stations in the Antarctic will be operated again by the contractor science technician who is responsible for maintaining and recording. Data which is collected using the University of Maryland's acquisition system, is sent annually to the principal investigators by ship at AT&T Bell Laboratories at the end of each summer season.

Magnetic pulsation sensors have been installed at McMurdo and South Pole Stations as well as Sondre Stromfjord in the Arctic. The measured pulsations, which range in frequency from a few millihertz to a few hertz, are used in conjunction with similar data acquired from a number of satellites and are vital to scientific understanding of the mechanism by which energy is transferred from the solar wind to the Earth's magnetosphere. This season Dr Roger L. Arnoldy from the Space Science Centre at the University of New Hampshire in Durham spent two weeks at the station checking and maintaining the equipment which is housed at Arrival Heights Upper Atmospheric Physics Facility and at the South Pole Skylab facility. The equipment operates throughout the year.

Manned and automatic stations

Among the projects focussing on the upper atmosphere is a study of atmospheric electricity and ionospheric electrodynamics. For the first a network of manned stations and automatic geophysical observations provide a measure of the power and voltage

level in the global circuit and a preliminary estimate of the geoelectric index. The ionospheric electrodynamics data will enable an interpretation of the differences in air-earth currents at various sites in terms of differences in the electrostatic potential of the ionosphere above the sites. If most of the automatic stations in the network are installed and operating, a continuous series of "snapshots" of the ionospheric electrostatic potential and convection patterns in the polar cap should be obtainable. Acquired data will also enable scientists to study the relationship of statistical patterns to instantaneous patterns, sub storm response and hemispheric differences. The programme is the responsibility of Dr Edgar A. Bering from the University of Houston's Physics Department.

Auroral studies

A two-channel all-sky camera which observes Aurora Australis was adjusted and serviced by a Dr Steven B. Mende from the Lockheed Research Laboratory in Balto Alto, California during the early part of the season. The 24 hour austral winter night allows a continuous monitoring of the daily movements and response of aurora to geomagnetic activity and to the changing conditions of the interplanetary medium. An intensified optical all-sky imager, operating on two wavelengths is also being used to record digital and video images of the phenomenon. The investigation allows scientists to learn about the sources and energised mechanisms of auroral particles and other forms of energy inputs into the high latitude atmosphere.

Using a newly developed imaging riometer (relative ionospheric opacity meter) and photometry as well as riometry techniques a group of scientists from the Institute of Physical Sciences and Technology at the University of Maryland are extending their study of the upper atmosphere, especially auroral phenomena. IRIS

will enable them for the first time to obtain contours, simultaneous conjugate measurements of the polar auroral phenomena, regardless of the sky brightness or weather conditions. One of their main objectives is to apply imaging riometry to the detection of F-region density structures to study aspects of the polar-cap convection. Other research will focus on studies of the conjugality of large and small-scale auroral structures and on establishing the statistical patterns of occurrence of pulsating aurora.

A 35 mm all-sky camera used to film the aurora has been operating at South Pole Station since 1965; recent advances in technology now make it possible to digitise photographic images and enable researchers to process automatically large amounts of information. This year researchers from the Center for Atmospheric and Space sciences at Utah State University are collaborating with Japanese researchers and the part of their data will be analysed with a all-sky camera processing system developed at Japan's National Institute of Polar Research. The results will be used to investigate dayside auroral structure, nightside sub storm effects and polar cap arcs as well as providing insight into the physics of the magnetosphere, the convection of plasma in the polar cap and the winds in the thermosphere.

Airglow and auroral processes are the subject of yet another upper atmospheric study. This project, being undertaken by scientists from the Department of Physical Sciences at Emory Riddle Aeronautical University in Florida focuses on the physical, dynamical, chemical and atomic molecular processes occurring in the upper atmosphere above Antarctica, particularly the mesopause, thermosphere and ionosphere. The long, dark winters at South Pole Station are used for more extensive observations of semi-diurnal, diurnal and longer period disturbances propagating through the mesopause. It is hoped that the data can be compared with that obtained from similar

stations in the Arctic in order to assess the contributions of these factors to the mesopause disturbances.

SPASE, MICE and AMANDA and the cosmic rays

Since early this century when cosmic rays were discovered, scientists have sought to determine their origin. Initially they believed them to be energetic electromagnetic radiation but more recently scientists have learned that cosmic rays are electrically charged particles, mainly hydrogen nuclei and protons. SPASE or the South Pole Air Shower Experiment comprises a large, phased array of scintillation detectors, which were installed in 1988 to search the southern sky for astrophysical sources of ultra-high energy gamma rays. The circumpolarity of the sky over the station makes this site one of the few from which continuous observations can be made for gamma rays from a large number of X-ray binaries and related compact objects - potential emitters of primary cosmic rays. The equipment is interfaced with MICE, the Muons in Ice and AMANDA, the Antarctic Muon and Neutrino Detection Apparatus muon data acquisition system, and will operate over the winter. Four researchers from the Bartol Research Institute in Newark spent between two and three months at the station preparing the experiment.

Interferometer

A field team of four led by Dr Gonzalo J. Hernandez from the Geophysics department at the University of Washington upgraded and recalibrated the Fabry-Perot Interferometer system during the summer. It is being used to study the dynamics and thermodynamics of the Antarctic mesosphere and thermosphere.

A field team of 12 from the Department of Physics at the University of Wisconsin and

Purdue University spent up to six weeks each at the station maintaining and adjusting the existing Gamma Ray telescope equipment. The objective of the project is to identify sources of cosmic radiation, which according to some theories, may have been created by a modest number of supernova. To do this, an atmospheric Cherenkov telescope has been installed near the South Pole. It comprises an array of parabolic mirrors with photomultiplier tubes at that foci which can detect light from very-high-energy interactions in a small amount of atmosphere. The geographic south pole is an ideal site for this program because it is possible to view a single object for extended periods through a constant thickness of atmosphere which is not possible at mid-latitude sites.

Ozone

In January, 1993 a ground-based, millimetre-wave spectrometer was installed at Amundsen-Scott South Pole Station, where it will remain until December. During its period of operation it will record abundances and cycles of atmospheric trace gas measurements that are important to scientific understanding of the annual antarctic "ozone hole". Specifically the equipment will measure chlorine monoxide, ozone, and nitrous oxide. Chlorine monoxide is a unique product resulting from the destruction of ozone by chlorine, and nitrous oxide is a valuable tracer of the dynamics of the atmosphere. Measurements of these gases will be useful for determining the degrees of stratospheric subsidence during the polar winter and are important to understanding how man-made chemicals, such as chlorofluorocarbons, can cause global change.

Climate modelling

Climate modelling suggests that the global warming might increase atmospheric

water vapour, and consequently, increase precipitation worldwide. Although increased temperatures are not likely to bring about significant melting of the antarctic ice sheet, increased precipitation could raise accumulation above the equilibrium line for nearly all of the antarctic ice sheet. Such increased accumulation on this massive ice sheet would lower global sea level, an effect that would counterbalance increases in sea level brought about by the melting of the alpine glaciers and sea ice. Because precipitation over the polar plateau will be one of several factors to consider when project future sea level changes a group of researchers from the Byrd Polar Research Center in Ohio have installed a permanent accumulation network comprising a 300 pole hexagonal array of stakes precisely surveyed along six arms, each 15 kilometre long. From this they will determine the long-term history of undisturbed net accumulation and assess the "station effect" on the spatial distribution and magnitude of net accumulation. Thirteen shallow ice cores were also collected for radioactivity measurements which will be used to determine if the net annual accumulation has increased since 1955 as current but limited evidence suggests. Over the next five years adjustments will be made to the array and testing, refining and standardising of procedures of recording data will be undertaken. Their goal is to develop and leave in place an optimally designed monitoring system than can be incorporated into routine science observations at the Station.

Also interested in snow surface is a team from the Atmospheric Sciences Department, University of Washington in Seattle. Dr Stephen G. Warren is the principal investigator and will winter over. Using the top two levels of the meteorological tower he will collect samples of snow and air, for analysis of the optical and physical properties make photometric measurements of sunlight reflected by sastrugi which is important for interpreting satellite data

Climate change

The Climate Monitoring and Diagnostics Laboratory's (CMDR) from Boulder, Colorado research effort will continue to study long-term changes in atmospheric composition in the Clean Air Facility at the South Pole. This year the field team of six, includes two who will winter over. They will measure carbon dioxide, surface ozone, winds, pressure, air and snow temperature, atmospheric moisture and trace constituents and their data will be used to make time-series analyses of multiyear records that focus on stratospheric ozone depletion, transantarctic aerosol transport and deposition, solar and terrestrial radiation fluxes on the polar plateau, the development of polar stratospheric clouds over the continent. Working with climate modellers and diagnosticians these data will be used to determine how the rate of change in aerosol concentrations affects climate. In support of this project, personnel at Palmer Station will also collect carbon dioxide samples.

Budgets

In Antarctica the components of the surface-heat budget show a high degree of temporal variability with significant amplitudes not related to local insolation. Even during the polar night, the surface temperatures can vary between -70 degrees and -40 degrees C over less than a day. During the 1992-93 summer five investigators from the National Oceanic and Atmospheric Administration in Boulder and the University of California at Davis studied the dynamics of the stable atmosphere boundary layer, focusing on the importance of intermittent and episodic forces mechanisms that determine the structure and energy transfer within the lowest layers of the antarctic troposphere. To obtain their data they use modern remote-sensing wind and temperature profil-

ing instruments to observe the local phenomena and their effect on boundary layer structure, turbulent transfer of heat and decreasing radiative cooling. Their data will be analysed using numerical simulation models to examine the mechanisms that produce the observed events.

ERBE

An integrated study of the optical and physical properties of the antarctic snow surface reveal several components that influence the processes by which global climatic variability is recorded in antarctic ice. To provide the information necessary for interpreting satellite data from the Earth Radiation Budget Experiment (ERBE), the effects of surface roughness or sastrugi orientation on the angular distribution of reflected sunlight and the special distribution of thermal infrared radiation are to be measured as are the dry deposition of atmospheric sulfates in the snow surface. Samples of hoarfrost will be examined to determine their isotopic composition. With the first set of measurements, the extent to which the aerosol concentrations in the firn and ice represent contemporaneous concentrations in the atmosphere will be evaluated and from these measurements comparative data of isotopic ratios to the ambient air temperatures will be obtained.

Lidar observations.

The lidar is designed to take vertical profiles of the upper stratosphere. From this data it is possible for scientists to infer the molecular and aerosol concentration of air, and under some conditions, measure such parameters as atmospheric temperature. This information which is being collected by two Italian investigators from the University of La Sapienza in Rome will be useful in climate change studies and is relevant to work on atmospheric radiation, structure

and composition and may help them understand the mechanisms involved in ozone depletion.

UV Monitoring

A UV monitoring project will be continued throughout the year at the Clean Air Facility at South Pole Station, Arrival Heights Upper Atmospheric Physics Facility at McMurdo Station and at Palmer Station. A field team of two visited McMurdo and the South Pole before Christmas. They come from Biospherical Instruments Incorporated and carried out annual maintenance and upgrades as well as calibrations. Prior to their arrival the UV monitor was moved to the T-5 building from the Clean Air Facility

Astrology

Infrared and Submillimeter astrology has the potential to answer some major questions about the formation of the universe, including inhomogeneities in cosmic microwave background radiation, the processes by which stars form from interstellar gas, the formation of planets; the nature of primeval galaxies; and the inhomogeneous distribution of matter and energy in the early universe. Making use of Antarctica's unique physical characteristics and geographic location, the Yerkes Laboratory at the University of Chicago, Princeton University., AT & T Bell Laboratories, and departments from the University of Colorado have established a Science and Technology Centre for Astrophysical Research in Antarctica (CARA). Their goal is to provide an observatory at the South Pole with three major instruments designed to probe the far reaches of the universe. Three experiments will be set up: ASTRO (Antarctic Submillimeter Telescope and Remote Observatory) will use a 1.7 metre diameter Submillimeter telescope, which will survey the galactic plane, the galactic centre and

the Magellanic clouds.

SPIREX (South Pole Infrared Explorer) will use an existing 60 centimetre diameter, near infrared telescope to explore the potential of the South Pole as an infrared site and to make initial surveys for primeval galaxies and brown dwarf stars. This spectral window is also located within a "hole" in the celestial background and may afford the most sensitive view of light from galaxies formed in the early universe. At this wavelength, a South Pole telescope will be more sensitive than the Hubble telescope and 200 times more sensitive than a ground-based telescope at a mid-latitude site.

COBRA (Cosmic Background Radiation Anisotropy) is an instrument that will search for and map anisotropies in the cosmic background radiation at sufficient sensitivity to test definitively current theories of the origin of the universe. Overall, the South Pole centre will enable researchers to make measurements at wavelengths that might otherwise be hampered by the absorption and emission of the earth's atmosphere. Because of the virtual absence of water vapour in the atmosphere above the central polar plateau, the infrared skies are clearer and darker than anywhere on earth. These unique environmental conditions overcome not only the diurnal variations in temperature that lead to atmospheric noise and wind at higher latitudes but also much of the infrared background radiation. The elevation of the antarctic plateau significantly reduces the atmosphere path that the light must traverse and the geographic singularity of the polar site allows a unique opportunity to reduce systematic errors in searches for cosmic microwave background anisotropy's. All of these factors combine to improve the observatory conditions by a factor of 10:100. *It is indeed a unique environment.*

Conflict studies

Studies of the effect of conflict on group structure continued this year with the usual

focus on the outgoing winter-team. A field team of three researchers from the Institute for Coastal and Marine Resources, East Carolina University, were spending time at the station consecutively over the whole season during which they conducted interviews and observed interaction. The station provides an environmentally extreme and geographically isolated site for the study of social structure as well as the individual's understanding of that structure. The incidence and management of conflict can be readily studied and the qualitative and quan-

titative data collected, used to understand groups, status and role consensus, perceived conflict and morale of the groups living at the station. Scientists say that the study helps in the understanding of the role of group structure and cognition in the functioning of groups in isolation and will complement work on health and adaptation in polar environments. It will also enable development of improved procedures for assembling groups of people who will live in Antarctica or other isolated environments.

Sub-Antarctic

Busy summer in New Zealand subantarctic

Staff at New Zealand's Campbell Island have had a busy summer with a record eight visits from tourist ships working in the subantarctic and Antarctic waters. Enderby Island in the Auckland group has also been subject to more intensive activity than usual with further work on the Hooker Sealion, the final stage of the rabbit eradication programme due for completion in May and recovery in February of two female Short-horn cattle by members of the New Zealand Rare Breeds Society. These are the last of the Enderby cattle and they are being shipped to New Zealand for breeding purposes.

Before Christmas the *Pacific Ruby*, chartered from an evangelical organisation operating in the South Pacific by Southern Heritage Tours based in North Canterbury, New Zealand, for the summer did two circuits of the southern and subantarctic islands bringing supplies and mail to the team in residence at Campbell Island. During January the *Frontier Spirit* called in twice, firstly on its way from Hobart to Bluff

via the subantarctic Islands and further south and then on a reverse visit from Bluff, via the subantarctic and waters further south to Hobart. The *Pacific Ruby* made three more trips to the subantarctic Islands and the *Frontier Spirit* and *Kapitan Khebnikov*, a Russian icebreaker chartered by Quark will complete further trips south before the end of February. The *Frontier Spirit* and *Kapitan Khebnikov* visits were usually of half a day's duration and their passengers were confined to the board walk areas of both Campbell and the Auckland Islands. The visit itineraries for the smaller vessels, usually carrying about 20 passengers, were extended a little beyond this. Each vessel carried a New Zealand government representative and lecturers.

During January the first live census of White Capped Mollymawks on Disappointment Island was undertaken by Cath Walker from the Department of Conservation in Nelson, Peter McLelland from DOC in Invercargill, Graeme Elliott, Landcare Nel-

son, and Chris Robertson from DOC in Wellington. They were off loaded onto Disappointment island by the *Pacific Ruby* and subsequently shifted to Adams Island where similar work was undertaken on the Wandering Albatross. At this stage too, Chris Adams boarded the *Frontier Spirit* as a lecturer and was replaced for the second part of the survey by Alison Davis also from DOC. The party are still working and will return to New Zealand on the *Captain Khebnikov* in late February.

The rabbit eradication group comprising Department of Conservation staff Nick Tor from Te Anau, Wayne Costelloe from the Invercargill, Murray Blake from Whitianga and Gary Aburn from Whataroa were transferred to the Island by the *Frontier Spirit* to prepare for the arrival of the Marine Countess which was to bring bait and supplies. A Squirrel Helicopter, piloted by Richard Hayes of Te Anau, rendezvoused with the *Marine Countess*, a 30 metre vessel, based in Bluff, and normally used to service oyster and crayfishing enterprises but chartered by DOC for this operation. This party will return to New Zealand on *MV Tangaroa* in May.

Recovering the cattle was the responsibility of Mike Willis, a representative of the Rare Breeds Society but who is based at the Willowbank Wild Life Park in Christchurch and Peter Trollove, a vet from Ashburton. The two Shorthorns, a cow and her heifer were located by the Squirrel, darted, netted and transferred to the Marine Countess which after a few days for the cattle to be monitored for their adjustment, was scheduled to sail for Bluff where they would be off loaded and travel by road to Wellington for 30 days in quarantine. They will probably be taken to Massey University where a high tech team of vets and geneticists will artificially inseminate them with semen obtained at death from bulls during the 1990-91 shooting operation. It will require special and complex techniques to induce full matu-

ration of the semen. The operation is of particular interest as these cows are descendants of the breed left on Enderby Island in 1895 which predates their division into beef and dairy cattle early this century.

New audiovisual

In the meantime in Invercargill a unique tourist attraction which brings the remote subantarctic Islands into a theatre setting at the Southland Museum and Art Gallery was scheduled to open on 10 February, 1993. It is a 25 minute audio-visual programme which represents the culmination of two years work by museum and Department of Conservation Staff who selected slides from thousands of images of New Zealand's five Subantarctic island groups. The principal photographers were Andris Apse and Kim Westerskov who have both won international awards for their work.,

New Zealand's subantarctic Islands are internationally important nature reserves. These outcrops of land hundreds of kilometres south and east of Stewart Island lie in the windy latitudinal region known as the Roaring Forties and Furious Fifties. The Islands provide refuge for seabirds, seals, whales, unusual plants and land birds and have been the scene of tragic tales of shipwreck and human hardship. Relatively few people visit the islands because of their location but under the management plans implemented by the Department of Conservation 600 people a year may visit but they are subject to strict controls such as permits, supervision and other restrictions.

The audio-visual was funded jointly by the museum, Department of Conservation and Ministry of Tourism. It is presented in a custom built 50 seat theatre and utilises nine projectors, multiple speakers and special effects for realism. This is the first stage of a permanent, major focus on the Subantarctic being developed by the museum. A garden

of subantarctic plants is being established outside and construction of a gallery to house artefacts and interpretive media has begun this year..

DOC Operations Manager Lou Sanson

said the facilities would confirm Bluff and Invercargill as the international tourist gateway to the subantarctic. The region has strong historical links to the Islands.

17th ATCM

Secretariat and Liability protocol key topics of discussion

The XVIIth Antarctic Treaty meeting was held in Venice between 11 and 20 November 1992. Among the key decisions were agreement to establish a secretariat but its location is still to be decided; that work on the liability protocol would continue and tourism would probably be covered by the Protocol on Environmental Protection which governs all human activity and not be the subject of a separate document.

As usual the meeting was divided into working groups. Among the major topics discussed by the first group were the Protocol on Environmental Protection to the Antarctic Treaty, the operation of the Antarctic Treaty system, tourism and non-governmental activities in the Antarctic Treaty area. The meeting was informed that 36 contracting parties, including 26 Consultative parties had signed the Protocol on Environmental Protection to the Antarctic Treaty since it had opened for signature on 4 October 1991 in Madrid. Before it can enter into force however, all the Consultative parties will need to ratify it. The process of ratification requires independent national legislation and only consultative party had so far achieved this; while others were making progress it would be 1994 before all had reached this stage. (Concern was expressed over the uniformity of interpretation of the provisions of the protocol and its annexes which require national legislation or other measures by parties for their implementation.) The matter was to be placed on the

agenda for the next meeting.

Articles 11 and 12 of the Protocol on Environmental Protection require that a Committee for Environmental Protection be established. While the rules and procedures are still being discussed it was agreed that the committee should meet at the same location and immediately before the annual ATCM but that provision should be made for more frequent meetings as well and that it be established and be operational at the time the Protocol comes into force. The question of establishing rules and procedures for the liability protocol was discussed and participants acknowledging the importance of developing a liability regime as being significant for the comprehensive protection of the Antarctic environment and dependent and associated ecosystems and agreed to convene a meeting of legal experts to achieve this.

The question of a secretariat was discussed at length by the group and it was agreed that such a body should be established to assist the Antarctic Treaty Consultative Meeting and Committee in performing their functions.

Tourism, which had been the subject of an informal meeting prior to the ATCM, was discussed at length by the group. All agreed that the Protocol and its Annexes apply to all activities in Antarctica including tourist and non-government activities. Some parties however felt that tourism should be subject

to additional controls; others thought the environment would best be protected by early entry into force of the Protocol. Others expressed the view that the Treaty and Protocol would provide a guiding statement for organisers of tourist and non-government activities. Agreement appears not to have been reached.

A second working group tackled a wide range of topics including, inspection under the Antarctic Treaty, environmental monitoring, implementation of the environmen-

tal impact assessment procedures, the Antarctic Protected area system, International Antarctic scientific and logistic cooperation, Antarctic meteorology and telecommunications, marine hydrometeorological services to navigation in the Southern Ocean, cooperation in hydrographic surveying and charting of Antarctic waters and air safety in Antarctica.

The next meeting is scheduled to be held in Japan in May 1994.

Tourism

At least 44 voyages carrying tourists planned for 1992/93 summer season

In addition to scientists traveling south during the summer of 1992/93 at least eleven other organisations were involved in non-governmental expeditions to Antarctica. These comprised ship-borne and air-borne operations. If all the voyages planned by travel companies based in America and Canada alone were fully booked, 8,503 people could have visited Antarctica during this 1992/93 summer. A number of other vessels visiting the area are not listed here but among those which planned trips this summer are:*

>Clipper Adventure Cruises which used *M/V World Discoverer*. She carries a maximum of 138 passengers and 75 crew per voyage and her eight cruises planned for the season included trips sponsored by Zegrahm Expeditions and Society Expeditions. Each of the voyages took her to the Treaty area and included visits to Elephant Island, King George Island, Deception Island, Torgerson and Anvers Islands, Port Lockroy, Neumeyer

Channel and Paradise Bay. Her season began in late November and concluded in early March and if she carried a full complement on each voyage would have taken 1704 visitors to the Antarctica Treaty area.

>Travel Dynamics used *M/V Iliria* which carries a maximum of 130 passengers and a crew of 90. Its expeditions included voyages sponsored by the Zoological Society of Pittsburgh, Pennsylvania and Mountain Travel-Sobek. Each of her six cruises, undertaken during January and February, departed and concluded in Ushuaia in Argentina with visits to Gerlache Strait, Neumayer Channel, Deception Island, Charlotte Bay, Cuverville, Half Moon Island, Peterman Island and other locations chosen en route. If fully booked the 1992/93 season her visitor complement to the Antarctic would have been 1320.

>Using *M/S Frontier Spirit* Sea Quest Cruises planned three expeditions south. She carries a maximum of 160 passengers

per voyage and a crew of 85 and covered a route encompassing Balleny Islands, Terra Nova Bay, Ross Ice Shelf, McMurdo Sound, Ross Island (Capes Evans and Royds), Franklin Island, Capes Hallett and Adare, Palmer Station, Deception Island and other sites on the Antarctic Peninsula and the Palmer Archipelago. She was in the Antarctic area between late December and mid-February. This vessel may have carried 735 visitors to Antarctica.

>M/V *Ocean Princess*, operated by Ocean Cruise lines carries 440 passengers, plus a crew of 165, and made three voyages during late December, January and early February to Elephant Island, King George Island (Admiralty Bay and Fildes Bay, Hope Bay, Deception Island, Paradise Harbour and Port Lockroy. Total potential visitors: 1815.

>Abercombie & Kent, using M/S *Explorer*, carrying a maximum of 96 passenger and 73 crew, was scheduled to make nine cruises and operate from mid-November to early March. Her planned itineraries included visits to the South Orkney Islands, Elephant, Livingston, King George, Deception, Anvers and Petermann Islands, the Lemaire Channel, Paulet Island and Paradise Bay. Visitors: possibly 1,521.

>Quark Expeditions chartered three vessels, the *Kapitan Khlebnikov*, 100 passengers and 60 crew, the *Professor Molchanov*, 38 passengers and 34 crew, the *Akademik Sergey Vavilov*, 45 passengers and 34 crew. The *Khlebnikov* was scheduled to make four voyages visiting a large number of sites in the Australian, French and New Zealand antarctic territories. The planned itineraries for the *Professor Molchanov* and the *Akademik Sergey Vavilov* includes visits to King George Island, Deception, Anvers and Petermann Islands, the Lemaire Channel, Paulet Island, Port Lockroy, Hope Bay, Melchior Islands and Paradise Bay. These vessels were variously operating in Antarctic area from early December to mid February and in total may have carried up to 1,372

visitors.

>A smaller vessel the *Abel J*, carrying eight passengers and a crew of five, planned a scientific expedition to the South Atlantic and South Georgia beginning in October 1992. She is operated by Spice Island Traders, may have visited Elephant Island and would have carried a further 15 people to the area.

In addition Greenpeace operated a vessel principally in the King George Island and South Georgia area and other vessels such as *Tracova*, *Columbus Caravelle* and *S/V Tradewind* are known to have carried tourists south.

Adventure Network International remained the key operator of aircraft in Antarctica during the summer. In addition to its normal tourist operations, for which passenger figures are not yet available, it supported the American Womens' Trans-Antarctic Expedition and the Pentland South Pole Expedition. (Details of these will be included in our next issue.)

ECO Expeditions also operated a DC-6 and a Twin Otter aircraft making two trips south each carrying a maximum of 12 passengers. Zegrahm Expeditions were among the sponsors.

**It should be noted that these were planned voyages organised mainly by American and Canadian companies and not all would necessarily have been fully booked.*

Confused?

During the week ending 23 January 1993 the New Zealand Press carried a number of items related to Captain Scott's ill-fated journey to the Pole. They couldn't however decide on the date he reached his objective.

For your information we quote the following without comment:

.....Exactly which date is the annisery depends on who you ask. *Enclyopeadia Brittanica*, gives both January 17 and 18 without noticing the conflict.

The journals kept by the explorers however show where the confusion arises: on January 17, 1912, Scott's journal entry is headed "The Pole", but another in the party,

Edward Wilson, writes of making

camp "on the pole itself at 6.30 p.m. Reading on, both journals make it clear that on January 18 they moved on, as Wilson said, "to a spot which we judged from last night's sights to be the Pole". After more observatioons they then trudded a further half mile to the "actual final spot, and here we left the Union Jack flying". At risk of starting an argument, says the Christchurch Press, January 18 it is.

Last of the oil removed from the Bahia Paraiso

All the oil remaining on board the sunken Argentinean supply ship *Bahia Paraiso* has been removed in a joint Argentinean and Netherland's operation undertaken in December 1992 to January 1993 and costing an estimated US \$4 million. Under the memorandum of understanding signed by the governments the Argentineans provided the vessel and the Netherlands, the personnel, much of the equipment and expertise. The Netherlands will also meet half the expense.

Tenders for the operation, called in Holland, closed on 29 July, 1992 and after evaluation of the offers by the Ministries of Transport, Public Works and Watermanagement and with the approval of the Netherlands Minister of Development Co-operation, the contract was awarded to the Noordhoek Diving Company from Zierikzee.

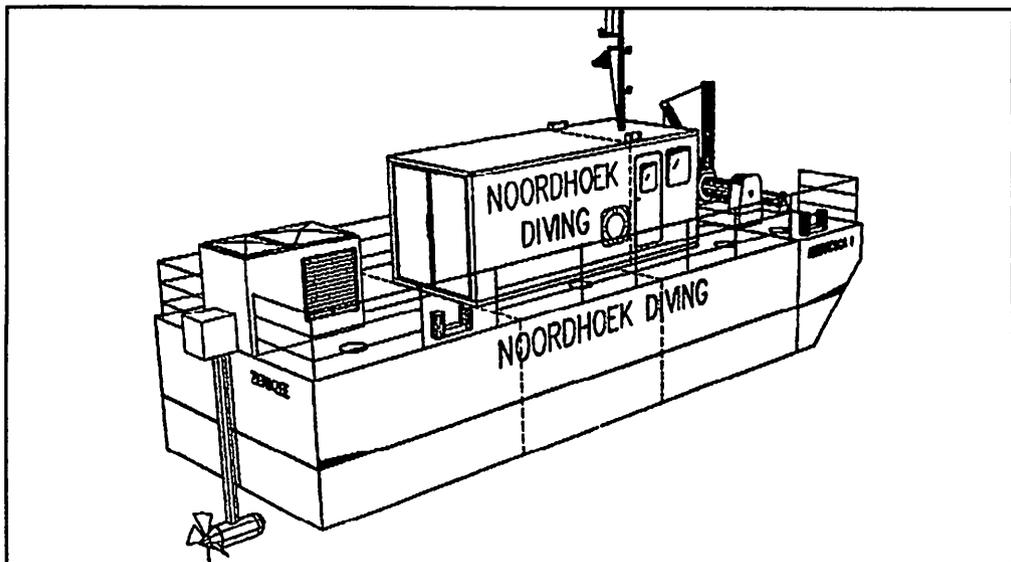
The *Canal Beagle*, an Argentinean Naval transporter with a large capacity for transporting oil, acted as the main vessel for the operation. She arrived in Buenos Aires on November 8 and all equipment was taken on board. This included a 600 metre oil

boom and E.D.P.V. launches provided by the Argentineans and working launches, containers, generators, hot tap equipment, hydraulic driven pumps, oil/water separators, skimmers and sorbents provided by the Netherlands.

On November 27 the vessel arrived at Ushuaia and the Argentinean crew of 46 were joined by two inspectors from the Netherlands Ministry of Transport, eight divers, four sailors, two technicians and two representatives from the contractor. The Dutch personnel on board were under the command of W. Daane from the Diving Company while the vessel and crew was commanded by Kaptain I. Aranglo.

On December 3 the vessel arrived at Arthur Harbour remaining there until January 4 when she returned to Ushuaia arriving on January 8.

At the site two container pontoons (see figure) were used. They are each 14.4 metres long, nearly five metres wide and 2.4 metres high with a deckload capacity of 2.5 tonnes. The 40 foot containers on board each have three compartments of which the middle one is a tank, the others housing the



steering, pump and diving equipment.. They are powered by a rudder propeller propulsion unit producing 132 kw.

All of the oil remaining on board the *Bahia Paraiso* was recovered. It comprised 100 tons of gasoil and 50 tons of lubricant oil. Due to damage and subsequent cracks in the hull of the wreck a great deal of oil has escaped in the four years since the vessel

A drawing of the workboats used in the oil recovery operation.

sank. However the anticipated volumes of the more harmful lubricants could be encountered and removed. The vessel will now be left in peace and the Americans will continue to monitor the site.

New Director for SPRI

Dr Peter Wadhams, has resigned from the directorship of the Scott Polar Research Institute in Cambridge, U.K. to become Reader in Polar Studies at Cambridge University. He has been replaced by Dr John Heap, who took up his appointment on 1 December 1992 and is the Institute's seventh full-time director.

Dr Wadhams has had a long association with SPRI; a former post-graduate student,

he was appointed assistant director of Research in 1981 and has subsequently led the work of the Sea Ice Group, involving field research in both the Arctic and Antarctic.

He was born in 1948 in Grays, Essex, educated at Palmers School for Boys and awarded an Open Entrance Exhibition to Churchill College, Cambridge to read physics and mathematics in the Natural Sciences Tripos. Graduating in 1969, he entered

physical oceanography, specialising in wave research, first at La Spezia in Italy and then at the Bedford Institute of Oceanography in Nova Scotia. From Bedford he was appointed assistant to the senior scientist on the Hudson-70 expedition, an interdisciplinary oceanographic cruise involving visits to the South Shetland Islands, a transit of the North West Passage, a geophysical survey of Baffin Bay and the first circumnavigation of the Americas.

In 1970 he joined SPRI as a PhD student studying the attenuation of ocean surface waves by sea ice in the marginal ice zone, his research taking him to Fram Strait in the submarine *HMS Oracle*, and later on a flight to survey the Labrador Current from a DC4 patrol aircraft from the Canadian Atmospheric Environment Service as well as a crossing by air of the Arctic Basin from Ellesmere Island to Norway via the North Pole. With his doctorate completed in 1974 he spent a year studying ice on a Canadian NERC postdoctoral fellowship held at the Institute of Ocean Sciences, Victoria, BC.

Between 1976 and 1980 Dr Wadhams returned to SPRI on a Fellowship from the Institute of Oceanography, University of British Columbia, the programme involving simultaneous submarine and aircraft transect of the Arctic Ocean to investigate surface and underwater sea ice topography. Further research in the Arctic followed and in 1979 he worked with the Swedes on the Ymer-80 cruise. In 1980-81 he was visiting Chair of Arctic Marine Science at the Department of Oceanography at the Naval Postgraduate School, Monterey in California and later led a group studying iceberg flexure aboard *HMS Endurance* before becoming involved in the International Marginal Ice Zone Experiment.

In 1981 Dr Wadhams became assistant director of research at SPRI and in 1983 he became its director. His replacement Dr John Heap was born in Manchester in 1932, educated at Leighton Park School in Read-

ing and the University of Edinburgh from where he gained his MA in Geography. In 1953 he led an undergraduate-initiated expedition to the Lyngen Peninsula in Norway prior to spending seven years conducting sea ice research for the Falkland Islands Dependencies Survey, now the British Antarctic Survey. His thesis, entitled "Sea ice distribution in Antarctica, between longitude 7 deg and 92 deg W from 1892-1962 earned him his doctorate in 1962. Two years at the University of Michigan followed and he was later appointed Deputy Head of the Polar Regions Section of the Foreign Office, now the Foreign and Commonwealth Office, becoming head of its polar regions section in 1975 until his recent appointment.

Dr Heap has participated in or led all UK delegations to the Antarctic Treaty and was responsible for the FCO policy relating to the ATS, and specifically for the Convention on the Conservation of Antarctic Marine Living Resources, the Convention for the Regulation of Antarctic Mineral Resource activities, the Convention for the Conservation of Antarctic Seals and the Protocol on Environmental Protection to the Antarctic Treaty. He succeeds Dr Peter Friend, who has acted as Director of the Institute since Dr Wadhams' departure. *Adapted from the Polar Record*

Iceberg sent back

The 11 January, 1993 issue of Time Magazine carried the following story

"What is dumber than hauling 72 tons of Antarctic ice halfway around the world to be showcased at last year's Expo '92 in Seville? Hauling it back again. That's just what the Chileans are doing, thanks to the protests of environmentalists. The greens said it was desecration to take ice from the pristine southern continent. The Chilean government, perhaps not realising that the theft

ing that the theft left approximately 90 quadrillion tons of the stuff still in tact, agreed. The ice has already completed the Seville-Valparaiso leg, and will now be heading south in an insulated container. Antarctica will once be whole - and the atmosphere will have to absorb an extra load of pollution, the by-product of the fuel burned in shipping the berg back home.

Highest endorsement

The Aurora Programme, led by Dr Monica Kristensen, has been awarded the Explorers' Club highest level of endorsement. Divided into two segments the programme involves the Filchner Ice Project, an international science programme to investigate the mass balance of the Filchner Ice Shelf and its interaction with the changing global climate and the location and retrieval of the tent left at the South Pole by Roald Amundsen in 1911. *See Antarctic Vol. 12 No. 8*

Continued from page 376

to Cape Royds to test a new gyro stabiliser, obtained through a grant from the Transantarctic Association supplemented by Landcare Research. The gyro should result in sharper pictures particularly in turbulent conditions or when they are using a larger lens.

A second ground count was made at Cape Royds and included the number of surviving chicks. Each breeding pair was credited with having produced 1.3 chicks. One hundred chicks were weighed and measured and the data will be used to generate a chick condition index enabling them to assess the quality of the breeding season. Further photography was undertaken at Cape Crozier East and, with the assistance of Grant Avery the technician from Scott Base, a partial ground count was carried out and over 100 chicks weighed and measured.

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