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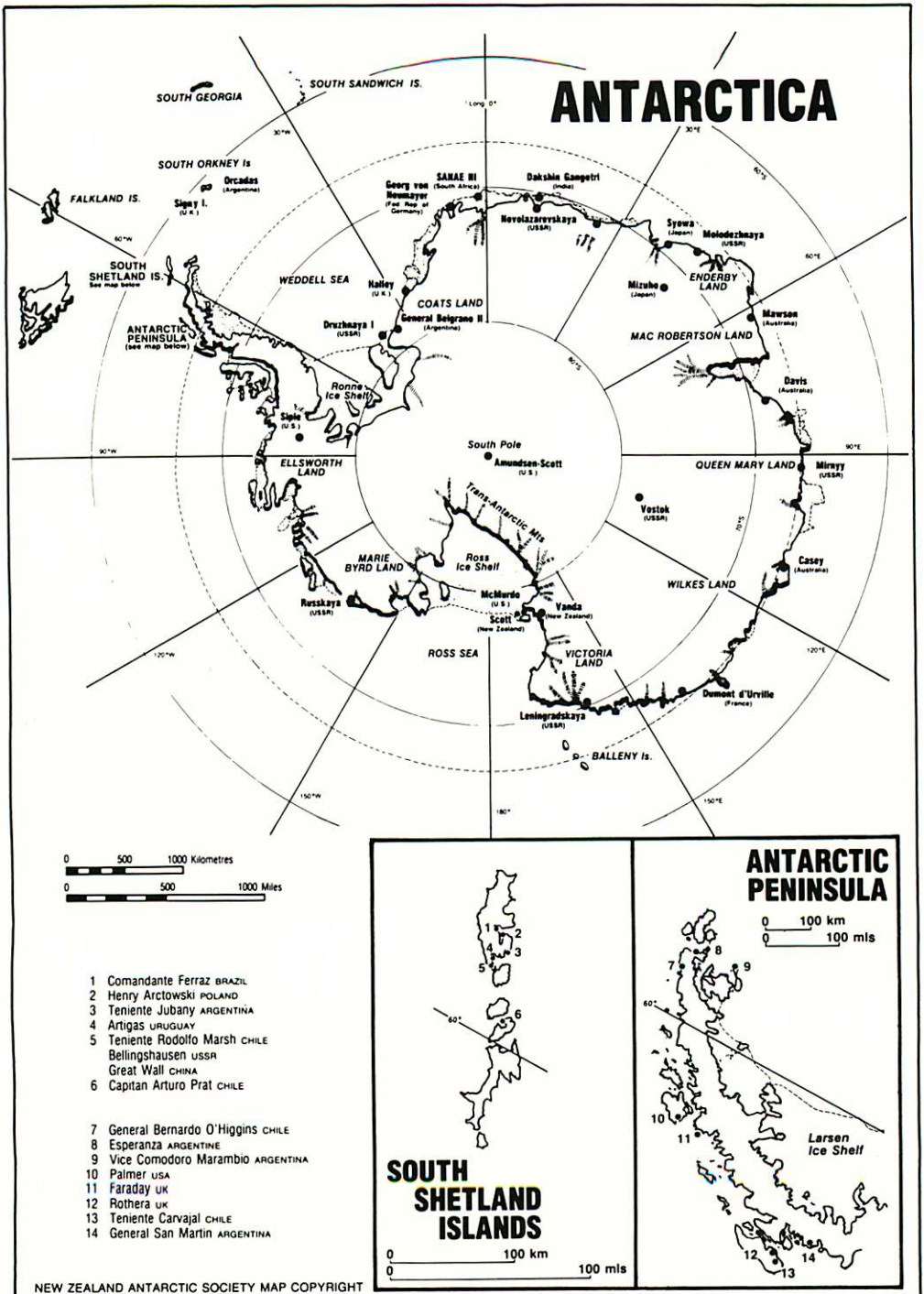

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***Cover**: "Fish Hotel", north east of Fault Bluff. See page 252. Photo: Margaret Bradshaw*

NZARP

Successful Expedition For Canterbury Museum Deep Field Party

"Antarctic" thanks Margaret Bradshaw for this article.

A four-person joint New Zealand-ANARE party completed an ambitious nine week sledging programme this season, travelling over 700 kilometers, passing for part of the time through unexplored territory in the Cook Mountains.

It was Canterbury Museum's fourth geological deep field expedition to the frozen continent, and was led by its Curator of Earth Sciences, Mrs Margaret Bradshaw who was making her sixth visit to Antarctica. Accompanying her was Fraka Harmsen, a New Zealand trained geologist now teaching at California State University in Fresno, who was on her second visit to Antarctica. The third scientist was Dr John Long of the Western Australian Museum, Perth, who was supported by ANARE. Mr Brian Staite of Tokaanu, employed by DSIR Antarctic, was field leader.

Dr Harmsen had been on Canterbury Museum's two month expedition to the Darwin Glacier and Britannia Range area in 1988-89, when she joined Mrs Bradshaw, Dr Martin Kirkbride and Ray Waters in a study of Devonian sediments in the Lower Taylor Group (Beacon Supergroup), mainly sandstones which contained animal burrows and trackways. Dr Long was also briefly in Antarctica that same season. He had hoped to join Margaret Bradshaw and Ray Waters at Scott Base after their return from the Darwin Glacier project, before being flown into the Upper Skelton, Lashly Mountains and Mt Fleming area by helicopter to collect Devonian fish from a sandstone and mudstone sequence known as the Aztec Siltstone. However, the Museum party experienced difficulties being pulled out from the field in mid-December, and were delayed for three weeks.

In 1988-89, the Canterbury Museum party was put in by C130 on the Darwin Glacier near Colosseum Ridge in the Darwin Mountains with a Victoria University party, but the Hercules broke through a crevasse bridge at the beginning of its drag-run. Unable to lift off again at the end of its drag, the plane offloaded the two field parties before safely taking off on the return run before the broken bridge was reached.

In mid-December a C130 drag-run was made further out on the glacier in preparation for picking up the Victoria University party but broke through yet a another crevasse and was aborted. Both parties became unexpectedly marooned over Christmas, and in the end had to drag pallets and sledges 27 kilometers down the glacier in early January to a previously used (and known safe) site near Roadend Nunatak. Several days after Mrs Bradshaw had finally met up with Dr Long at Scott Base, a US helicopter was damaged and reduced flying

hours forced the cancellation of Dr Long's part of the expedition. Mrs Bradshaw decided to resubmit that part of the programme in a more expanded form as her party had unexpectedly found Aztec Siltstone on Gorgon's Head in the southern Cook Mountains, 100 kilometers further south than previously known.

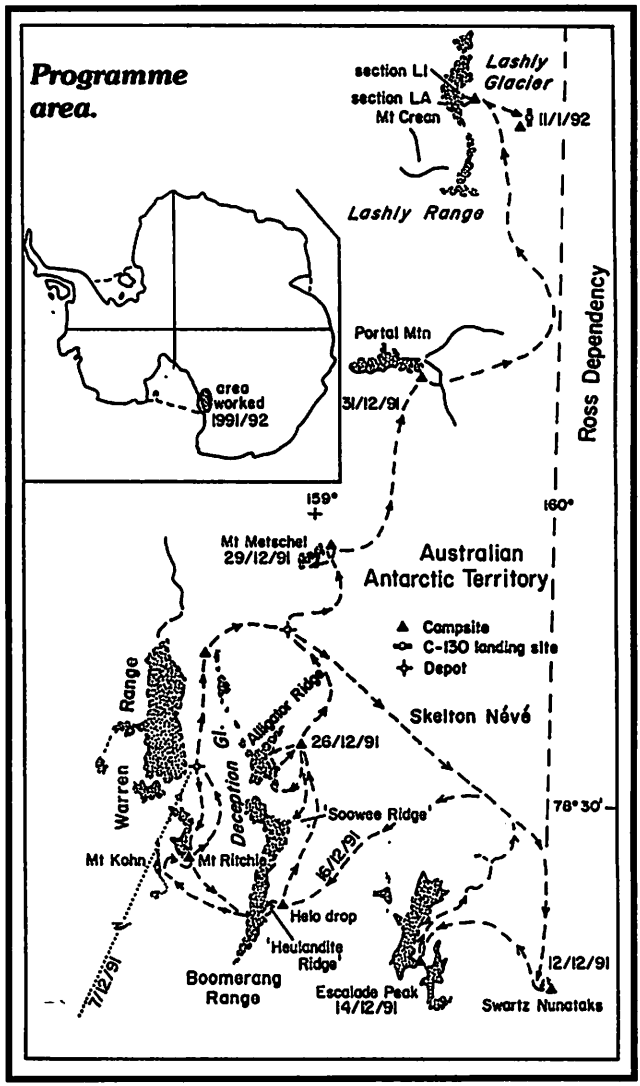
The 1991-92 Museum party planned to be put-in near Roadend Nunatak, then after revisiting Gorgon's Head, to travel through the Cook Mountains northward to the Mulock Glacier, investigating new outcrops along the way.

Two routes through the mountains were considered possible. An eastern route passing north of Mulgrew Nunatak and east of Mill Mountain, over a divide near Kanak Peak and down onto the glaciers draining towards the Mulock Glacier. The route seemed feasible from oblique aerial photographs taken by Wing-Commander John Claydon from a single engine plane on reconnaissance in 1958 during the Trans-Antarctic Expedition.

A more westerly route followed the middle of the Darwin Glacier as far as its confluence with the McCleary Glacier, which it then ascended north onto Festive Plateau, down past Fault Bluff and into the area west of Kanak Peak. Neither route had been traversed before. The only people to previously enter the Cook Mountains were Harry Ayres and Roy Carlyon, who during the preparation period for the Trans-Antarctic crossing,* sledged with a team of dogs from the head of the Darwin Glacier to Mount Ayres along the edge of the Polar Plateau. After climbing Mount Ayres the two men travelled east across a high plateau which they called Festive Plateau because it was Christmas, then climbed Mill Mountain and Mount Longhurst, the highest peaks in the Cook Mountains, before returning westwards to the Polar Plateau.

During the 1991-92 pre-put-in reconnaissance flight over the Cook Mountains this year, the more easterly route was found to have dangerous crevasses halfway along, but that the McCleary Glacier route seemed feasible.

The party was flown into the Darwin Glacier on 15 November in perfect weather, accom-



panied by Scott Base Information Officer, Yvonne Martin, Storeman Keith Henley and Photographer Mike Perry. The next day they moved, in rising winds, 24 kilometers into the Cook Mountains, establishing a camp with some difficulty south east of Mount Hughes. Winds of over 70 knots confined the party to their tents for two days, before they could revisit the important Aztec Siltstone site at the top of Gorgon's Head, and they spent several days investigating other outcrops in the area.

On 23 November they began their journey through the Cook Mountains, first returning to near the put-in site, then following the 1988-89 party's route up the centre of the Darwin Glacier, turning north towards the McCleary Glacier before reaching the dramatic Circle Ice fall. By the time camp was erected near Peak 1970 at the mouth of the McCleary Glacier, the party had sledged 60 kilometers across varied terrain that had included many kilometers of blue ice, soft snow and some difficult metre and a high sastrugi. It was one of their best day's travel.

The next day the weather continued fine and steady progress was made up the stairlike fall of the McCleary Glacier, avoiding crevasse fields and relaying sledges wherever the slope became too steep. A line of crevasses at the head of the valley was negotiated without mishap, and the party sledged across the heavily sastrugied Festive Plateau, crossing the earlier route of Harry Ayres and Roy Carlyon, until finally rewarded with a spectacular view northwards across the Mulock Glacier of the Boomerang and Warren Ranges. The party then turned east and dropped down onto the glacier between Mount Longhurst and Fault Bluff, with sastrugi fields causing some sledge overturns and backtracking. Fault Bluff was reached after 40 kilometers of travel that took almost 12 hours.

Here they were pleased to find good outcrops of Aztec Siltstone containing excellent fish and plant fossils. The party spent two days at Fault Bluff, then had a short day's travel east and north to a well exposed Aztec Siltstone ridge. This locality was so rich in fish fossils that they dubbed it Fish Hotel. During one of their three days working on the ridge an NSF chartered Twin-Otter flew over. It was reconnoitering their resupply site on the Deception Glacier north of the Mulock Glacier planned for the following day.

Still in cold but excellent weather (-26°C at one point), and now heavily laden with many fish fossils and rock samples, they sledged 40 kilometers steadily down hill across enormous sastrugi fields towards Seay Peak adjacent to the Mulock Glacier, visiting a promising looking nunatak on the way.

At Seay Peak they left a depot, then sledged east, first to study a good section of pre-Aztec Siltstone Beacon Sandstones on a ridge near Kanak Peak where they were visited by two skuas. Following that, they visited what turned out to be very important sections of Aztec Siltstone on Mount Gudmundson, although access involved a long, narrow snow arete and a scramble through steep cliffs. They were particularly excited about this locality because

Brian Staite helping to collect fish fossils from Fault Bluff
Photo: Margaret Bradshaw

it provided a lot of new fish material, as well as some giant Beaconites burrow (a horizontal tubular burrow packed with sediment in a regular crescentric pattern), one of which appeared to have the underside impression of a "crab-like" animal.

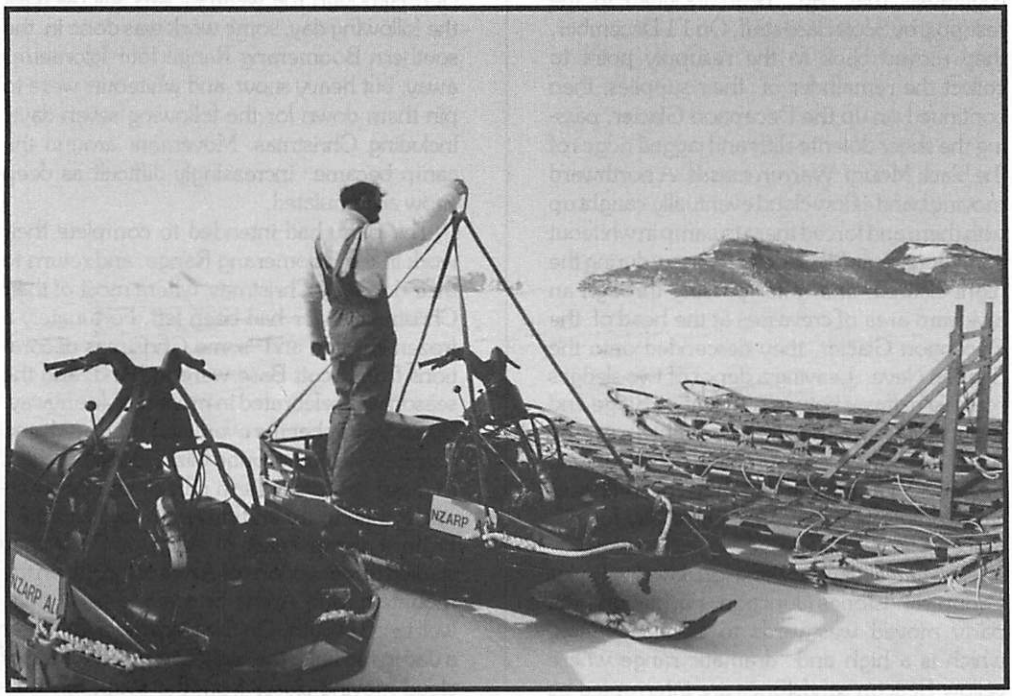
The party travelled back to Seay Peak to prepare for an airlift across the Mulock Glacier the following day, December 7. It had been arranged for safety because of the very heavily crevassed nature of this glacier, particularly at this point where it was over 40 kilometers wide.

An exceptionally good spell of weather continued and conditions were cloudless and still when the first helicopter (US Gentle 11) landed mid-morning. With two sledges strapped to the skids and an Alpine toboggan slung underneath, the US helicopter took off across the Mulock Glacier shortly before the second helicopter, belonging to the New Zealand Air Force (Kiwi O01) landed after dropping a fuel dump onto the Deception Glacier. (For the three New Zealanders the sight of a kiwi helicopter in the field was a tremendous boost to the morale.)

With the two woman geologists on board, a sledge and two tents strapped to the skids, and the second toboggan underslung they flew to the resupply point to be greeted by the Manager of DSIR Antarctic, Dave Geddes, and Scott Base Engineer, Shane Coleman. Two further trips by the helicopters carried the remainder of the party and its gear across to the Deception Glacier.

While the helicopter refuelled and loaded rock boxes and bags of accumulated rubbish, the party packed the sledges and prepared to move down the Deception Glacier that evening as the blue ice area of the resupply was not

The party preparing for a helicopter lift across the Mulock Glacier. Photo Margaret Bradshaw



suitable for camping. Because of their weight and the altitude, the helicopters were compelled to leave one load of helo fuel drums for a later pickup. After they departed the party travelled to a camp site near Mount Ritchie in the southern Warren Range.

Fish fossils had been discovered in the Warren Range by Bernie Gunn and Guyon Warren in 1957. In 1971-72 a Victoria University party with two Australian paleontologists, Gavin Young and Alex Ritchie, had made important fossil fish discoveries in outcrops between the Mulock Glacier and Lashly Mountains. The thickest, uninterrupted sequence of Aztec Siltstone had been located on Mount Ritchie (230 metres) and the Museum party revisited this site to see whether the sediments sequence was interrupted by the Mulock Glacier, and to determine the relative positions of the known fish horizons. Two days were spent in the area in very strong winds and blowing snow.

The party was much cheered by the fresh vegetables that had been included in the resupply by Scott Base staff. On 11 December, they moved back to the resupply point to collect the remainder of their supplies, then continued on up the Deception Glacier, passing the sheer dolerite cliffs and jagged ridges of the black Mount Warren massif. A northward moving band of low cloud eventually caught up with them and forced them to camp in whiteout conditions near Moody Peak. Snow during the night cleared, and after passing through an awkward area of crevasses at the head of the Deception Glacier, they descended onto the Skelton Neve. Leaving a depot of two sledges roughly halfway between Alligator Ridge and Mount Metschel, they travelled light across the neve eastward to Swartz Nunataks 47 kilometres away. During the day they covered over 60 kilometres; their second best day for distance.

After a day working on lower Taylor Group sandstones (Junction Formation), the party moved westwards to Escalade Peak, which is a high and dramatic range where yellow Beacon sandstones are interrupted by numerous dark dolerite intrusions. They were again investigating the pre-Aztec sandstones (Arena Sandstone, Beacon Heights Orthoquartzite), comparing them to rocks at the same level on the far side of the Mulock. The Arena Sandstone looked identical to the Hatherton Sandstone of the Darwin and Cook Mountains and the Britannia Range to the south. Of special interest at Escalade Peak was a giant arthropod track way about 80 centimeters in width.

On 16 December they sledged round the north side of Escalade Peak, pausing briefly after a bracket was lost off one of the sledges, and waiting while Brian fashioned a new one from a rasp file. After struggling through sastrugi, they finally camped near the wide blue icefield that fringed the southern Boomerang Range.

In deteriorating conditions, helicopter Kiwi 001 dropped mail to the party and uplifted a rock box and some rubbish on its way to retrieve the fuel drums on the Deception Glacier. Although the weather was still overcast the following day, some work was done in the southern Boomerang Range four kilometres away, but heavy snow and whiteouts were to pin them down for the following seven days, including Christmas. Movement around the camp became increasingly difficult as deep snow accumulated.

The party had intended to complete their work in the Boomerang Range and return to their depot by Christmas, where most of their Christmas cheer had been left. Fortunately a frozen chicken and some Christmas decorations from Scott Base were to hand, and the season was celebrated in modest style anyway. By 26 December the overcast had cleared, and despite a vicious ground blizzard they decided to move to the northern part of the Boomerang Range to try and make up for lost time. From a camp east of Alligator Peak they studied three sections of Aztec Siltstone on the mountain, and Arena Sandstone on a ridge well to the south. On the December 29, after a day in the field, the sight of a sinister band of cloud moving closer from the south encour-

aged them to travel overnight to guarantee arriving at the depot before the weather closed in again. After picking up the two sledges, the party continued on to camp in the shadow of Mount Metschel at 3.30 in the morning.

Outcrops visited at this locality the next day provided some of the best bone "pavements" they saw. These are bedding planes on which the disarticulate fish bone lay clearly visible. After leaving Mount Metschel en route for Portal Mountain, the party chanced on an old NZARP tent minus poles. The tent was partially frozen into the snow and they removed it for environmental reasons. It is not yet known if the tent originated from the 1970-71 VUWAE party, or the visit of Gunn and Warren 15 years before.

Overcast conditions spread overhead once again, but they managed to reach Portal Mountain before ground definition was lost completely. A great deal of snow lay at their campsite east of the mountain, burying, they found later, blue ice crazed with narrow crevasses.

That night, while heavy snow fell outside, both the New Year and a birthday were celebrated with the turkey they had been unable to have for Christmas, and a little "spirituous liquor". After two days work and two days of whiteouts and heavy snow, they moved up onto the main Skelton Glacier. The deep snow caused traction problems forcing them to relay the sledges for much of the way.

After passing through The Portal (between Portal Mountain and Mount Feather), the Lashly Mountains on the edge of the Polar Plateau were reached without any problems. Extremely strong winds off the plateau and ground blizzard conditions however, confined them to their tents. Some concern was caused subsequently when the snow on which they were camped was steadily blown away to reveal blue ice.

Two sections were measured on Mount Crean, one of them for the first time.

Because the unexpected delay over Christmas had been compounded by further delays at Portal Mountain and Mount Crean, they decided to omit the last locality, Mount Fleming, which lay 50 kilometres to the north.

On 10 January a suitable strip was marked by toboggan on the Lashly Glacier east of Mount Crean, and was investigated later that day by a C130 on a recce flight.

Early the following day the C130 landed after making two successful ski-drags, and the sledges were loaded onto the plane packed as for travel but the plane had great difficulty building up enough speed to lift off because the thin snow cover would not compact. After two hours of trying the attempt was aborted; the toboggans and sledges were offloaded, leaving only passengers aboard, and later another C130 returned to the Lashly Glacier and retrieved the four sledges and two toboggans. Several days were spent at Scott Base sorting out gear and geological specimens and on January 16 they returned to New Zealand.

The expedition was highly successful, with much of the material collected likely to provide new information about the evolution of the early fishes. The Devonian Period, about 370 million years ago, is often referred to as the "Age of the Fishes", because at that time the fish were the only vertebrate animals on the face of the earth. The Aztec Siltstone in Antarctica indicates that the fish were very varied and sometimes almost bizarre. Jawless fishes and early sharks lived alongside placoderm fish, whose bodies were covered with thick bony plates and possessed arms, lung fish and a group of crossopterygian bony fish from which the later amphibians evolved. The Museum party was particularly interested in the crossopterygians as scattered bone collected by the 1970-71 party suggested huge animals up to four metres in length. The Aztec Siltstone contains some of the best preserved fish material in the world, and questions still remain about the evolution of Devonian fish that the Antarctic fossils may answer. There are indications that during the Devonian the Antarctic-east Australian region may have been an important site of fish evolution, with new forms migrating to other parts of the world.

As well as collecting fish material, the Mu-

seum party was also studying the sediments in which they were found. The Aztec Siltstone was deposited by large rivers flooding across low-lying alluvial flats. Freshwater fish lived within channels of these rivers and during floods when the rivers broke their banks, mud was spread across the river flats leaving dead and dying fish. Fossil root horizons indicate that quite often these mud-flats were colonised by primitive vegetation; soft low growths and moderate size shrub like trees. Preserved mudcracks and soil horizons are common in the sequence. There are indications that the region had a savanna-like climate with well-marked wet and dry seasons.

Overall about 750 kilograms of rock were collected. The fossil fish will be studied by John Long in Perth, while Margaret Bradshaw and Fraka Harmsen will work on the remaining material respectively, in New Zealand and the United States.

CHINARE

Environmental programme implemented at Zhongshan

The government of the Peoples Republic of China have declared 1990-1992 as "China's Antarctic Environmental Years." As part of the implementation of the declaration the Chinese Committee on Antarctic Research has issued "Document of the State Oceanographic Administration, People's Republic of China, No. 35 (1990. On the Decision of 1990-1992 being "China's Antarctic Environmental Years".

It states: "The Antarctic is the only continent not to be polluted and not to be developed on the earth in which human beings live. It is also the "sacred place" and "natural laboratory" of scientific investigation and research. Protecting the Antarctic environment is an unshirkable duty and responsibility of nations who have dispatched expeditions and people all over the world. The People's Republic of China stresses and adheres to the relevant regulations on environmental protection within the Antarctic Treaty System.

In order to maintain the Chinese Antarctic Great Wall and Zhongshan stations as a wholly site for scientific research and to make significant contributions to Antarctic environmental protection it is proclaimed that the years of 1990-1992 will be "China's Antarctic Environmental Years" with the following objectives.

1. Enhance the consciousness of protecting the Antarctic environment and the relevant regulations on environmental protection within the Antarctic Treaty System and also the regulations of CHINARE, must be studied seriously and observed faithfully by the CHINARE organisation and managers of Antarctic affairs, the crew of the Ji Di vessel and the staff of the Arctic and Antarctic Research Institute and training base. They are required to thoroughly understand their significance.
2. Protecting the Antarctic environment and maintaining its ecosystem balance must be one of the most important missions in the Great Wall and Zhongshan stations.

1. Station Area

A. Waste material must be kept in hermetically sealed containers according to its type. Those materials that are incombustible, or not allowed to be burnt off in the Antarctic, must be

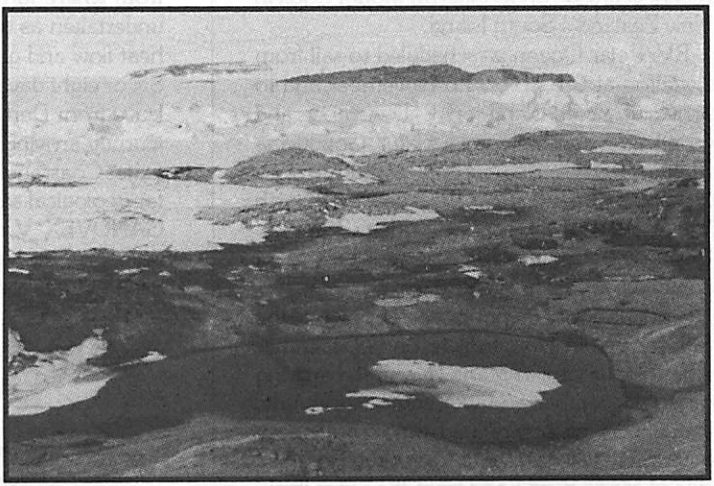
carried back to China. Other materials must be burnt off periodically in the incinerator.
B. Waste water must be processed by means of biological and chemical methods before draining into the sea.
C. Exhaust from the generators must be processed by purifiers.
D. Rubbish (including cigarette ends) must be properly disposed in appropriate containers. Rooms should be vacuumed every day and maintained in a clean and neat fashion. General duties around the stations are required once a week.
E. Living things must be protected in the station area. Personnel are not allowed to frighten animals or to step on plants and it is forbidden to catch and kill animals and to pick up plants and rocks without the permission of China's State Committee on Antarctic Research.

2. Field Parties

A. Every member of the field party must bring rubbish bags to return waste material (including packing material, cigarette ends and human waste) to the station for proper disposal.
B. The same as (I)E.
C. Vehicles driving in the field must avoid animals and plants.
D. Nothing is allowed to be discarded into the sea while barges and amphibious vehicles are operating.

3. Scientific Survey Vessels

Scientific survey vessels to the Antarctic must abide by the relevant regulations on environmental protection within the Antarctic Treaty System.
(1) Waste material (including cigarette ends) is not permitted to be dumped into the sea.
(2) Members of the crew visiting the stations must abide by 2, especially 2 (1) E.
Zhongshan Station in the Larsemann Hills, 80km south of Australia's Davis Station at the northeastern tip of the Broknes Peninsula has now been occupied continuously since January 1989. It comprises eight buildings, meteorology, power station, mess and living quarters, laboratories, storage and equipment buildings, a fuel farm and a volleyball court.
During 1991-92 summer 20 scientists and support staff pursued a scientific programme, begun at the station's inception and which focusses on upper atmosphere, physics, geophysics, meteorology and geology. In addition this year a major environmental clean up was being implemented. Waste metal was removed and compacted, wood burnt or removed and rubbish sorted and all of it was returned to China.
Water at Zhongshan is piped from two tarns immediately behind the station, the smaller providing a quality suitable for drinking and the



Zhongshan buildings, left to right, meteorology, power station, mess, living quarters and volley ball court, laboratories, storage, equipment storage, fuel farm. Photo: David Stephenson, ANARE News

larger more mineralised for washing and ablution. During the winter icemelters are used. The two diesel generators which produce power for the station consume about 150 tonnes of fuel per year. Road access is restricted to the foreshore which was also subject to the cleanup.
Reference: Anare News, Autumn 1992 pages 24, 25

Germany

Scientific programme for GANOVEX VII being finalised

Three major scientific programmes are planned for GANOVEX VII scheduled to take place in the Ross Sea area of Antarctica in 1992/1993. The expedition will charter the Norwegian Research Vessel "Polar Queen", an icebreaker/sealer which will make two trips down to the ice. Sixty-three scientific and support personnel will be involved. Additional logistic support is to be provided by four Aerospatiale AS 350 Squirrel Helicopters and four skidoos will be used for geological and geophysical research. The leader will be Dr Norbert Roland from the Bundesanstalt fur Geowissenschaften und Rohstoffe in Hannover Germany .

Of the personnel participating in GANOVEX VII; 35 will be scientists from Australia, Germany, Italy, the Netherlands, New Zealand and the United States; 13 will crew and service the helicopters, six will manage the logistics and there will be nine field guides and one environmental officer. Survival training will, as usual in recent years, be undertaken at Mount Cook in New Zealand's South Island.

RV/Polar Queen is scheduled to sail from Lyttelton at 6 p.m. on 26 November and to arrive at Scott Island on 2 December and Gondwana Station four days later. Gondwana Station is the German summer station at Terra Nova Bay on the Ross Sea coast in North Victoria Land. It lies at 74deg/38minS/ 164deg, 13 minutes E and was built from container modules in 1988/89.

Unloading of equipment and supplies at the Station should be complete on 7 December when she will sail to Marie Byrd Land arriving on 11 December and working offshore until January 9. Helicopters fitted with aeromagnetic equipment will be used to survey the Ross Sea side of Marie Byrd Land from the outer flank. This is a continuation of a project previously undertaken as part of the Italian, US and German programmes. The ship will then return to Gondwana for two days on December 10 and make her way back to Dunedin by 14 January 1993.

Two helicopters will be based at Gondwana from where further geophysical work will be undertaken as well as gravity measurements, heat flow and geological programmes.
Six or eight days later the ship is scheduled to leave from Dunedin on the second leg of her journey arriving at Yule Bay on 28 January, Oates Coast and providing support for a month for geological sampling being continued from GANOVEX V. The Polar Queen will then return to Gondwana to load and make her way back to Lyttelton arriving on 6 March.

Norway

Climate change studies and the recovery of Amundsen's tent from the South Pole combined into one expedition

"Antarctic" acknowledges the assistance of Dr Monica Kristensen with this article.

Studying the interactions between the Filchner Ice Shelf and the changing climate is the scientific purpose of an international expedition being conducted over three years. Some members are also seeking to recover the tent left by Amundsen at the South Pole on 14 December, 1911 just six weeks before Captain Scott's illfated party reached their destination.

Led by Dr Monica Kristensen of the Meteorological Institute in Oslo, the first part of the three year programme comprised scientists and support staff from the UK, Norway and Sweden. They came from the Mullard Space Science Laboratory, University College of London, from the British Antarctic Survey, the Norwegian Meteorological Institute in Oslo, the University of Bergen and the Swedish Antarctic Program. The annual budget for the Filchner project is estimated at 2.5 million pounds sterling, of which 1.3 million pounds has been committed from participating institutions and the remainder from private contributions through industries interested in environmental issues.

According to the expedition brochure "Calculations based on existing trends show that the amount of CO2 in the atmosphere will probably be doubled by the year 2030. Forecasts from the global ocean atmosphere circulation computer models show that the air temperature may rises as much as 4deg C in the same time period. Some forecasts show values for coastal regions of Antarctica being much higher and this includes both the Weddell Sea and the Filchner Ice Shelf. With a rising air and ocean temperature the oceans will expand leading to a faster rise in seal level. But if a far more dramatic rise in sea level was to occur it would be caused by the melting of ice from Greenland and the Antarctic Ice sheet. Over 90 percent of all fresh water on the surface of the planet is found in the ice mantle that covers Antarctica. This mantle can be up to 5 km thick. If all the ice on the continent was to melt, sea level would rise about 70 metres." While it remains unlikely that the ice in Antarctica would melt completely the West Antarctic ice sheet would certainly be reduced by a warming of the climate.

The Filchner Ice shelf lies between Berkner Island, the mountain ranges to the east and the South Polar Plateau from which several streams flow across the shelf to the ice front in the north. It is an important area for research as it is

sensitive to climatic change; the sea ice zone will decrease in a warming climate.

To investigate this possibility the team planned to carry out several types of experiment.

Glaciological surveys are to be performed in different areas on the shelf, the adjacent streams and the Polar Plateau. Results from the analysis of field data will be used for satellite data validation and for glaciological modelling. Oceanographic measures are to be conducted at the shelf front to explore the under-shelf circulation and bottom melting. Radar measurements taken both on the ground and from aircraft will provide data on ice thickness and sub-surface stratigraphy. Automatic weather stations to be deployed in various locations will transmit data via satellite year round.

The 11 scientists and 12 support staff who comprise the main expedition arrived in Montevideo on Air France around December 1, 1991.

Here they boarded *MV Aurora,* sold in 1990 by Monica Kristensen to the Lauritz Eidevsik, a shipping company based in Haugesun, Norway specialising in seismics work in the North Sea, for approximately NOK 5 mill but chartered for the expedition. Further logistic support was by a Twin Otter, chartered from the Greenlandic Company GLACE and destined to fly to the planned base for the expedition from Punta Arenas via the Chilean base Teniente Marsh, some 14 hours flying time.

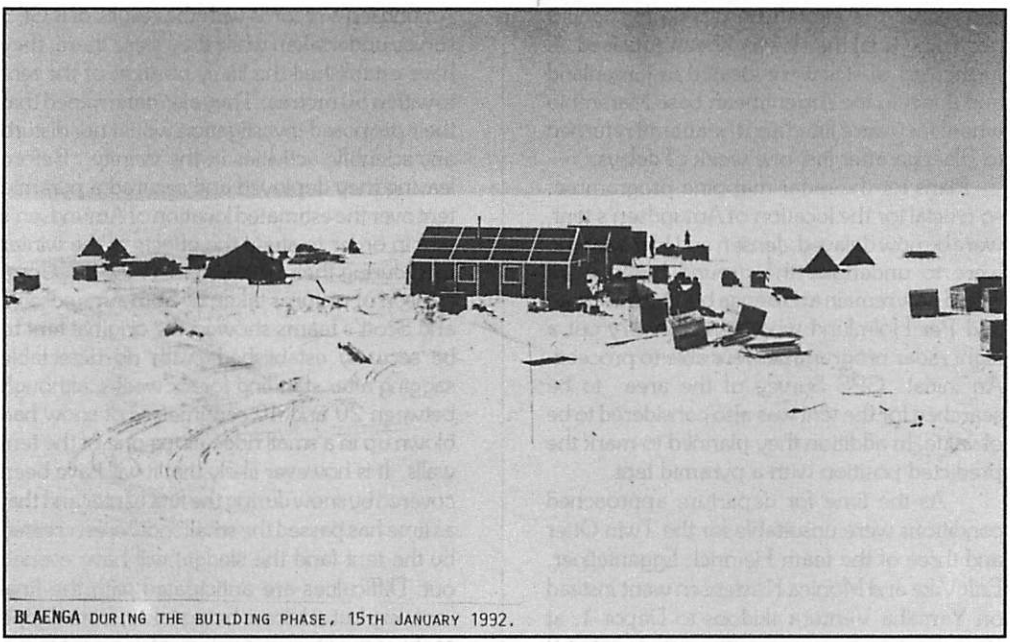
(Dr Kristensen has had a long association with MV Aurora which she purchased for her expedition 90 Degrees South in 1986-87 during which she hoped to follow in Amundsen's footsteps but (ironically) short of time and too late to meet her objective returned to the vessel for safety reasons. In the interim the ship has been under charter for one science expedition to Bouvet Island and two to the northern Arctic and where her new owners are likely to use her for seismic work. The aircraft, piloted mainly by Sven Ahlquist was also the same as that used in the expedition. Its call sign was OY-POF; it is also called Arctic Fox after landing on an iceberg in 1986.)

MV Aurora, captained by Lief Barane left Montevideo during the evening of December 12 and sailing in relatively calm waters set a course for 65degO2minW. On December 23 sea ice was encountered for the first time, and in increasingly heavy ice conditions the ship turned to a course along the coast of Dronning Maud Land following longitude 50deg West before turning southwest for Berkner Island where expedition members had planned to establish their base. Icebergs, which have calved off from the front of the Filchner Iceshelf, blocked their passage to Berkner and they followed a shore lead towards the coast choosing instead a site on Coats Land, some 40 km to the north of the Argentinean Belgrano 2 wintering station.

On January 2 they arrived at the position for Blaenga, (Norwegian for Blue Fields) a base which was to comprise five wooden huts with accommodation for up to 20 people, offices and workspace and serve as the Antarctic headquarters for the expedition.

Aurora was anchored to the fast ice. It was 19 days since they had left Montevideo and they were two days ahead of the schedule as planned for Berkner Island when they started unloading and assembling the station, having first visited the Argentineans at Belgrano II under the command of Comodoro Lautaro. By January 18 the station (located at 77.5D/ 34.2W) was finished with all stores and equipment in place. It should have been earlier but weather conditions reduced the use they could make of the helicopter, a Bell Jetranger, carried aboard *Aurora.*

In the meantime plans to use the Twin Otter for early deployment of their field parties (including the two to the Pole) had also gone astray as the aircraft in Punta Arenas was to transfer two Norwegian scientists from the University of Bergen and a reporter from the Swedish Broadcasting Corporation, who had been flown into the ANI base at Patriot Hills by



BLAENGA DURING THE BUILDING PHASE, 15TH JANUARY 1992.

the organisation's DC6. But because of white out and blowing snow in the region around *Aurora* the aircraft did not rendezvous until 14 January by which time the radio reporter (Anna Schytt of Swedish Broadcasting), and logistics manager had to return to Sweden and Denmark because of time problems.

Initially they had planned to fly in the South Pole Party first. Four scientists and logistic personnel were to make up two parties, the first comprising Niels Jensen and Peter Hansen and their support, who were to be deployed in early January. They were to establish the camp, undertake a GPS survey of the outer boundaries of the test or search area, deploy a pyramid tent at the likely site of Amundsen's tent, secure it and leave it for the winter to check effects of the weather on it and undertake land radar investigations over an area 500 metres square. A second party, comprising Per Holmlund, Ulf Hedman and Monica Kristensen were to fly in during early February and use the Twin Otter to undertake a variable frequency radar programme over an area 3.2km square. However, because of unstable weather, the complexity of the South Pole Operation, the essential deployment of two field depots between Blaenga and the South Pole and a mishap with the Twin Otter, priorities were changed.

On January 19 the first of the two fuel depots required for the South Pole operation was deployed on Recovery Glacier. In addition to the essential fuel, Niels Jensen and Peter Hansen were flown into the site where they were to stay and provide weather reports. However one of the skis on the Twin Otter was damaged in a crevasse encountered as the aircraft taxied into land and, as further crevasses were found when the site was checked, it was abandoned and the team flown back to Blaenga. A better position for the depot was found close to the Pensacola Mountains and a flight carrying the two men and scheduled to continue onto the Pole landed at the second site in near whiteout conditions causing further damage to the skis. The men again returned to Blaenga and on close inspection the mechanic

considered the aircraft unsuitable for continued flying until the skis had been replaced. A further set of skis were located in Greenland and flown to the Argentinean base Marambio where they were fitted and the aircraft returned to Blaenga after just one week of delays.

Plans for the radar mapping programme, so crucial for the location of Amundsen's tent, were by now delayed. Jensen and Hensen who were to undertake the ground based work would now remain at Blaenga but Dr Kristensen and Per Holmlund who were to carry out a flight radar programme were able to proceed. An initial GPS Survey of the area to be searched for the tent was also considered to be of value. In addition they planned to mark the predicted position with a pyramid tent.

As the time for departure approached conditions were unsuitable for the Twin Otter and three of the team Heinrich Eggenfellner, Erik Vike and Monica Kristensen went instead on Yamaha Ventura skidoos to Depot 1, at Recovery Glacier, covering the distance of 560 km in less than 24 hours. Each of the three skidoos towed a sledge carrying tents and equipment, and sufficient fuel to return to base at any stage. This change to their plans enabled them to make a preliminary investigation of the area around Recovery Glacier which they hope to stake for monitoring of ice movement next season. Two of the party Eggenfellner and Vike however staked a line at the foot of the glacier for comparative purposes. During the trip they navigated by GPS Trimble Transpac.

On 16 February Eggenfellner and Monica Kristensen flew from the depot in the Twin Otter to the South Pole where US personnel assisted them by providing a SPRAY overland vehicle to drive them out to their site.

During their four hour stay the temperature was -38deg C and the wind speed 25 knots. They had planned to ski along the boundaries of the proposed test area or research site but time and conditions precluded this. However they were now able to mark the boundaries and undertake a general survey.

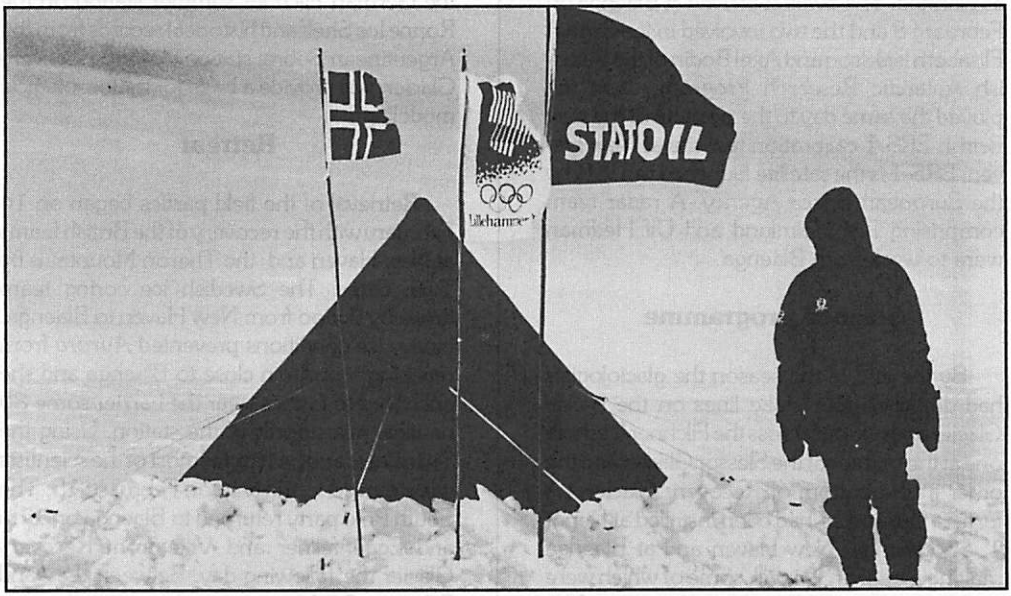
By combining data from Scott and Amundsen's records with the results of a GPS survey undertaken while they were there, they have established the likely position of the tent to within 50 metres. They also determined that their proposed investigation would not disturb any scientific activities in the vicinity. Before leaving they deployed and secured a pyramid tent over the estimated location of Amundsen's tent in order to study the effects of the winter on it during their next visit in 1992-93. Comparison of pictures taken by both Amundsen's and Scott's teams showed the original tent to be securely established with no detectable sagging after standing for six weeks, although between 20 and 40 centimetres of snow had blown up in a small ridge along one of the tent walls. It is however likely that it will have been covered by snow during the first winter and that as time has passed the small snow crest created by the tent (and the sledge) will have evened out. Difficulties are anticipated with the final recovery but advice is being taken from Jeppe Mohl of the Danish Zoology Museum. He is a leading authority having worked extensively on digs in the ice and permafrost of Siberia and Greenland.

For a time three flags flew close to the new Norwegian tent erected by the party; the Norwegian flag remained but the Statoil and Lillehammer winter Olympics flag were returned to Base.

In the meantime the other scientific projects were proceeding. The British party comprising Dr Jeff Ridley, Dave Mantripp and Peter Webb was deployed with three Twin Otter flights on 17 January in the middle of the Filchner Ice Shelf called Snowhenge.

On January 18 two further field parties were deployed by Twin Otter, the first comprising Peter Midtboe, geologist and Heinrich Eggenfellner (GPS reference station) and was called "Eagles Nest" and positioned close to a nunatak on the Bailey Ice stream. The second party comprised Erlend Moe and Erik Vike (GPS field station) and was deployed close to the Theron Mountains by the Bailey Ice Stream. Each was deployed with a pyramid tent, re-

Dejected, Scott's party find Amundsens tent at the South Pole Thursday, 18 January 1912



For a time three flags flew close to the Norwegian tent erected by the party; the Norwegian flag remained but the Statoil and Lillehammer winter olympics flags were returned to Blaenga.

serve Storebjorn tent, equipment and supplies for three weeks, as well as a skidoo and sledge.

On 22 January *MV Aurora* left her position below Blaenga. Among those on board were Nina Nordlund and Stenar Myking who conducted an oceanography programme comprising CTD measurements along several transects across the continental shelf slope and the deployment and retrieval of current rig. Plankton samples were also collected from several sites for scientists from the Norwegian Ministry of the Environment who are studying the effects of the thinning ozone layer on genetic material in plankton.

At Blaenga the weather again deteriorated with snowstorms and whiteout conditions. Four Swedish glaciologists, participants in the Aurora programme who had been deployed at Wasa by the Akademik Federov in November were transferred to Blaenga by the Aurora, (whose oceanographic programme was being delayed by heavy ice), instead of the Twin Otter as planned. The Swedes arrived at Blaenga on February 8 and the two involved in ice-coring, Elisabeth Isaksson and Axel Bodin of the Swedish Antarctic Research Program, were deployed the same day to the position of the new British ERS-1 calibration test site at New Haven. ERS-1 is the satellite launched in 1991 by the European Space Agency. A radar team comprising Per Holmlund and Ulf Hedman were to work from Blaenga.

Science programme

By the end of the season the glaciologists had deployed four stake lines on the Bailey Glacier and two out across the Filchner Iceshelf, one at the bottom of the Slessor Glacier and the other at the bottom of Recovery Glacier. A further four stakes had been installed at Depot 1, Snowhenge, New Haven and at Blaenga making a total of 39 in all, some of which were remeasured during the season. A survey of the sedimentary geology of the Theron Mountains was completed. Two sites were investigated for ERS-1 calibration, one at Snowhenge where the work was hampered by crevasses and the other at New Haven on Touchdown Hills. In all, eight ice cores were obtained, including one of ten meters from Snowhenge and another of 20 metres from New Haven and others from along the flow line of the Bailey Ice Stream. [These have been shipped to Maine in the USA for analysis by E. Issakson.]

The 30 hours of flying time allocated to the making of radar measurements was reduced because of 11 days of snow storms but one track was flown at 50 feet above ground from the shelf margin, through a grounding line zone and up part of the flowline on the Bailey Glacier. Another track was made across New Haven and over Coats Land to Blaenga.

Four automatic weather stations with advanced instrumentation were positioned at Blaenga and others, simpler in operation, at New Haven, Snowhenge and close to the GPS reference point in the Theron Mountains. The data, together with that from stations such as the German Filchner summer station on the Ronne Ice Shelf and historical records from the Argentinean Sobral station close to Recovery Glacier, will provide a basis for meteorological modeling.

Retreat

Retrieval of the field parties began on 14 February with the recovery of the British teams at New Haven and the Theron Mountains by Twin Otter. The Swedish ice coring team drove by skidoo from New Haven to Blaenga. Heavy ice conditions prevented *Aurora* from reaching a position close to Blaenga and she anchored to fast ice near the barrier some 80 nautical miles north of the station. Using the Twin Otter and helicopter most of the scientists were moved to the ship on February 15. The South Pole party returned to Blaenga on 17th and Eggenfellner and Vike from Recovery Glacier the following day. Between then and February 24 the station and associated equipment was secured for winter conditions. The last of the party left Blaenga by Twin Otter on 24 February for the ship and two days later the

aircraft set out for South America via the Argentinean base Marambio.

A small fuel depot and camp comprising a tent, assorted equipment and supplies was left on the fast ice near the Twin Otter runway as the weather there was often better than at the base site. *MS Aurora* also left the area on February 26, making a short call at South Georgia, before arriving at Montevideo on March 10.

Next season

Plans for 1992/93, the second phase of the programme, are now underway. Among the priorities will be the removal of Blaenga to a location inland and more favourable to Twin Otter operation for only three days out of 30 were suitable for flying to the plateau while, by comparison at a the site of the GPS reference station only three days were overcast.

Amundsen's tent

Originally standing two-metres high the tent of gabardine and leather more recently described as being of silk and leather, topped by a Norwegian flag, was last seen by Scott and his companions on 17 January, 1912.

Amundsen returned to Norway, a hero. The British party, comprising Captain Scott, Lieutenant Bowers, Dr Wilson, Captain Oates and Petty Officer Evans perished on the return journey.

Amundsen reached the area of the Pole at noon on December 17. For three days members of the party made a circumvention of the area, all the time making navigational observations. He later wrote:

"First we set up the little tent we had brought with us in case we should be compelled to divide into two parties. It had been made by our able sailmaker, Ronne, and was of very thin windproof gabardine. Its drab colour made it easily visible against the white surface. Another pole was lashed to the tent-pole, making its total height about 13 feet. On the top of this a little Norwegian flag was lashed fast, and underneath it a pennant, on which "Fram" was painted.

"The tent was well secured with guy-ropes on all sides. Inside the tent, in a little bag, I left a letter addressed to H.M. The King (Haakon VII) giving information of what we had accomplished. The way home was a long one, and so many things might happen to make it impossible for us to give an account of our expedition. Besides this letter, I wrote a short epistle to Captain Scott, who, I assumed, would be the first to find the tent. Other things we left there a sextant with a glass horizon, a hypsometer case, three reindeer skin foot-bags, some kamiks and mits.

"When everything had been laid inside, we went into the tent, one by one, to write our names on a tablet we had fastened to the tent-pole. On this occasion we received the congratulations of our companions on the successful result, for the following messages were written on a couple of strips to leather, sewed to the tent: "Good luck," and "Welcome to 90 deg zero". These goodwishes, which we suddenly discovered, put us in very good spirits. They were signed by Beck and Ronne. They had good faith in us. When we had

finished this we came out, and the tent-door was securely laced together, so that there was no danger of the wind getting a hold on that side."

And so goodbye to Polheim. It was a solemn moment when we bared our heads and bade farewell to our home and our flag..... A 12 foot wooden sledge was left standing up as a landmark for Scott's party.

The South Pole, an account of the Norwegian Antarctic expedition in the "Fram" 1910-1912, in two volumes published in London by John Murray, Albermarle Street West, 1912. Pages 133/134

Scott's reaction

Bitter with disappointment Captain Scott and his party had been following the Norwegian tracks and of Thursday January 18 he wrote. "Decided after summing up all observations that we were three and a half miles away from the Pole - one mile beyond it and three to the right. More or less in this direction Bowers saw a cairn or tent.

"We have just arrived at this tent, two miles from our camp thereabout one to one and a half miles from the Pole. In the tent we find a record of five Norwegians have been here, as follows:

Roald Amundsen
Olav Olavson Bjaaland
Hilmer Hanssen
Sverre H. Hassel
Oscar Wisting
16 December 1911.

"The tent is fine - a small compact affair supported by a single bamboo. A note from Amundsen, which I keep, asks me to forward a letter to King Haakon!

"The following articles have been left in the tent: three half bags of reindeer containing a miscellaneous assortment of mits and sleeping-socks, very various in description, a sextant, a Norwegian artificial horizon and a hypsometer without boiling point, thermometers, a sextant and hypsometer of English make. "Left a note to say I had visited the tent with companions..... Between half to three quarters of a mile from the tent "we built a cairn, put up our poor slighted Union Jack, and photographed ourselves - mighty cold work - all of it....

"We carried the Union Jack about 3/4 mile north with us and left it on a piece of stick as near as we could fix it. I fancy the Norwegians arrived at the Pole on 15th December and left on the 17th ahead of a date quoted by me in London as ideal, viz. Dec 22. It looks as though the Norwegian party expected colder weather on the summit than they got. It could scarcely be otherwise from Shackleton's account. Well, we have turned our back now on the goal of our ambition and must face our 800 miles of solid dragging - and good-bye to most of the day dreams."

Scott is believed to have a left a letter in Amundsen's tent; this has never been recovered.

Scott's last expedition, in two volumes published in London by John Murray, Albermarle Street W., February 1927 (The cheaper edition!). Pages 425-426

South Africa

Three winter stations operating

Atmospheric sciences, biological studies, geological, solid earth geophysics programmes, the collection of geodetic and geographical information made up the South African National Antarctic Programme for the summer of 1991/1992. Major logistic support was provided by the research vessel *mv SA Agulhas* and supplemented by the use of two SA 330 Aerospatiale Puma J helicopters. Work was carried out at SANAE, Marion (in the Prince Edward Islands) and Gough Stations, all of which are permanently occupied and also during relief and supply voyages.

Programmes operating at SANAE include two focussing on aspects of Cosmic rays, riometer imaging of auroral electron precipitation, other electron aurora work and geomagnetic studies as well as meteorological and seismic observations and studies of VLF emissions. The base, situated 69.3m above sea level at 70deg18'35.3"S/ 02deg24'41.6"W, on the Fimbul Ice Shelf in Dronning Maud Land accommodates 12 winter scientists and support staff and up to 70 researchers and other personnel during the summer. A new programme begun last season aims to study the effects of guano and other remains on the biota of selected nunataks in the Ahlmannryggen area of Dronning Maud Land. An ornithologist, botanist and an entomologist were involved in the programme.

Geological programmes were also undertaken in the Kirwanveggen region of Dronning Maud Land. They included a structural metamorphic and geochemical project; Isotopic studies to determine the geological evolution of Western Dronning Maud Land within a Gondwana framework, ground investigation, including detailed magnetic surveys and paleomagnetic studies of key anomalies. These three projects are part of interdisciplinary earth sciences programme designed to be undertaken over the next five years. Topographical mapping of HU Sverdrupfjella for a set of 1;50,000 maps also continued and a primary survey station at Grunehogna was occupied as part of the SCAR working Group on Geodesy and Geographic Information, VLB/GPS Antarctic Plate Tectonic project.

Marion Island

Biologists working from the station on Marion Island undertook studies of the migration of the southern elephant seal Mirounga leonina, the effects of artificial control on the cat population, Felis catus and the design and initiation of a long monitoring of surface nesting sea-birds started previously at Prince Edward Islands. Studies are also being undertaken of the herbivore, saprivore, carnivore, vegetation interactions and nutrient cycling under a changing climatic regime on the island. This multidisciplinary project on the ecology and ecophysiology of mice, soil invertebrates, plants and micro-organisms is being undertaken in relation to nutrient-cycling and changing climate regime. Marion Island lies at 46deg52'34"s/37deg51'32"E in the Southern Indian Ocean and supports 16 staff over the winter and up to 60 during the relief period.

Much of the work undertaken this season at Gough Island involved ecological research. The island lies at 40deg21'00"/ 09deg52'40"W in the South Atlantic Ocean. The base is 54 metres above sea level and supports seven personnel during the winter and up to 45 during the summer relief period.

Routine meteorological programmes are regularly undertaken.

Oceanographic programmes undertaken from *mv SA Agulhas* included analysis of the biological productivity at Antarctic oceanic fronts which was South Africa's contribution to JGOFS (Joint Global Ocean Fluxes Study) and WOCE World Ocean Circulation Experiments). This was done during the first of a major series of cruises planned over the next five years in which scientists will investigate the nature of eddies shed across the subtropical convergence. The eddies are distinctly visible in satellite thermal infra-red imagery, allowing for detailed real-time planning. The meridional flux of heat characteristics of these eddies is being investigated for WOCE. The subtropical convergence is also known for its unusual chlorophyll distribution, aspects of which are being studied in greater detail. Ongoing programmes on krill aggregation and abundance continued.

mv SA Agulhas made six voyages in support of the programme during the 1991-92 season. These bring the total number of voyages made for the South African National Antarctic Programme to 70 with a further seven programmed over the next two seasons.

BAS

Halley - 5 The most modern UK Research Station in the Antarctic

by Dr J.G. Paren, Director's Assistant, British Antarctic Survey

Halley 5 is the fifth station to be built on the Brunt Ice Shelf, Coats Land. The first station was established in 1956 by the Royal Society for the International Geophysical Year (IGY), 1957-58, and named Halley after the astronomer Edmond Halley. The station filled an important gap in the IGY Antarctic network with studies in meteorology, glaciology, seismology. Many of these studies have continued uninterrupted since 1957.

The extreme environment of the Brunt Ice Shelf poses great technical problems to builders with blizzards and snow drift eventually burying everything. Buildings disappear beneath the snow, requiring ever-lengthening vertical shafts to provide access to the outside world. Because of burial by snow and movement of the ice shelf it was necessary to replace and resite the first Halley station in 1967, and subsequent stations in 1973, 1983 and 1992; all being abandoned before being crushed by the weight of overlying snow.

Once a year Halley Research Station is supplied by ship. Cargo is normally off-loaded onto sledges on the sea ice, and towed by tracked vehicles up ramps of drifted snow onto the ice shelf and 15 kilometers inland to the station. Work continues around the clock with 24 hours daylight. AT times the site of a suitable snow ramp has lengthened the resupply route from the ship to the base to 60 kilometres.

Halley 5 took six years from conception at the drawing board to commissioning in February 1992. It is novel in that the buildings sit four metres above the snow on independent jackable steel platforms. The largest is the Accommodation Building (ACB) which is 59 metres long, 14.6 metres wide and three metres high. The other two smaller platforms, the Ice and Climate Building (ICB) and Space Sciences Building (SSB), house specialist laboratories. The height of the platforms above the ice shelf affects the local wind turbulence and the build-up of drifting snow. Each summer the platforms must be raised an average of one metre to compensate for the accumulated snowfall. Small adjustments throughout the year are made to compensate for differential movement.

The Accommodation Building comprises three sections, a services/technical support area, living area and sleeping quarters. Diesel engines provide electrical power and their vast heat warms the buildings and melts snow to provide water. The living area includes a photographic darkroom, lounge, library, dining room, kitchen, computer room, base commander's office, communications room, recreation room, storage areas and a hospital. The isolation and long periods of complete darkness make Halley a valuable site for medical research. There are 20 bedrooms, giving each of the winter staff, a room of their own, with doubling up of accommodation in the busy summer. The winter base complement is 18, with eight scientists, one doctor and nine support staff.

Science at Halley

Climate, ice and ozone studies

Polar regions play a key role in studies of the global environment. Studying the processes at play and evaluating the impact on the world outside are essential ingredients of BAS science at Halley.

BAS meteorologists take advantage of the flatness of the ice shelf to study the dynamics of the atmosphere close to the ground. This research is improving the representation of high latitude processes in Global Circulation Models used for climate modelling. Meteorological data have been collected daily since 1956, and are transmitted to the European Meteorological Satellite (EUMETSAT) ground station for use in weather forecasts at the UK Meteorological Office and elsewhere. Halley and 11 other stations in East Antarctica provide a climatic database for an area larger than Europe. Halley meteorological data supplemented by a programme on atmospheric chemistry are used to support the work of glaciologists who use ice cores to study past climate. Halley data underpin studies on the effect of climate change on sea level, and provide ground truth for satellite studies on the dynamics of intense polar depressions.

Total ozone has been monitored at Halley since 1956. A spring-time depletion in ozone was discovered by BAS in 1985, and this led quickly to the international response to curtail production of Chlorofluorocarbons (CFSs). Halley lies well under the ozone hole and houses a range of instruments that monitor key chemical constituents of the stratosphere.

Geospace research

The near-earth region of interplanetary space (called Geospace) is dominated by the interaction of the Sun's atmosphere with the upper atmosphere and magnetic field of the Earth. Understanding the physics of geospace is of increasing practical importance. Periodic increases in solar activity create magnetic storms which affect such things as radio communication, power-line transmission, and equipment on satellites. Halley, lying at the edge of the southern auroral zone, is ideally situated for geospace research. The Polar Anglo-American Conjugate Experiment (PACE) radar provides an unparalleled spatial picture of the consequences of geospace interactions in the upper atmosphere (above 100 kilometres altitude) over an area of around three million square kilometres of geospace over the South

Pole. Halley is the focus of the BAS Automated Geophysical Observatory (AG) programme which aims to establish a network of observation sites under the field of view of the PACE radar.

The station provides state-of-the-art computing and digital communication facilities. This sophisticated facility is crucial to BAS participation in the forthcoming NASA Global Geospace Science Mission, which involves many spacecraft. Key parameters from the whole suite of geospace experiments will be obtained and transmitted each night to the Mission Centre in the USA where they will be merged with spacecraft data. BAS is one of only four ground-based teams world-wide contributing to the mission.

USAP and Russia

Science aboard an iceberg engenders spirit of international cooperation

"Difficult environmental conditions in the western Weddell Sea have previously prohibited data collection in the area of the global ocean. Only now in the closing decade of the 20th century has this region been properly explored through the joint US Russian effort. Ice Station Weddell I, the first drift station of the Southern Ocean, becomes an important part of the history of Antarctic exploration." - Dr Arnold Gordon, Columbia University, New York Project co-ordinator.

The United States Antarctic Program of the National Science Foundation and the Soviet Union Antarctic Expedition officially closed the Ice Station Weddell I on 9, June, 1992 with the lowering and exchange of the US and Russian flags and complete evacuation of personnel and removal of the base. It was the first time such a base had been established.

The expedition included scientists from the Arctic and Antarctic Research Institute in St. Petersburg, where Dr Gordon and his American and Russian colleagues first planned the joint expedition at a meeting of scientists in June 1988. About one third of the U.S. contingent, funded by the National Science Foundation, came from Columbia's Lamont-Doherty Geological Observatory. About 60 people participate, including scientists and research personnel from Oregon State University, the University of Southern California, the University of North Texas, the University of Washington, the U.S. Cold Region Research Environmental Laboratory in Hanover, N.H., Science Application International Corp., in Seattle, Washington and McPhee Research Company in Naches, Washington.

A total of 60 researchers spent time aboard the floe, some rotating via airplane or ship, others remaining for the entire 117 day mission. The station supported a maximum of 32 at one time.

The expedition began in Montevideo Uruguay where the Russian vessel *Akademik Federov* was loaded. The ice floe on which Ice

Station Weddell was erected was sighted February 6 at 71deg35min S and 50 deg 01 minutes West. "It looks like a good home", one of the oceanographers said in a transmission to Lamont Doherty in New York from the *Federov*.

More than 80 tons of equipment and gear were transported onto the floe and ferried by bulldozer and helicopter from the edge to the interior, taking precautions to distribute weight evenly and avoid triggering breaks in the ice. Food, fuel, survival gear and living quarters were also widely deployed in case a break-up occurred. Some cracks did open, but the floe did not break apart.

Two area of living quarters, called South Town and North Town, were on either side of the mess hall area comprising storehouses, generators, latrines, and a sauna used on a weekly basis. Freshwater came from newly fallen snow. The expedition included a doctor and a chef. The scientists lived in pre-assembled Russian-built huts placed on skis and moved into position by bulldozers, or in 12 x 16 foot tents made of two layers of plastic. All were supplied with fuel heaters.

Temperatures ranged from about 29 deg F in February, the height of the Antarctic summer, to a low of -33deg F, with wind chill factors dropping to as low as -60deg F. Personnel were each issued with 72 pounds of polar clothing.

"Its amazing how fast you can get into four layers of clothing at 2 a.m. when your heater malfunctions and temperatures are between -23 deg F and -28deg F" said Columbia's Douglas Martinson, chief scientist at the Ice Station Weddell from 11 March, when he flew onto the floe, until April 30, when he departed via the *Palmer* the new US research vessel that was on its first mission.

Contaminated fuel that clogged heaters and temporarily grounded helicopters (see Antarctic Vol 12. No.7 pages 232ff) remained the expedition's major problem. On April 1 members of the 437 Airlift Wing were despatched from Charleston, S.C. to parachute 5,865 gallons of new fuel to the floe.

In a dispatch from Ice Station Weddell, Dr Martinson reported: "The fuel drop was a complete success – 100 percent of the fuel survived the drop, which came right on schedule. The C-141 made three low-level passes over the camp, the first to check out the drop zone, the second to drop 10 bundles, each weighing 1,600 pound and comprising four barrels of fuel and the third to drop the remaining 19 bundles.

Overnight snowstorms often created eight foot drifts that buried equipment and sealed personnel in their tents; escape came through special zippered hatches or by a request via walk-talkie for outside help to shovel out doorway.

Poor contrast between sky and ice and the absence of shadows hampered visibility, causing camp dwellers occasionally to walk directly into snowdrifts or fail to notice sudden rises or depressions in the ice. But there were glorious sunsets as well as the intricate "frost flowers" that formed on wires. There were also surprises. One night, while sleeping in his tent next to a hole drilled though the ice for experimental work one scientist was awaked by the "sound of Darth Vader-like breathing. I saw bubbles coming from the hole, he said, and the air in the tent was suddenly befouled. A seal had come up for a breath of air.

There were no injuries or illnesses on the expedition other than mild frostbite and minor bruises. "This is amazing given the opportunity for accidents in a place like this" Dr Martinson wrote in a dispatch, "things like serious frostbite or falling into leads. openings in the floe that refreeze with a thin layer of ice.

Packed in by other floes and accompanied by a few icebergs the floe drifted northward at a top speed of ten miles per day when strong winds blew from the south. Other days, it barely moved.

The floe generally followed the path of Sir Ernest Shackleton's ship *Endurance* in 1915. That ill-fated ship had become trapped in the ice and over more than nine months had been carried 570 miles north before being crushed by the ice pack and sunk.

Station disbanded

US and Russian Icebreakers, the *Nathaniel B. Palmer* and the *Akademik Federov* met southeast of the Orkney Island on May 25 and reached the ice floe at 65deg87minS and 52 deg75min W in the western Weddell Sea, about 900 miles south of the tip of South America on Thursday 4 June as expected. The drift on the 6.5 foot thick, 1.7 square mile floe began on February 7 and took the team nearly 400 miles through the Antarctic's Weddell Sea.

On 5 June the 32 scientists and support personnel began to leave the floe, loading gear and scientific instruments aboard the vessels over the next five days leaving nothing behind.

"The science objectives of the programme were met with a vast array of information collected on the ocean, atmosphere and sea-ice in this remote and unexplored part of the planet....Already an early assessment of the data suggests that we will have to alter our views on how this region fits into the global climate system," reported Dr Arnold Gordon, Professor of Oceanography at Columbia University, in a satellite message relayed from the ice floe. He is a physical oceanographer at Colombia's Lamont-Doherty Geological Observatory and was coordinator of the two-nation expedition's science programmes.

The researchers had conducted a wide range of studies on the formation and movement of sea ice, the ocean currents beneath it, the atmospheric conditions above it and the rich marine plant and animal life under and in it.

In short, they lowered instruments in holes drilled through the ice; used air balloons to measure atmospheric conditions, dived in the frigid waters beneath the ice, collected samples of plankton and krill from below and within the ice and flew helicopters to deploy buoys and take measurements across a wide region.

During trips to the ice station the *Palmer* and the *Federov* also made observations of the ocean and sea ice east and north of the station. "The entire western rim of the Weddell Basin has also been mapped in great detail.

Among the initial discoveries, the scientists found that the continental slope off the Antarctic Peninsula is about 62 miles further west than previously thought, a fundamental topographic difference that will change scientists understanding of ocean circulation patters, Dr Gordon said. They have also found clues that may explain the mystery of why the western Weddell is covered by ice all year, unlike areas to the east where ice melts in summer and remains thin even in the winter.

Expedition scientists gathered the first extensive data on the rates of heat exchange between the atmosphere and ocean, the intervening role of the sea ice cover, and the circulation of the ocean below the ice in the Weddell Sea.

The poles are critical regulators of the Earth's climate because they are only places cold enough for the vast reservoir of the oceans' deep waters to be able to release large quantities of heat, carbon dioxide and other gases into the atmosphere. In the western Weddell Sea, water becomes cold and dense enough to sink and spread along the sea floor into most of the world's oceans - a phenomenon responsible for maintaining low temperatures in the oceans' deep interiors.

A thin layer of water, called a pycnocline, separates cold surface waters from deeper, warmer waters in the western Weddell. After gathering measurements of temperature, salinity, heat fluxes and currents through many oceanic layers as the ice floe drifted northward, the scientists now believe that this pycnocline is strong and stable in the western Weddell and prevents warmer waters from rising and melting the ice.

By contrast, warm waters do occasionally rise to the surface of the eastern Weddell, melting sea ice. The cold refreezes the ice, but as it does, salt is released, destabilising the pycnocline and allowing warm waters to reach the surface and melt the ice again in a cyclcline process. The scientists now think that cold air funneling up the Antarctic Peninsula brings more snow to the western Weddell, which deters the melting of sea ice and helps maintain

the pycnocline barrier, Dr Gordon said. The snow, which holds many air pockets, insulates the sea ice from warmer atmospheric temperatures in the summer, preventing melting. Summing up his views of the expedition, Calvin Mordy, a scientist from the University of Southern California wrote ...."Few studies have been undertaken in this part of the world, and most of those have been the result of unfortunate circumstances. Ice station Weddell, provided a unique opportunity to study biological and physical developments in the ice over several months. Thus, we have not a snapshot of these processes but a videotape.

"Finally, the ice camp has also provided Russian and American scientist s with a unique opportunity to collaborate, not only in science but also in life. While I take home some wonderful data and new perspectives in science, perhaps I will be most enlightened in my heart towards Russian people."

U.S. Coast Guard reviews icebreaker contract

The US Coast Guard has cancelled the contract solicitation for a new ice breaker because the bids were significantly over budget. Advice has been sought from the polar research community in the United States and negotiations are now underway for a new design more in keeping with the funds available. The vessel was to have been a sister ship for the *USCGC Polar Sea* and *USCGC Polar Star* both of which are capable of cutting through six foot thick ice at three knots, but is likely to have a reduced capability enabling it to cut ice four to four and a half feet thick at three knots. Special research facilities however, are still likely to be incorporated.

Sub-Antarctic

Merger of Falkland's Conservation organisations

The Falkland Islands Foundation and the local Falkland Islands Trust, two organisations concerned with the natural history and historic heritage of the Falkland Islands, have merged to form a single body called Falklands Conservation. Its aim is to promote the conservation of wildlife, wrecks and places of historic interest in the islands, with much more local involvement than previously. The Falkland Islands Government has granted the new organsiation 50 percent core funding for its first year of operation: the remainder which will be sought outside the islands. Among projects to be promoted are seabird monitoring programmes, surveys of sea lions and tussock islands, production of education material, archaeological surveys of historic sites and the stabilisation of hulks in Stanley Harbour. (*Source: Falkland Islands Newsletter, August, 1991. Polar Record, January 1992.)*

Heat on Heard Island

A small article written by Ken Green, a member of the Heard Island wintering party and appearing the the autumn 1992 edition of Anare News, describes the highest temperature recorded by ANARE on the Island.

The party were on the Spit when at 1700 local time on Sunday April 11 they were hit by a foehn wind. "Within minutes the air temperature had risen to about 20 degrees. Rising air cooling on the windward side of Big Ben by 0.5deg C every 100m caused precipitation. On the leeward side, the now dry air descended, warming at the adiabatic dry rate of 1.0 degrees/100 metres" producing a sudden rise in temperature accompanied by strong

winds throughout the night. The camp at Spit Bay is very sheltered but "just offshore the wind was lifting slabs of water out of the sea and exceeding 100 knots." During the night the temperature peaked at 21.6deg C. Nothing approaching this temperature had been recorded previously for the Anare meteorological records, the previous maximum 14.4deg C in February 1951.

In June, 1991 the Treaty nations, at the 16th Consultative meeting held in Bonn recognised the 30th anniversary of the Antarctic Treaty with the following:

DECLARATION BY CONTRACTING PARTIES TO THE 30TH ANNIVERSARY OF THE ENTRY INTO FORCE OF THE ANTARCTIC TREATY

The Representatives of the Contracting Parties present in Bonn for the XVIth Antarctic Treaty Consultative Meeting:

***Recalling** the Antarctic Treaty, done at Washington on 1 December 1959 and which entered into force on 23 June 1961;*

***Reaffirming** the objective of the Treaty to ensure, in the interest of all mankind, that Antarctica shall continue for ever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord;*

***Noting** with pleasure the continuing growth in the number of states acceding to the Treaty;*

***Conscious** of the measures adopted pursuant to Article 1X of the Treaty and the associated and separate conventions regulating their activities in the Antarctic;*

***Welcoming** the recent adoption in Madrid of the Protocol on Environmental Protection to the Antarctic Treaty which designates Antarctica as a natural reserve devoted to peace and science; and*

***Convinced** of the continued effectiveness of the Antarctic Treaty for cooperation in Antarctica;*

***Declare** that in the interests of all mankind Antarctica shall continue to be used exclusively for peaceful purposes, and in this regard, dedicate themselves to enhancing further their record of cooperation in a decade of international Antarctic scientific cooperation, 1991 to 2000, and record their achievements over the first thirty years of the Antarctic Treaty as set out in the Annex.*

ANNEX
30TH ANNIVERSARY OF THE ENTRY INTO FORCE OF THE ANTARCTIC TREATY

A unique agreement for a unique continent.

The Antarctic Treaty has for thirty years united countries active in Antarctica in a uniquely successful agreement for the peaceful use of a continent. Scientific research conducted by the Treaty Parties, and the cooperation between them, have signaled to the world that nations can work together for their mutual benefit and for the benefit of international peace and cooperation. Antarctica is the largest unspoiled continent on earth and Treaty Parties have committed themselves to its study and to protecting its unique environment. The Antarctic Treaty provides an example to the world of how nations can successfully work together to preserve a major part of this planet, for the benefit of all mankind, as a zone of peace, where the environment is protected and science is pre-eminent.

Thirty years ago

The Antarctic Treaty was adopted by twelve governments in 1959 at a time when other parts of the world were subject to international tensions. The governments of Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, the Soviet Union, the United Kingdom and the United States, which had conducted scientific research in the Antarctic during the International Geophysical Year, were convinced that the unique opportunities that the Antarctic presented for science should not be jeopardised by disputes between them. The Treaty, which entered into force on 23 June, 1961, ensures that in the interests of all mankind Antarctica shall continue for ever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord.

A continent devoted to peace and cooperation

The Antarctic Treaty contains farsighted means to achieve its objectives. It prohibits measures of a military nature and prohibits nuclear explosions and the disposal of radioactive wastes. The Treaty guarantees freedom of scientific research and promotes international scientific cooperation. Article IV of the Treaty ensures that differing positions regarding claims to territorial sovereignty do not prevent Parties to the Treaty cooperating in the pursuit of the Treaty's objectives. It provides for exchange of detailed information about activities in Antarctica and allows observers complete freedom of access to all areas of Antarctica to ensure that the provisions of the Treaty are respected by Parties to it. The Treaty has, through these means, been outstandingly successful in achieving its objectives.

The strength of the Antarctic Treaty continues to grow and Parties to the Treaty now represent over 70% of the world's population. Following their access to the Treaty, Brazil, China, Ecuador, Finland, Germany, India, Italy, the Republic of Korea, the Netherlands, Peru, Poland, Spain, Sweden, and Uruguay have joined the original signatories as Consultative Parties. The Consultative Parties have welcomed the access to the Treaty of Austria, Bulgaria, Canada, Colombia, Cuba, Czechoslovakia, the Democratic People's Republic of Korea, Denmark, Greece, Guatemala, Hungary, Papua New Guinea, Romania and Switzerland.

In accordance with Article IX of the Treaty representatives of the Parties meet regularly to exchange information and consult together on matters of common interest and to formulate and recommend to their governments measures in furtherance of the objectives of the

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Who are the Treaty Parties?

The Antarctic Treaty entered into force on 23 June 1961, when there were 12 signatories. There are now 40 Contracting Parties to the Treaty, of which 26 are Consultative Parties (ATCPs):

Party	*Date of ratification or accession, status*
Argentina	23 June 1961 ATCP, original signatory, claimant state
Australia	23 June 1961 ATCP, original signatory, claimant state
Austria	25 August 1987 Acceding state
Belgium	26 July 1960 ATCP, original signatory
Brazil	16 May 1975 ATCP from 12 September 1983
Bulgaria	11 September 1978 Acceding state
Canada	4 May 1988 Acceding state
Chile	23 June 1961 ATCP, original signatory, claimant state
China	8 June 1983 ATCP from 7 October 1985
Colombia	31 January 1989 Acceding state
Cuba	16 August 1984 Acceding state
Czechoslovakia	14 June 1962 Acceding state
Democratic Peoples Republic of Korea	21 January 1987 Acceding state
Denmark	20 May 1965 Acceding state
Ecuador	15 September 1987 ATCP from 19 November 1990
Finland	15 May 1984 ATCP from 9 October 1989
France	16 September 1960 ATCP, original signatory, claimant state
Germany*	5 February 1979 ATCP from 3 March 1981
Greece	8 January 1987 Acceding state

Guatemala	31 July 1991	Acceding state
Hungary	27 January 1984	Acceding state
India	19 August 1983	ATCP from 12 September 1983
Italy	18 March 1981	ATCP from 5 October 1987
Japan	4 August 1960	ATCP, original signatory
Netherlands	30 March 1967	ATCP from 19 November 1990
New Zealand	1 November 1960	ATCP, original signatory, claimant state
Norway	24 August 1960	ATCP, original signatory, claimant state
Papua New Guinea	16 March 1981	Acceding state
Peru	10 April 1981	ATCP from 9 October 1989
Poland	8 June 1961	ATCP from 29 July 1977
Republic of Korea	28 November 1986	ATCP from 9 October 1989
Romania	15 September 1971	Acceding state
South Africa	21 June 1960	ATCP, original signatory
Spain	31 March 1982	ATCP from 21 September 1988
Sweden	24 April 1984	ATCP from 21 September 1988
Switzerland	15 November 1990	Acceding state
Union of Soviet Socialist Republics†	2 November 1960	ATCP, original signatory
United Kingdom	31 May 1960	ATCP, original signatory, claimant state
United States	18 August 1960	ATCP, original signatory
Uruguay	11 January 1980	ATCP from 7 October 1985

*The German Democratic Republic was united with the Federal Republic of Germany on 2 October 1990. GDR acceded to the Treaty on 19 November 1974 and became an ATCP on 5 October 1987.

†From December 1991 the Soviet Union's Antarctic activities became the responsibility of the Russian Federation.

It was originally prepared by Robert Headland of the Scott Polar Research Institute in Cambrige, UK.

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Treaty. In 1964 the Parties adopted the Agreed Measures for the Conservation of Antarctic Fauna and Flora. Two separate conventions, the Convention for the Conservation of Antarctic Seals and the Convention for the Conservation of Antarctic Marine Living Resources, have subsequently entered into force.

Committed to protecting the environment

On 4 October 1991 the Parties adopted in Madrid the Protocol on Environmental Protection to the Antarctic Treaty. The Protocol, which is an integral part of the Antarctic Treaty, designates Antarctica as a natural reserve devoted to peace and science. It establishes a comprehensive legally binding regime for ensuring that activities that parties undertaken in Antarctica are consistent with protection of the Antarctic environment and its dependent and associated ecosystems.

Thirty-one Contracting Parties to the Antarctic Treaty signed the Protocol on the date of its adoption, and have committed themselves to taking the necessary steps to achieve the earliest possible entry into force of the Protocol. In the meantime, parties will ensure that as far as possible and, consistent with their legal and constitutional processes, the provisions of the Protocol in 1991 is a fitting tribute to the thirtieth anniversary of the Antarctic Treaty and signals the commitment of Parties to the future strength of the Treaty.

A priority to science

The Antarctic Treaty Parties are fully committed to scientific research in Antarctica which has been effectively coordinated by the Scientific Committee on Antarctic Research since the 1950s. Parties have long recognised the fundamental role that Antarctica plays in understanding global environmental processes and the unique opportunity it provides for research.

Antarctica provides an outstanding opportunity for a the free conduct of science for the benefit of all mankind. It is a pristine laboratory, of world-wide significance, which has enabled research to detect and monitor global environmental phenomena such as the depletion of atmospheric ozone, global warming and sea level changes. Antarctic meteorological research has provided data essential to forecasting in the Southern Hemisphere. Glaciological research provides important information about the heat exchange budget and Antarctica's influence on weather and climate. Geophysical research in Antarctica provides new insights into global geological history and the formation of continents. The earth's geomagnetic field makes Antarctica particularly well suited to the study of solar-terrestrial interactions and cosmic rays which travel from outside our galaxy. The extreme environment of the Antarctic provides unique opportunities to study the specialised adaptations of organisms with their environment, and biological research is providing data essential to informed decision-making about marine living resources. Human biology and medicine provides information on the physiological adaptation of man to extreme climates and isolation. The Treaty Parties have ensured that the results of these important research efforts are freely available to all mankind.

A natural reserve devoted to peace and science.

The Antarctic Treaty Parties are proud of their achievements over the last thirty years and the example of peaceful cooperation that the Treaty provides to the rest of the world. The determination of Parties to maintain and strengthen the Treaty and to protect Antarctica's environmental and scientific values is convincingly demonstrated in their adoption of the Protocol on Environmental Protection to the Antarctic Treaty and their decision to designate Antarctica as a natural reserve devoted to peace and science.

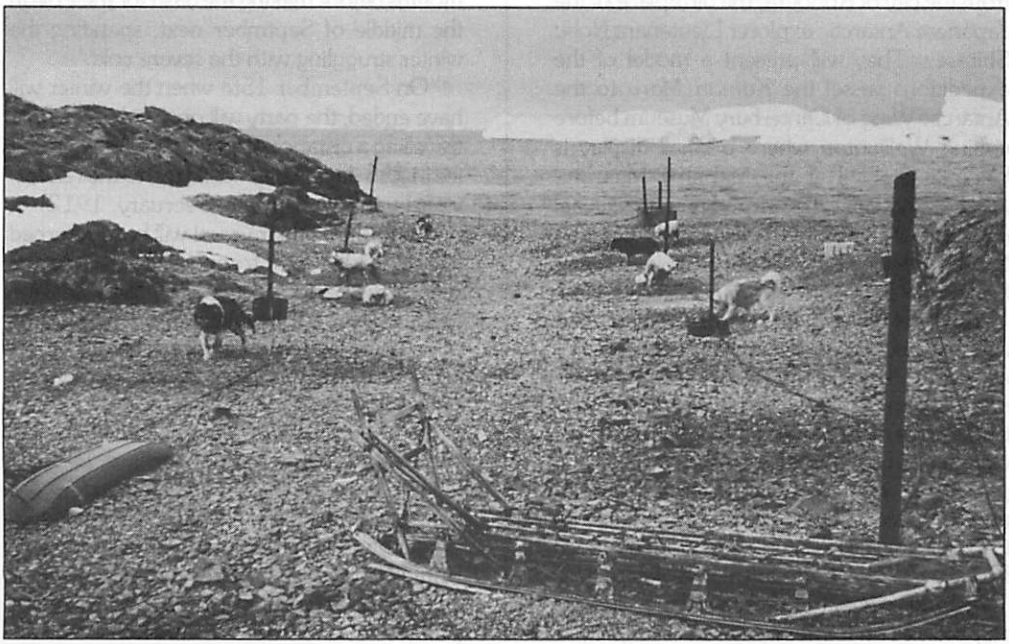
Dogs to be removed from Antarctica

Annexed to the protocol for the Comprehensive Protection of the Antarctic environment agreed to at Madrid in 1991 are revised provisions for the Conservation of Antarctic Fauna and Flora. These establish measures to control the introduction of non-indigenous species thus banning further dogs on the continent of Antarctica and call for the removal of all dogs in the Treaty area by 1 April 1994.

Australia, Argentina and the United Kingdom are currently the only countries still maintaining dog teams in Antarctica.

The Australian dogs, of which there are 27 are based at Mawson and are used for recreational purposes and some field trips. Antarctic Division has set up a committee comprising Rob Easther, Operations Manager for Davis-Mawson, Mark Conde, computer systems officer and dog handler for two winters at Mawson, Rod Ledingham, field equipment and training officer and manager of the dog teams and Robyn Taylor, quarantine officer to examine ways of removing the dogs with minimal stress and respect for their traditional role in supporting expeditions. Also on the committee is Mrs Margaret Gibson, a representative of the Antarctic Animal Care and Radiation Usage Ethics Committee and member of the committee of the RSPCA in Tasmania. The final decision on the removal of the dogs will be taken only after thorough consultation with interested persons and organisations. Ros Kelly, Minister responsible for the programme said that no dogs will be destroyed as a result of the decision to

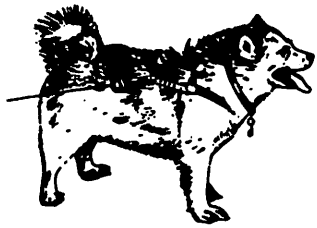
The dog lines at the Argentinean Station General San Martin photo - Dave Geddes, DSIR Antarctic



remove them.

Argentina has a team of 14 dogs at Esperanza which are being used to provide logistic support for scientific programmes. Under the agreed measures they will be removed from the Treaty Area in December 1992. Current plans are to allocate them to the relevant institutions in areas with climatic conditions.

The British Antarctic Survey have 20 dogs, all stationed at Rothera where they are used exclusively for recreational purposes. None of their dogs will be removed from Antarctica; they will instead be allowed to live out their natural active lives. Breeding has stopped but some, at least, of the existing dogs are expected to remain at Rothera for about another seven years.



Exhibition

The Japanese Antarctic Expedition

Among the contributors to the forthcoming festival of Japan to be held in Christchurch, New Zealand in July are a group of dignatories from the city of Konoura, the birthplace of the Japanese Antarctic explorer Lieutenant Nobu Shirase. They will present a model of the expeditions vessel the *Kainan Maru* to the Antarctic Wing of Canterbury Museum before visiting Wellington where a small display is being assembled at the Maritime Museum. Among the will be Mr Nohumitsu Oyagi (Director of the Shirase Antarctic Expedition Memorial Museum), and Mr Kosiwoki (a former leader of a Japanese Antarctic Survey Team).

Relatively little is known of the Japanese Antarctic Expedition but on Thursday 9 February, 1911 the Christchurch Press carried a story stating the following item had appeared in the Japanese papers. "At Wellington the expedition will take in a supply of coal and provisions, and enter the Antarctic Sea and after proceeding 2172 miles, struggling with icebergs and floes, will it is hoped, reach Edward VII Bay about the middle of February. There the expedition party will land, and the ship will return immediately to Wellington, as it is considered dangerous for the vessel to stop in the Antarctic. Meanwhile, the party will carry out explorations on shore for about seven months before making the dash for the Pole in the middle of Septmber next, spending the winter struggling with the severe cold."

"On September 15th when the winter will have ended, the party will proceed to the Pole travelling a distance of over 900 miles over the ice in 155 days. They will return to the rendezvous by the latter part of February, 1912.

"By this time their vessel will have returned to Edward VII Bay from Wellington and will receive the party. On arriving in New Zealand fuel and water will be taken in, and the expedition will arrive back in Japan in July, 1912. The time occupied by the expedition is estimated at one year and nine months."

The *Kainan Maru*, the expedition's vessel was a three masted schooner, just 108 feet long, with a beam of 24 feet and a displacement of 204 tons. She was owned by Shigenofu Okuma, Count Okuma, presiosly Prime Minister of Japan and Minister of Foreign Affairs. It had been purchased for 2,500 pounds and her hull of three inches thick

doubled for strength by a resheeting of wooden planks from her keel to the foot above the water line. Outside she was further sheeted with steel plates. The vessel was only ten months old having been built for a deep sea fishing company and first named the *Hoko Maru*. Inside conditions were primitive with bunks surrounding the small but warm comfortable saloon on all sides. It was used for accommodation for the officers and scientists. A table filled the whole of the open space; only the captain, leader and another officer had cabins of their own. A tiny chart room was situated aft facing the steering. It was not possible to stand up in it unless the stairs of the adjoining companionway were used.

The leader

Renamed the *Kainan Maru* meaning "Boat to open the South" she left Tokyo on 1 December 10 under the command of Captain Naokichi Nomura. On board was the expedition's leader Lieutenant Nobu Shirase and 26 crew and expedition members.

Shirase, is described in the press of the day as "a brave and determined soldier", who had spent several years preparing himself for the attempt to plant his country's flag at the South Pole. He was the sole survivor of Lieutenant Gunti's expedition to the Kurile Islands in 1893 and passed two terrible years on the island of Shenshu where all his companions died of cold and starvation before a warship reched the scene with a relief party. Since that time he had fought amid the snows of Manchuria and travelled and lived among the eskimoes in the Far North to acquire polar experience. He did not drink, invariably ate cold food and never took medicine of any kind. A member of the Japanese Commissariat he had for some years been fascinated by Polar expeditions and had enlisted the support of a General Kodama for a north pole expedition. However the General died, the war with Russia intervened and when Peary led an expedition to the north pole Shirase's attention turned to the south.

At 2 p.m. on 8 February 1911 the *Kainan Maru* sailed into Wellington Harbour, her decks packed with six sledges, a strong shallow boat for use in the ice, limited scientific equipment and stores and a dozen Siberian dogs, 16 having died on the voyage. A special flag comprising the Southern Cross with one of the principle stars in the constellation missing and the other four connected by bands of red was flown from the vessel.

Having secured port clearance the Lieutenant, dressed in a khaki uniform with red facings and carrying a sword and gloves, came ashore with others from the party to make contact with Mr T.M. Young, a Wellington Barrister and Solicitor and Japanese Consul. The immediate but constant language problem was solved by Mr Hwang, the Consul-general for China who could speak a little Japanese. Apparently no-one on board spoke any English which was to lead to suspicion and misunderstanding.

Expedition members

The chief officer was Z Takao, second officer T. Tsuchiya, chief engineer K. Shimzu, botswain K. Sakai, carpenter I Jasuda, sailormen K. Shibada, T. Fukushima, S. Takagawa. I. Sato, J. Kamada. K Watukabe, firemen K. Fujihira, R Sujicaji, S Takatori. The actual party to make the dash to the Pole was to consist of Lieut Shirase, K. Watanabe, G. Zamabe, S Miura, S. Havamari, S. Niusha, T. Takeda, S. Tada and K Nishikawa, G Yashino and S. Matsumura, a total of 11 men. Zamabe at the age of 44 was the oldest in the party, Shirase was 43, Hanamari and Mushi each 34, Takeda, 33, Tada 29, Mura 28, Watanabe and Matsumura each 27, Nisikawa 26 and Goshino 25.

The supplies

During the next three days they took on board, 15,000 gallons of water, amd coal for the vessel's small compound surfacing condensing auxilliary engines which drove a four

bladed propellor and gave a speed of five knots an hour.

According to the customs manifest quoted in the press of the day the food purchased in Wellington comprised 90 bushels of rice, 90 bags of flour, three bushels of wheat, one bay of soya beans, two bags of peas, two bags of arrowroot, three dozen loaves of light white bread, 10lb of dried cuttle fish, two boxes of pastry, 40 dozen cans of meat, 12 casks of pickled plums, 143 casks of Takawonzuke, 12 casks of rakyo, four boxes of butter, five boxes of meat and three dozen cases of sauce. two boxes of cured beans, two boxes of onions, ten bags of salt, two boxes of coffee, five boxes of bread rice, three sacks of potatoes, five boxes of brown bread, two boxes of tea, 60lbs of tobacco and 300 bundles of charcoal for fuel. (Notably absent were the pemmican and concentrated foods of the European explorers; the Japanese clearly intended to live much as normal.)

The route

A representative of the New Zealand Times was shown a bromide print of an Admiralty chart, corrected to April 1910, on which, Shackleton's route was indicated. The expedition was not provided with an actual chart of the South Polar regions, as it was expected that one could be obtained in New Zealand. "Unless this expectation turns out to be correct, the Kainan Maru will have to be navigated South of latitude 60 upon a photograph reproduced eight inches by ten inches in size," the reporter wrote.

Shackleton had landed at the eastern end of the Barrier, the Nimrod penetrating to latitude 77deg 50 but Biscoe Bay, to the westward and nearly two degrees more to the north, appeared to be the actual objective of the Kainan Maru. This point should have been ice-free later in the season than McMurdo Sound, so that the explorers could make a good landing even though they were starting from New Zealand a month later in the season than Shackleton considered advisable.

The course tentatively mapped out for the *Kainan Maru* lay to the westward of all marked ship's tracks, the nearest being that taken by Sir James Ross when returning north in February, 1842. Thus it was evident that the Japnese, if they were to achieve success would reach the Pole along an entirely new route. Biscoe Bayis in King Edward VII land and near it is a mountain 1450 feet high, the only bit of identified land in the vicinity."

As the *Kainan Maru* weighed anchor at 3.30 p.m. on 11 February, 1911 a small flotilla of local yachts accompanied her to the Wellington heads along with the steamer *Duchess* whose passengers cheer was answered similarly by the crew.

The departure

Prior to her departure the Marine Department issued the captain with a Nautical Almanac and navigation tables and the Government Meteorologist inspected the scientific instruments while others of his staff checked the barometers and gave the standard time.

For most of the journey south the expedition encountered gales and storms. They saw their first iceberg on 26 February and sighted land on 6 March. Having reached the coast of Victoria Land, conditions made it impossible to proceed and Shirase ordered the ship turned and they made for Sydney Habour. It anchored off Double Bay on 1 May, 1911 and later moved to Vaucluse Bay where the team established a hut, 30 ft by 15 ft intended for their Antarctic base but now used for the scientists and reception of stores while the ship was refitted.

A report in the Sydney Morning Herald of Tuesday May 2 stated that "On March 10 the vessel was off Coulman Island in the Ross Sea, an islet lying near the coast of South Victoria Land. The weather was bad, the ice was forming strongly. It was too late, the summer was gone. For days the *Kainan Maru* hung off and on, avoiding the icebergs and keeping

clear of the pack. Ten of the 11 dogs that were taken died. It was immpossible to land. Commander Shirase determined to give up his plans for the present and make for Syndey to wait until the winter was over.

The arrival of the ship in Sydney evoked great mistrust of the expeditions real intentions. Language was certainly part of the problem. The Sydney Morning Herald reported "The appearance of the vessel and what could be seen of the equipment leads one to the belief that nothing so serious as a dash for the Pole is part of the plan of the expediton. There is little about the schooner to give the impression that she is a polar ship except the crow's nest at the mainmast head. She is certainly heavily beamed, but her planking does not seem to be specially designed for exploration in ice regions."

The others

With both Scott and Amundsen already in McMurdo Sound, Mawson in the throes of organising an expedition of his own, German plans being developed, the Japanese were regarded by some as poachers on Captain Scott's scientific territory. Mawson is even alleged to have claimed that they were simply evaluating whale stocks in the area! Scott, when told of their plans, cautioned never to underestimate the Japanese.

Both Scott and Shackleton's expeditions had created enormous interest in New Zealand and in Australia and the press had acquired certain observational expertise regarding the equipment carried aboard the Japanese vessel and indulged in much speculative comparison. The late departure of the *Kainan Maru* had not gone unnoticed either.

Shirase however obtained the respect of Professor Edgeworth David, a member of Shackleton's 1907 expedition and this helped restore some credibility to the Japanese programme and he may indeed have been influential in their apparent change of plans.

In an interview with the Daily Telegraph in Sydney (3 May, 1911) Edgeworth David explained "At Cape Adare there are three huts -two built by the expedition under Borchgrevink, fitted out by Sir George Newnes and a third recently erected by Lieutenant Campbell. It would appear that Cape Adare would have been the only possible place where the Japanese expediton could have landed in the middle of March. But this locality is not favourably situated for a dash to the Pole, inasmuch as it is over 450 miles to the north of Captain Scott's base and over 500 miles to the north of Amundsen's base. At the same time, it is a conveniently situated base for studying the geology of the great coast range, known as the Admirality Range, lying to the north-west of the Ross Sea, and also for the further exploration of the magnetic pole region, which is nearly equidistant from Coulman Island and Cape Adare, lying approximately 330 miles west-north-west of the former and the same distance west-south of the latter."

The second voyage

The ships departure was delayed as it waited for the arrival of some of the crew, captain and some replacement dogs from Saghalien. (It had been rumoured that Shirase had returned to Japan to raise additional funds while the rest of the party remained in Sydney but in fact some members did return to Tokyo to lay the position of the expedition before its promoters, the head of which was Count Okuma. Shirase however was not one of them.

Shirase had been given 15,000 pounds for the expedition, less the amount paid for the *Kainan Maru*. The sum was expected to last three years and to cover the stores, clothes, seamen' wages. The bulk of the funding, which had come from Count Okuma, was supplemented by other patriotic Japanese.)

Edgeworth David's continued interest and the sustained publicity led to the belief that the scientists aboard the expedition were not bent upon locating the pole at all but were anxious to procure some of the mineralogical and

zoological specimens known to be peculiar to the Antarctic regions. However plans published in the Daily Telegraph on Monday 20 November, 1911 then indicated that their first landing place was to be the Great Ice Barrier where members were to separate, one party going as far south as the 84th parallel while the other spent time exploring the region in the vicinity of the 78th parallel. Eventually the whole party were to re-assemble where they had left the ship and steer a course for King Edward VII Land. After exploring this territory they would head for Admiralty Island and then return to Sydney. Shirase wrote to Edgeworth David, thanking him for his support and generosity during their stay and on 17 November 1911 the ship left Sydney.

The return

On March 24, 1912 the *Kainan Maru* appeared at the Wellington Heads. For a time she lay close to Soames Island until a berth was allotted to her. She had been away 124 days. Nothing had been heard of the vessel between her departure from Sydney and arrival in Wellington but apparently she had gone straight to the Bay of Whales where a party was landed before the ship proceeded south. At the Bay of Whales, she encountered the Fram awaiting Amundsen's return from the Pole. Although visits were exchanged, language problems again made communication difficult. Their next call was was made at King Edward VII Land where a party was landed to explore the coast before the vessel went further into unknown territory.

"We confined our attention to scientific exploration. The results will be communicated to Tokyo, and I am sorry that I cannot add more except to say that we returned to King Edward VII land and the Bay of Whales for the parties who were landed there and picked them up. We left the ice on February 4," Lieutenant Shirase told the press through a translator in Wellington. The expedition had taken 47 days to work her passage north and the press assumed about the same time had been spent on the southward journey. This meant some 30 days in all in the Antarctic.

The programme

The plans, too, had been much altered; the dash to the Pole being a definite early motivation to which Shirase had made a public committment in Japan and "all the other members of the expedition had taken an oath not to return to Japan until they had reached the South Pole."

"It is admitted that the expedition is not nearly as complete as Captain Scott's or Amundsen's, but these Japanese explorers are nothing daunted. Even if they learn that Scott has reached the Pole before them, even if Amundsen has, they will go on, for the sake of their honour and the glory of Japan. From 78 south lattitude to the Pole was a distance of about 759 miles in a straight line, and probably they would have 1000 miles to cover. They reckoned on covering 18 miles a day, so that it would take between 50 and 60 days to do it. But the Pole is very high and 78 south latitutue is very low."

The returning crew and exploring parties were in excellent health, the ship which had largely depended on sail for power was in good order. Only six of the 30 dogs taken south however survived. As for the scientific programme it remained certain that two parties were landed, one reaching 80deg 5" South about 100 miles south of the barrier.

According to the Reader's Digest account of the expedition, at the Barrier Shirase was now faced with the task of getting his party to the top of the ice shelf which was 90 metres (300ft) high at the place where the *Kainan Maru* was moored. For 60 hours the entire crew laboured to cut steps to the top and and a small party investigated the ice shelf returning with encouraging reports. Shirase then put ashore his "Dash-patrol" which comprised seven men, two of whom were to remain at the ice edge in the base camp while the other five

would take sledges and dogs to the Pole. Blizzards and the loads the dogs were expected to pull retarded progress and the team turned around after covering 257 kilometers and reaching 80deg5'South on January 28 where they saluted the Emporer and buried a copper case containing a record of their visit.

In the meantime the ship had dropped another shore party at Biscoe Bay in King Edward VII Land. They reached the Alexandra Range before erecting a memorial board and returning to the ship which then headed to the Bay of Whales but because of conditions, was not able to pick up the Dash patrol until 2 February. The vessel then turned for home calling in at Wellington.

The science

On April 12 the New Zealand Times ran a further story quoting Professor Takeda "We cannot give you full information at present" he said "We are preparing to hand over a record of the trip to Professor David. This we will do when we get back to Japan, and he will forward the account on to the Cambridge University in England. The work will be of considerable value, including, as it does meteorological, astrononical as well as biological and geological observations. After we left Sydney on November 19 we went south straight to the Bay of Whales which is in 78deg S latitude and 145 degress to 164 deg W longitude. Here we took triangular surveys and collected a large variety of stones, rocks etc. To one part of a very big icefield we gave the name of Yamato Plain."

"A great question in the scientific world is whether King Edward VII Land and Victoria Land are connected by land. We have proof now that King Edward VII land is an Island. Professor David thought this too. Another interesting observation was as to the structure of the ice barrier, and the cause of the peculiarities in its formation. We specially consulted Professor David before we left on this matter, and we took a specimen and made microscopical investigations which cause great interest.

"We found the Land at the Bay of Whales and King Edward VII different from what it is shown on the chart. We surveyed both land and sea. The specimens were collected here, the soundings and other data, we will hand over to Professor David before proceeding to Japan. We also investigated all tides, the warmth of the water, its saltiness and other things. We had four trips in the Ross Sea and took the average of each observation. The photographic work we are preparing to send to Sydney University from Japan".

Left to time

Doubts however still remained. Earlier on Monday March 25 1912 the New Zealand Times had reported "The statements" regarding the expedition "are perplexingly vague, and a further account of the discoveries that were made beyond King Edward VII Land will be waited with keen interest. If Lieutenant Shirase has found open water beyond that land, which has been regarded as the eastern limit of the Ross Sea, and has been able to proceed in a south-easterly direction, he has done work of very great scientific importance. But it seems not improbable that what he readlly did was to leave the Ross Sea after landing his parties and then move eastwards along the ice-edge that was traced by Ross in 1842. In the absence of the Japanese leader's complete narrative it is impossible to make any precise estimate of the extent of his claim to be regarded as a serious Antarctic explorer. It will be well in the meantime to suspend judgement." The expedition which had left Japan amid speculation and doubt of its success returned home to Yokohama on 20 June as heroes. They had left Wellington on 2 April 1912 and during her voyages the *Kainan Maru* had sailed some 48,000 kilometers.

Refs: Reader's Digest, Antarctica; a series of

newspaper articles compiled on the Japanese Antarctic Expedition with the Kainan Maru during her calls at Wellington and Sydney in 1910-1912 compiled by Kou Kusunoki of the National Institute of Polar Research in Tokyo, Japan, 1977.

Three new Polar Medals awarded

The award of three new polar medals to participants in the New Zealand Antarctic Research Programme was announced in November 1991. Dr's Graeme Claridge of Wellington, Iain Campbell of Nelson and John Macdonald of Auckland are the recipients.

Dr Claridge worked for the New Zealand Soil Bureau, a division of DSIR, as a soil mineralogist with interests in soil genesis, formation and related topics. He first went to the Antarctic in October, 1959 with John McCraw, also of the Soil Bureau. Their instructions were to prepare a soil map of the Ross Dependency. They spent three months visiting various localities on Ross Island, Hallett Station and the Taylor Valley. As helicopter support was minimal they were taken across the Sound by Fergusson tractor, and, from a camp in New Harbour they walked the length and breadth of the valley. This field work resulted in the first, and only, detailed soil map of one of the dry valleys and a number of papers on the soils and physiography of the places seen. A soil map of the Ross Dependency was produced, but most of it was extrapolation from the limited area. The awareness of soils of a sort in Antarctica, and that useful scientific information on weathering in cold climates, and the beginnings of soil genesis, led to a number of other researchers becoming interested. However Dr Claridge recognised that the Taylor Valley could hardly be considered representative of the whole of the Ross Dependency and wanted to look further afield.

In 1964, accompanied by Iain Campbell, also of the Soil Bureau, he again went to Antarctica, looking at soils from a number of localities along the length of the Transantarctic Mountains, from Hallett Station in the north, to the Shackleton Glacier in the south. They used all available means of transport, including open field landings with DC-3 aircraft, manhauling, helicopters, when available, but mostly walking. This trip showed that, as expected, soils varied from place to place in a predictable manner, that they formed age sequences related to the glacial history and that they contained information on global atmospheric circulation, the recent Cenozoic history of Antarctica, and on the chemistry of weathering. Ten publications on various soil topics followed as a consequence of this field work and of the subsequent laboratory studies.

The next step was to study the soils exposed alongside one glacier, from where it left the inland ice to where it joined the Ross Ice Shelf. The glacier chosen was the Scott, at the apex of the Ice Shelf, where at its head were the two southernmost exposures of ice-free ground in the world. Along with two geologists, Rudi Katz and Barry Waterhouse, and two field assistants, they spent nearly three months traversing the glacier using motor toboggans, and obtained much valuable information.

In two subsequent trips, in the 1964-75 and 1977-78 seasons, Ian and Graeme revisited the Taylor Valley, worked extensively in the Wright and Victoria Valleys and also looked at soils on Mt Erebus. They revisited the Darwin area in 1978, and went into the Ellsworth Mountains in 1979, both in association with United States field camps. In 1982 they worked in the Mt. Howe-Convoy Range area, the most northerly of the extensive ice-free areas in the McMurdo Sound area. In 1984, they returned to this area, trying out a new technique of sampling the ice-cemented permafrost which is usually impossible to dig

The three medallists on their way to the ice; Drs John Macdonald, Graeme Claridge and Ian Campbell. Photographer unknown.

into. This time, they tried taking core samples with a diamond tipped coring barrel, which provided the first available samples of the material within the ice cement.

The pair continued to produce articles and in 1987 Elsevier in the States published a book entitled "Antarctica: Soils, Weathering processes and Environment" which they had written. It summarised much of the knowledge of Antarctica gained by the two over the years. Unfortunately the publication was to lose the authors their jobs, as, with the need to reduce costs by redundancy, it was noted that the book contained almost all that was known of Antarctic soils and further work on the subject was not required according to the Minister for the department at the time.

In recent years Graeme and Iain have formed their own company and as such are members of first private research organisation in New Zealand to have visited Antarctica twice, the first time during January and February 1990 and the second in November-December 1991, 32 years after Graeme first visited the continent. They have continued their work on ice coring cement. Their long term interest in, and observations on, the impact of man on the Antarctic environment have led to the study of the ice content of permafrost in relation to potential changes brought about by climatic warming or by mechanical disturbance. The work has been funded directly by the Foundation for Research Science and Technology.

Fish studies

John Macdonald is a zoologist/comparative physiologist who was born and educated in Honolulu before graduating from Stanford University In the States with a degree in biological sciences. He subsequently did a Ph.D at the University of Texas at Austin and undertook postdoctoral study in neurophysiology at the University of California at Los Angeles. In 1972 he joined the staff in the Department of Zoology at Auckland University and in 1980 was made senior lecturer, a position he has held ever since.

Over the last 30 years John has made 14 trips to Antarctica spending a total of 134 weeks on the continent. This included a year at McMurdo Station in 1963-64 with the United States Antarctic Research Program and a subsequent trip; all others have been under the auspices of the New Zealand Antarctic Re-

search Programme. In recent years much of the time has been spent with the Italians both at Scott Base and Terra Nova Bay.

John writes "My interests in Antarctica are directed mainly toward biological problems - particularly on the origins of Antarctic animals and the specialisations that permit them to thrive in an environment which would seem to be hostile. I am especially interested in the Antarctic *notothenioid* fishes, which appear to represent a monophyletic radiation under the constraints of low temperature, seasonal darkness and famine, but without a high degree of competition from other taxa. These fish show a fascinating array of adaptations which seem to stem from particular environment pressures; for example: molecular antifreezes, metabolic cold adaption, neural rate compensations, diversity in lateral line morphology, and reduction or loss of hemoglobin."

Over the years John has consistently encouraged other zoologists to join in the study of Antarctic fish, in the hope of acquriing sufficient data for Antarctic ichthyology to become a self-sustaining field, as well as being intellectually rewarding. He has published over 30 scientific research papers on the neurobiology of fish and amphibians, most on Antarctic fish.

Rare Ponting photographs sell at Christies

A cache of photographs taken during Scott's Last Expedition in 1910 to 1912 found in Britain was offered for auction at Christies in London on May 7. All the photographs were taken by Herbert Ponting, the official expedition photographer, in 1911 and include seven glass plate colour transparencies as well as black and whites. Client confidentiality precludes Christies from releasing the source of the photographs but they are known to have come from a variety of sources and that the autochromes and collodion on glass positives were from one collection. The sale was well attended and bidding for the autochromes was particularly strong.

Lot 184 comprising the four autochromes on plate sizes five by seven inches masked to three separate smaller sizes featured sunsets and afterglows taken at Cape Evans on 10 and 11 April in 1911, titled and dated in the margins by Ponting. They and others offered in the sale, are according to the catalogue, the only examples of autochromes by Ponting from Scott's expedition which are known to have survived. The Lumiere Brothers, who had introduced their colour plates in 1907 gave Ponting several boxes of prepared plates of which Ponting wrote "They did not hold out much hope that the plates would retain their qualities for more than a few months. These sold to a private collector for 7,150 pounds, while a second lot of two autochromes sold to the National Gallery of Australia for 3,080 pounds. The National Gallery of Australia also purchased a further autochrome of Mount Erebus and the frozen sea for 1,980 pounds.

Thirty-eight on-glass-collodion positives, each of six and a half by four and three quarter inches, numbered in ink and covering a good selection of subjects including the interior of the darkroom and stables, portraits of individuals and groups, flashlight views, studies of icebergs and flows, the Terra Nova and Antarctic fauna were sold to a private collector. A gelatin silver print measuring 13 x 18 inches of the Southern Party in 1911 also went to a private collector for 418 pounds. A carbon print of Captain Scott writing up his journal in 1911 and measuring 17 3/8 x 23 inches and mounted on card did not sell.

The New Zealand Antarctic Society Inc.,

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