

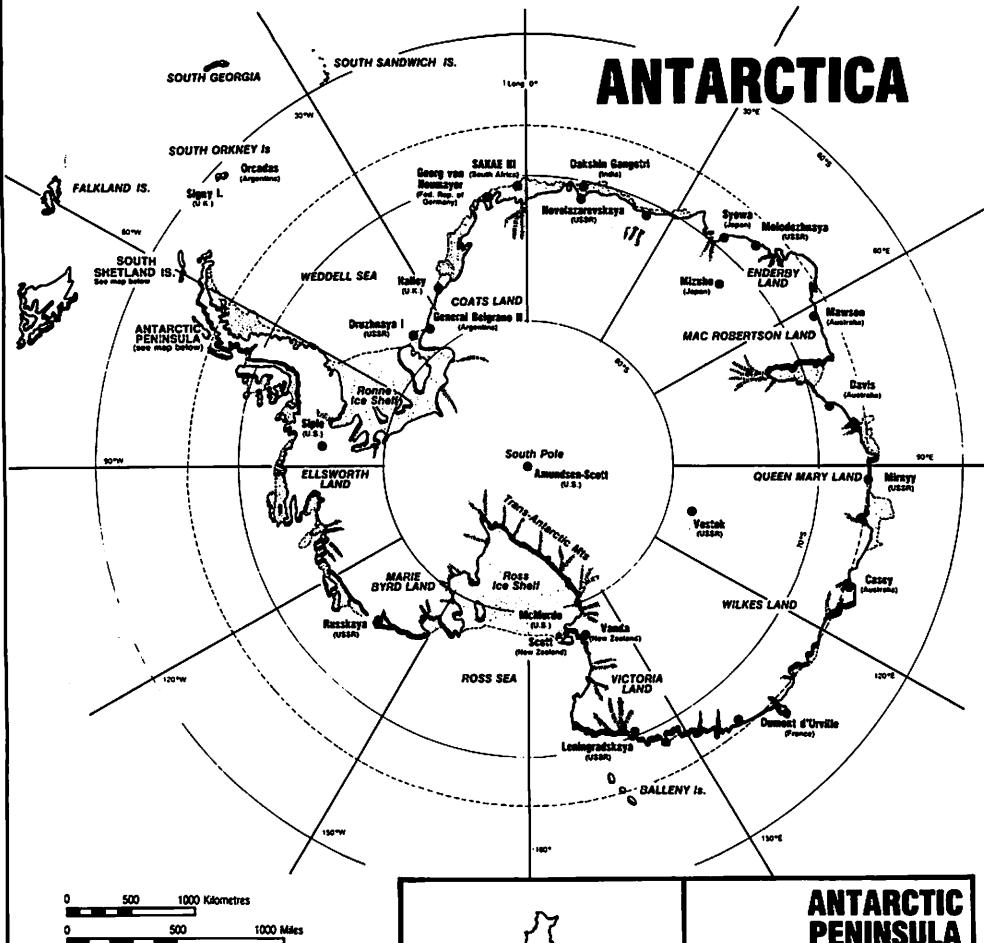
ANTARCTIC



Bulletin Vol.11 No.9 & 10



ANTARCTICA



0 500 1000 Kilometres
0 500 1000 Miles

- 1 Comandante Ferraz BRAZIL
- 2 Henry Arctowski POLAND
- 3 Teniente Jubany ARGENTINA
- 4 Artigas URUGUAY
- 5 Teniente Rodolfo Marsh CHILE
- Bellinghausen USSR
- Great Wall CHINA
- 6 Capitan Arturo Prat CHILE
- 7 General Bernardo O'Higgins CHILE
- 8 Esperanza ARGENTINA
- 9 Vice Comodoro Marambio ARGENTINA
- 10 Palmer USA
- 11 Faraday UK
- 12 Rothera UK
- 13 Teniente Carvajal CHILE
- 14 General San Martin ARGENTINA

SOUTH SHETLAND ISLANDS

0 100 km
0 100 mls

ANTARCTIC PENINSULA

0 100 km
0 100 mls

ANTARCTIC

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Cover: An anenome found 15 metres beneath the surface at Cape Armitage. See story pages 358 and 359. Photo: Dr Chris Battershill.

*Note: The second part of the minerals article appears in our next issue. See Vol. 11 No. 8 page 340.

NZARP

Two part study yields clinical and environmental information

In a two part study New Zealand scientists have extended the search for new pharmaceutically useful chemicals to the Antarctic and gathered information which may have important implications for pharmaceutical development of anti-cancer drugs as well as initiating a monitoring programme for the Antarctic sea-floor ecosystem. The team, led by Drs John Blunt and Murray Munro, are from the Marine-Chemistry Group working at the Chemistry Department, University of Canterbury. Advantage was taken of the unique nature of the benthic (bottom) sea life beneath the ice around Ross Island to pursue a number of novel investigations, which have included examination of the ecological aspects of the sponge community which characterises much of the benthos (bottom life) and the collection of samples of invertebrates for assessment of antiviral or antitumour activity.

Much of the benthic life in Antarctic waters comprises diverse sponge communities which are stable over long periods of time. Individual sponges may live unchanged in size or shape for hundreds of years in the constant conditions of light and temperature. They are however sensitive to disturbance and are therefore ideal environmental indicators.

In 1987 a team led by Dr Chris Battershill, a marine biologist, and comprising researchers Greg Smith and Nic Nevin, accompanied by Antarctic Division's diving supervisor Mr Trevor Dick from Dunedin made a series of dives over three weeks at Cape Armitage. Two permanent quadrats of ten by ten metres square were pegged out on the sea floor 25 metres below the surface. The areas within the quadrats were mapped and all the large invertebrates within them counted and measured. Fifty gram samples were taken from 35 species, (all but the rarest) and each was photographed under water and in the Scott Base laboratory. Colour and texture were noted and any physiological peculiarities were recorded. Mapping results provided baseline environmental data while the samples were sent to Christchurch for bioassay of anti-tumour anti-viral activity.

As was expected very little bioactivity was recorded. Unlike species from temperate or

tropical reef communities benthic organisms in the Antarctic are comparatively competitively naive in that they are seldom attacked by natural marine viruses and bacteria or experience competitive interactions. It has been found from work around New Zealand that those species which possess the best chemicals in terms of pharmaceutical use are those which occur in densely encrusting communities where competition is rife. Without such competition Antarctic invertebrates have no real need for toxic chemicals. This finding is in marked contrast to about 40 percent of those species taken from other waters.

This summer the research team led by Dr Chris Battershill returned for a longer expedition with Dr Nigel Perry, a chemist, researchers Reyn Naylor and Greg Smith and Rowan Strickland, the Antarctic Division diving supervisor for 1988 from the Water Quality Division, MAF, Rotorua.

They planned to examine in detail how the sponge communities at Cape Armitage may have originated and how their structure was maintained as well as continuing the collection identification and chemical analyses of each species. The reef in front of Scott Base, at Pram Point, a steeply sloping cliff plunging to over 150 metres was surveyed to provide

comparative data and more samples.

One hundred and twenty-nine dives were completed at five locations in order to survey the diversity of reef types in the area around Ross Island. Most work was carried out at Cape Armitage on the shallow sloping gravel reef in about 20 to 0 metres of water. A 1.5 metre diameter hole was drilled by the Americans through two metres of ice after two metres of snow had been cleared from around the site to increase light penetration. The second major site below Scott Base at Pram Point supported the richest benthic community yet seen in Antarctica. Strong currents characterised the area and the formation of pressure ridges close inshore made access through the ice difficult. Additional locations included Turtle Rocks directly adjacent to McMurdo Station and a dive through the Scott Base seawater intake hole to install a tide gauge.

The permanent quadrats set up at Cape Armitage in 1987 were rephotographed and counts made of the abundance of benthic

predators chiefly starfish, urchins and three species of fish. Further permanent quadrats were established. Sediment traps were installed to measure sedimentation rates, changes in which can disturb the sensitive sponge dominated reefs. These will enable other scientists in future to assess any changes.

By comparing last year's results, the scientists found that in general the overall stability of the communities were confirmed. Unlike their temperate and tropical counterparts the species appeared to have never been threatened by competitive overgrowth by neighbours or attacked by predators. The hypothesis that they needed no defensive chemicals, a finding which accounted for the apparent lack of bioactivity, was supported. This finding was subsequently tested by grafting small pieces of allogeneic tissue onto sponges. In most cases hosts demonstrated an immune response evident in the production of toxic chemicals. Such production of bioactive chemicals by completely naive organisms is considered

ANTARCTIC HERITAGE TRUST

Field work, Ross Island, Antarctica 1989-90

As part of the Trust's ongoing building conservation programme applications are invited from interested persons to fill four vacancies during the 1989-90 summer season.

Applicants must demonstrate proven experience in building conservation, historical archaeology and museum science.

Some experience in mountaineering, photography and architecture and also a knowledge of polar history would be desirable.

Successful applicants must be physically and medically fit to work in Antarctica and be prepared to work as volunteers. They will be required to attend the pre-Antarctic Training Camp in August.

Applications should be sent to the Antarctic Heritage Trust by 18 March, 1989:

P.O. Box 13-247
Christchurch
New Zealand

important and has implications in research of chemical models from marine natural products which may have use in pharmaceutical development.

Information on the ecology of Antarctic reef communities is also of significance to the whole Antarctic marine ecosystem but the links between the benthic sponge communities and the higher vertebrates, including marine mammals are poorly understood.

High densities of mobile benthic

invertebrates and fish are closely associated with the sponge community and in turn support higher levels of the food chain.

The only conceivable threat to this community is from man. Any human activity which could possibly increase rates of sedimentation on the sea floor from land runoff or blown dust for instance, would probably have devastating effects on the reef ecosystem.

Trackways and fossils help unravel geological history

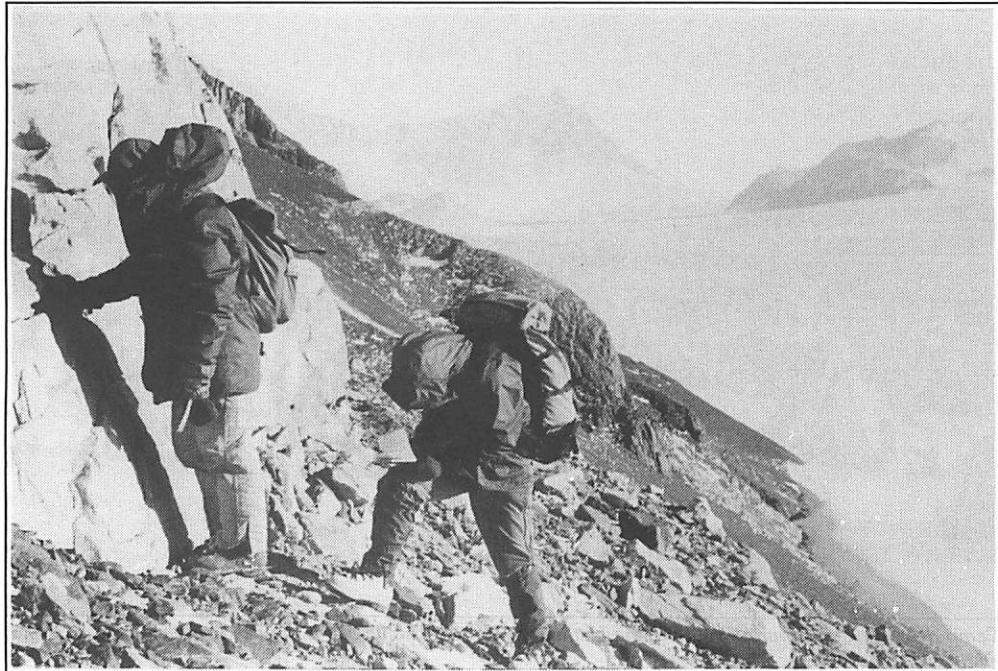
Arthropod track-ways on surfaces typical of a sandy ocean floor, plant fossils of the Devonian period, new exposures of Aztec siltstones and a 65 kilogram fragment of a nickel-iron meteorite found first by a party from Waikato University in 1978 were among the discoveries of a team comprising Margaret Bradshaw of Canterbury Museum, Fraka Harmsen, a New Zealander lecturing at the University of California, and Martin Kirkbride from the University of Canterbury. They were working on the 400 million year old Devonian sediments of the otherwise unfossiliferous lower Beacon Supergroup in the Darwin Mountains, Cook Mountains and Britannia Range of southern Victoria Land for seven weeks of the season. Ray Waters, an Antarctic Division field leader accompanied the party which travelled some 510 kilometers with two Grizzley toboggans and four sledges, visited 13 localities and measured nearly five kilometers of geological section.

The objective of the expedition was to extend knowledge of the Devonian trace fossils of the Taylor Group in the Darwin Glacier area and relate them to earlier work in the Dry Valley region and to use the trace fossils for sedimentological analysis for developing models for the palaeoenvironment of the Taylor Group. Collection of the Devonian fossil fish from new and observed localities on the edge of the Polar Plateau was abandoned because weather conditions delayed the party's departure from the Darwin glacier area prior to a put in at the new location.

A preliminary C-130 aerial reconnaissance of the Darwin area on November 9 was abandoned when the aircraft encountered hazy conditions over the proposed landing site. The following day a reconnaissance of the Darwin Glacier was successfully completed and six days later the party, with another

working in the area, was successfully put into the field at a site on the Darwin Glacier between Collosseum Ridge and Richardson Hill with 3,803 kilograms of equipment at 3pm local time. Working from the south-west to the north-east across the Darwin the team encountered a heavily crevassed area. Rising wind and blowing snow pinned them down for a day before they were able to backtrack and make camp close to Colosseum Ridge. They worked on the Hatherton Sandstone for five days finding good trace fossils, repairing sledges damaged during their attempted crossing of the glacier and adding ice cleats to the toboggans for safety.

The Darwin was successfully crossed further up on the 26 and 27 of November the last five kilometers before Tentacle Ridge being hard blue ice. Detailed sections of 1000 metres were measured from the basal contact on Tentacle Ridge to the top of the Hatherton



Fraka Harmson and Martin Kirkbride at work on the Junction sandstones near Junction Spur in the early hours of the morning. The Darwin and Hallerton Glaciers can be seen in the distance. Photo: Margaret Bradshaw.

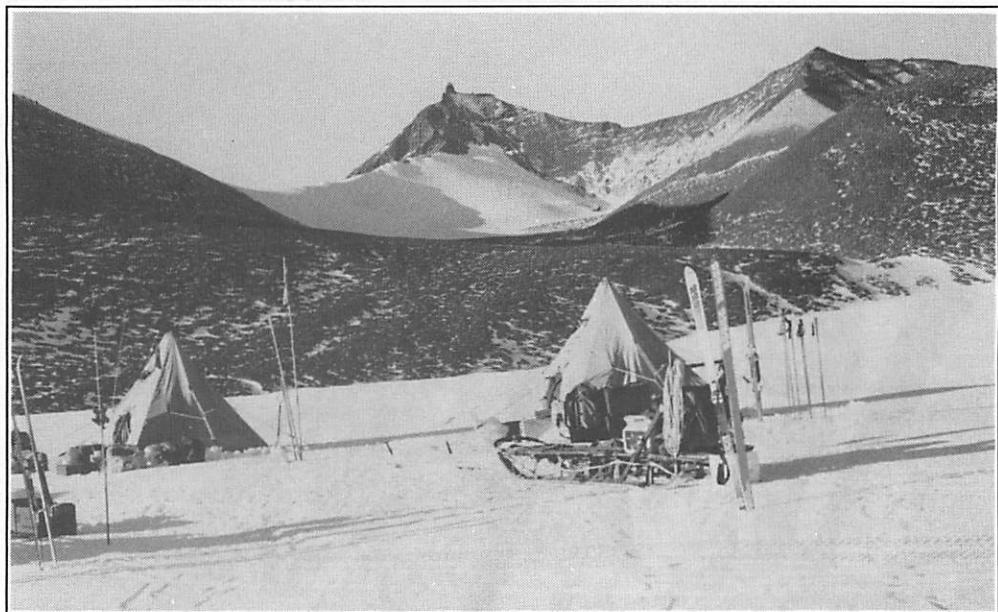
sandstone on Gorgon's Head; a peak near Mt Hughes on the other side of the Minerva Glacier from Tentacle Ridge. During a trip taking nearly 24 hours members of the party made a traverse of 16km and climbed and descended 2,520 metres to reach the top of Gorgon's Head where they found plant fossils provisionally identified as *Haplostigma*, rare in the Beacon sequences and indicating middle Devonian age. The fossils occurred in a sandstone unit devoid of trace-fossils and that had been correlated with the Beacon Heights Orthoquartzites further north. The plant bearing sandstones were found to be overlain by Aztec siltstones, making these outcrops the most southerly known of the formation.

Returning to the put-in site on December 4 the party repaired further damage to a sledge runner and repacked their equipment before setting out the next day on a route which took them obliquely down the Darwin glacier to Roadend Nunatak where work was undertaken on the Brown Hills Conglomerate

that rests directly on the basement.

On December 8 they crossed the Darwin Glacier again and travelled up the blue ice of the Hatherton Glacier to near Junction Spur where a C130 returning from the South Pole dropped fresh vegetables, bread and mail on December 9. Continuing up the Hatherton to the McCraw Glacier they measured extensive geological sections on Derrick Peak in the Onnum Valley and on Sabrina Ridge, their work interrupted for several days by whiteout and snow.

While on Derrick Peak Ray Waters found a large fragment of the meteorite first discovered in 1978 and the party set about devising a method of retrieving it. Weighing 65kg it proved too heavy for a rucksack and returning to camp they cut a damaged sledge runner in two and returned to the peak with a cradle made from a fuel drum, leather lashings and ropes. In a two part journey it was carried along the rocky ridge and down gravel slopes to the glacier where a route was chosen across a series of frozen lakes through moraine to



Camp near Junction Spur en route to the Hatherton Glacier. The first air drop was made near here. Photo: Margaret Bradshaw.

the Hatherton Glacier. The retrieval was halted by bad weather for several days and the final return to the camp took over nine hours. The fragment was loaded onto the back of a toboggan for the rest of the trip before being flown to Scott Base and subsequently loaded onto the Greenwave for the trip back to Christchurch where it will be on display at Canterbury Museum.

Working their way back down the Hatherton on December 20, three days before their planned pickup, two windshields were lost in a local blizzard before they camped near Junction Spur. The next day, from the ridge above the camp they watched a Hercules abandon an attempt to pick up the other field party when a crevasse was found on the drag run. Two days later they travelled 49km arriving at the put-in point on December 23 in whiteout conditions, but the next day the weather cleared for a special airdrop of fresh chicken, vegetables, cake, wine and mail and pudding that provided supplies for the Christmas that should have been spent at Scott Base.

As two locations had proved unsuitable for

pickup the parties working in the area made their way independently down the glacier to Roadend Nunatak. Before the museum party left, work was completed on Colosseum Ridge and in Island Arena after which they waited for a flight on December 31. By the time the aircraft arrived, the weather had again deteriorated and the party spent an unscheduled New Year in the field with an ascent of Mulgrew Nunatak before a Hercules arrived on January 5 to return both groups to Scott Base.

Information from the sediments will now be used to determine whether the environment during deposition about 400 million years ago was marine, non-marine or a combination of the two. Preliminary findings from the Taylor Group in the Darwin Glacier area are indicative of a braided river coastal plain within a rapidly subsiding basin into which there were short-lived marine incursions followed by prolonged shallow marine conditions, before an abrupt reversion to fluvial conditions.

In the lower most sediments (Junction Sandstone) the party found shallow channels up to 20 metres wide which they have

interpreted as braided stream sediments with paleocurrents towards the east. Trace fossils left by animals whose bodies have not been preserved were rare, but dense vertical burrows in several well-defined horizons (identified as Skolithos were observed) suggesting short lived marine incursion.

The Hatherton Sandstone contains many features that suggest shallow marine deposition, including bimodal cross-bedding and

hummocky cross stratification. Trace fossils are very common, including horizontal (Beaconites) and vertical burrows, (Skolithos), and a variety of arthropod trackways. The abrupt disappearance of all indications of animal life in the plant bearing (Haplostigma) Beacon Heights Orthoquartzite and the overlying Aztec Siltstone suggests a return to fluvial conditions after the deposition of the Hatherton Sandstone.

Supplies for Scott Base

Nearly 80 tonnes of food, equipment and machinery were included in the 478 tonnes of cargo which the United States supply ship Greenwave took south from Lyttelton when she sailed for McMurdo Station on January 30. The ship also carried other cargo loaded at Port Hueneme before she left California.

In the eight New Zealand containers was more than eight tonnes of food for the winter team of ten men and two women and another 220 people during the summer season.

Mrs Helen Phillips, the Antarctic Division's purchasing officer, went to Scott Base last year to prepare for her shopping list which contains enough food to last until February next year. One the menu are 3560kg of meat, 3120kg of frozen vegetables, 600kg of poultry

and 400kg of fish. Mrs Phillips has also provided for 500 litres of ice-cream, 700kg of French fries and 42.5kg of macaroni elbow.

Like any household or hotel Scott Base has dishes to wash so the cargo includes about 12kg of soap powder. For transport in the field and at the base the Greenwave carried four Canadian-built Bombardier motor toboggans worth \$NZ12,000 each, a front-end loader and three new trucks.

Field equipment, some clothing, barrels of anti-freeze, and alcohol for laboratory and field use were also in the containers. Scientists and support staff can't escape paper work. Their needs will be met with the help of 100,000 sheets of photo-copying paper.

Information officer breaks leg

Scott base finished the second half of the season without its regular information officer. Ms Yvonne Mulder went south in October and had to be flown to Christchurch on January 5 for orthopaedic treatment after she broke her right leg in two places the day before when she was knocked over by a skier at Castle Rock.

She was replaced by Janet Bertaud, who went south on January 9. Janet last visited Scott Base as part of a team from Television New Zealand in 1987/88.

Yvonne Mulder had been in a party of ten who went to Castle Rock about two kilometers from the Scott Base to watch the US Coast Guard icebreaker Polar Sea

cutting its way towards Winter Quarters Bay. Some of the party were skiing to the bottom of the hill when one clipped skis with another, lost control and ran into Ms Mulder who was waiting to photograph them.

After the accident Ms Mulder was driven to McMurdo Station medical centre for treatment. She spent the night there and went to Scott Base on January 5 to prepare for departure. In the early hours of January 6 she was admitted to Christchurch Hospital for the orthopaedic treatment advised by the medical officer at McMurdo Station.

Iceberg B-9: update

The supergiant iceberg, B-9, which broke away from the Ross Ice Shelf in October 1987, has now drifted over 100 kilometres around the eastern Ross Sea. At 154 kilometres long when it was formed, the berg was one of the longest on record. Its formation and drift have produced new data on how icebergs are formed and on the currents in the Ross Sea.

The creation of B-9 was a natural event. It broke off the eastern part of the ice shelf, the northern margin of which was probably further north than it had been this century. Very few icebergs had broken off this part of the shelf over the last few decades, despite the continual flow and advance of the ice in the area. The break could therefore be regarded as being overdue.

B-9's shape was mostly delineated by weaknesses in the ice shelf as revealed by mapping as early as 1971. A huge rift 100 kilometres long, and up to 5 kilometres wide and extending mostly through the 300 metre floating shelf, formed about 75 percent of the southern side of what became B-9. Further rifting, probably caused originally by ice movement, with some contribution from currents flowing under the ice shelf, is the likely cause of B-9's birth in 1987.

Still south of 75 deg

After 15 months, B-9 is still south of latitude 75 deg S in the cold waters of the Antarctic continental shelf. In cold water, icebergs decay by splitting apart or fracturing around the sides; however B-9 has not changed much so far and is still about 140 kilometres long. Antarctic icebergs finally melt when they drift into warmer waters north of the continent, between latitudes 68 to 45 deg S. Because B-9 is still south of such waters and because its drift path is not easily predictable, it may take several years to reach them.

Complex drift

Since it formed, B-9 has drifted slowly but in a complex manner. It has been pushed at an average speed of about 2.5km/day by a succession of ocean currents. Between late June and mid-December 1988 it followed an almost circular course, over 100 kilometres across. This may be the first overall evidence

that a huge current gyre exists in the Ross Sea.

By studying such a large, easily visible iceberg scientists can learn where icebergs drift and examine their behaviour. This will help in predicting how possible mineral activities in the region could be threatened by icebergs. More immediately the formation of B-9 throws more light on how large icebergs are created and the mechanisms through which ice shelves, and the Antarctic ice sheet, lose mass. Such knowledge is important because the ice sheet exerts a major control over processes affecting the world's climate and sea levels.

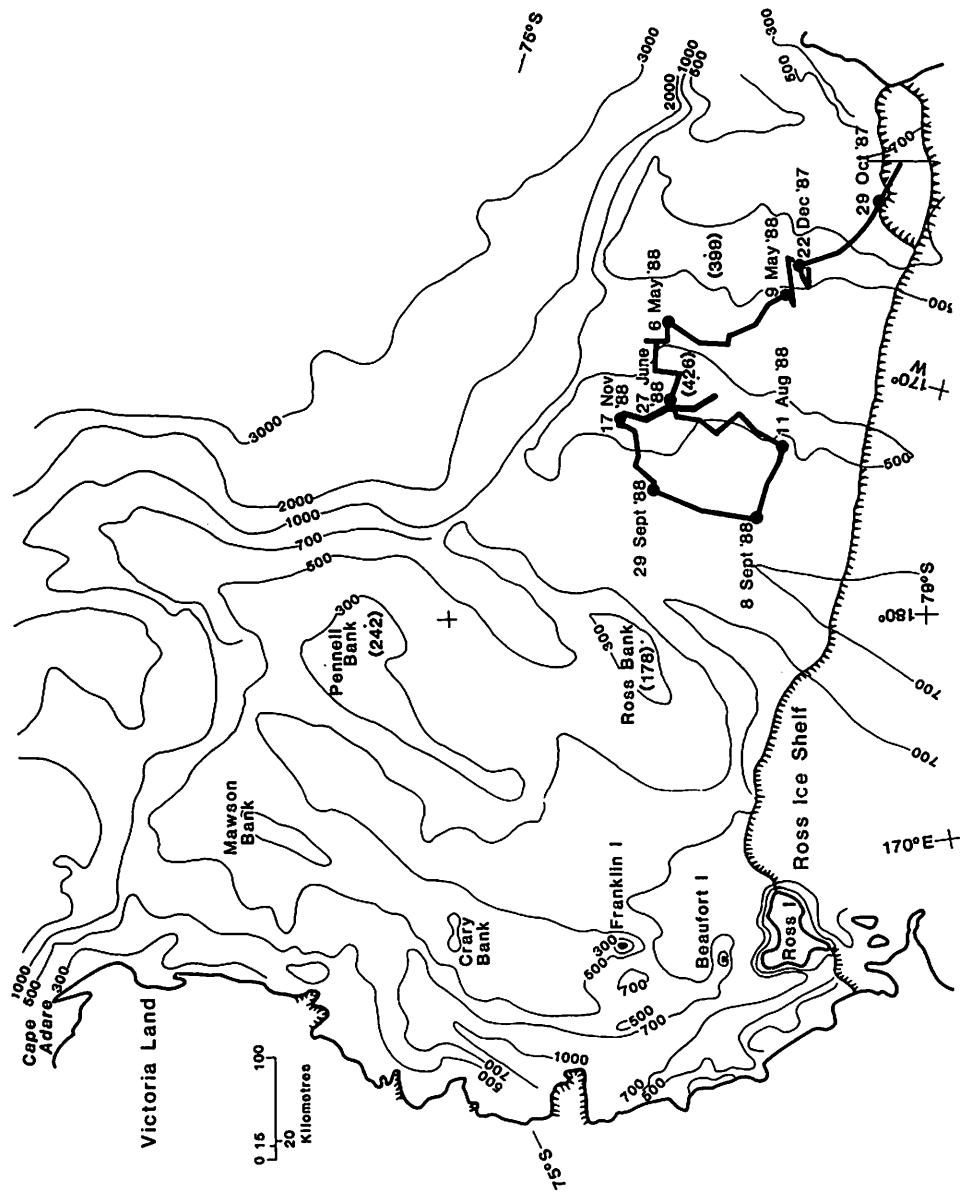
Information on currents

The drift is giving information on currents which are important for several reasons. They influence the annual freezing of the sea around Antarctica and sea ice drift and melt. Currents also affect the marine ecosystem including krill, whales and penguins by influencing food availability, habitat and breeding success.

Currents in Ross Sea affect the rates of melting or ice accumulation at the base of the Ross Ice Shelf and may play a part in mechanisms by which the greenhouse effect could influence the Antarctic.

(Antarctic thanks Dr Harry Keys of the Department of Conservation in Wellington for this article and acknowledges the US Navy/NOAA Joint Ice Center in Maryland for supplying position data for B-9.)

*The drift of B-9 in the Ross Sea, Antarctica from October, 1987 to late December 1988 during which time it followed a circular course almost 100km across. — Bathymetry after Davey and Cooper. ** J. R. Keys, Department of Conservation, Wellington, New Zealand.*



ANARE

"Aurora Australis" due in service late 1989

Construction of Australia's first flagged and built icebreaker began officially on 28 October 1988 and the vessel to be called "Aurora Australis" should enter service in December 1989 with a complement of 133 persons, including crew. Named from a national competition after Sir Douglas Mawson's "Aurora" the \$124 million vessel is designed to meet the key Australian requirements of base resupply and marine cruising. With a range of 25,000 nautical miles and minimum endurance of 90 days the ship's design incorporates the latest technology developed for operating in ice conditions.

In July 1986 Australia's Antarctic Division personnel formulated a set of characteristics for the ship they sought. These led to a conceptual design and over 100 submissions from Canada, Norway, Finland, Germany, United Kingdom, Japan, Denmark and Australia to build or adapt existing vessels.

On 16 December 1987 the Government announced its intention to enter into detailed contract negotiations with P & O Polar (a joint venture of P & O Australia Ltd and Polar Schiffahrts Consulting GmbH of the Federal Republic of Germany). P & O Australia is the major partner with a Finnish Company Wartsila Marine contracted to complete a detailed design of the vessel and provide technical assistance to the selected shipyard. Wartsila Marine, is one of the largest shipbuilders in Europe with over 60 percent of the world's icebreakers to their credit and with 33 new ships in their order book when the Australian government made its decision.

Work begins

An agreement with the Government to enter a ten year charter arrangement with the ship's owners P & O Polar was subsequently reached and, soon after, work began on the icebreaker at Carrington Slipways Pty Ltd of Newcastle.

The vessel will be 94.8 metres in length with a beam of 20.3 metres, a draught of 7.65 metres and a displacement of 7800 tonnes. She will be classified under the Lloyd Register of Shipping with a notation of 1/3100AI,

UMS, Ice Class IA Super, DP(CM), Special Purpose Ship, and will comply with the Canadian Arctic Ship Pollution Prevention Regulations Arctic Class 2 and Arctic Class 3 hull strength in the bow and stern. Her main engines will have a 10,000kw capacity enabling the ship to cruise at 13 knots and to navigate in 10/10th pack ice breaking an equivalent of 1.23 metres of first year level ice, of 500kg Pa flexural strength at 2.5 knots continuously.

Marine science

For marine science purposes the Norwegian Simrad Subsea system, trialled in 1988 and commercially available in 1989, will be installed allowing comprehensive hydroacoustic surveying. The system incorporates hydrographic sounders, trawl surveillance sonar, scanning sonar, echo sounders for the estimation of krill and fish biomass and split beam transducers to allow target strength analysis and comprehensive hydroacoustic surveying. It will allow scientists to assess stocks of important organisms such as krill in the Southern Ocean.

The output of oceanographic, meteorological and hydroacoustic instruments will be logged on a central data system. A second computer system with terminals throughout the ship will allow onboard data processing.

A wet laboratory for processing net samples, a hydrographic laboratory, fish freezer, meteorological laboratory and five multi purpose laboratories will be permanent features and provision has been made for

eight container laboratories to be installed as required. Four can be placed in between deck, and two each on the heli and aft decks.

All laboratories will have hot and cold fresh water, uncontaminated sea water, compressed air, a stabilised electricity supply and data lines to the computer.

Trawling operations with commercial sized nets will be possible using a winch controlled system supplied by Hydraulic Brattvaag of Norway. The vessel will be capable of bottom trawling in depths of up to about 1000 metres and other trawls requiring up to 35 metre headline length. A zooplankton sampling system designed to enable use of instrumental packages will also be available and a photographic dark room, a gravity metre compartment and scientific workshop will be installed.

"Aurora Australis" will be able to transport 1700 cubic metres of general cargo and 40 containers. Two or three cranes and two forklifts will be available for cargo operations. A forward 25 tonne crane will be able to discharge over the bow and the forklifts will

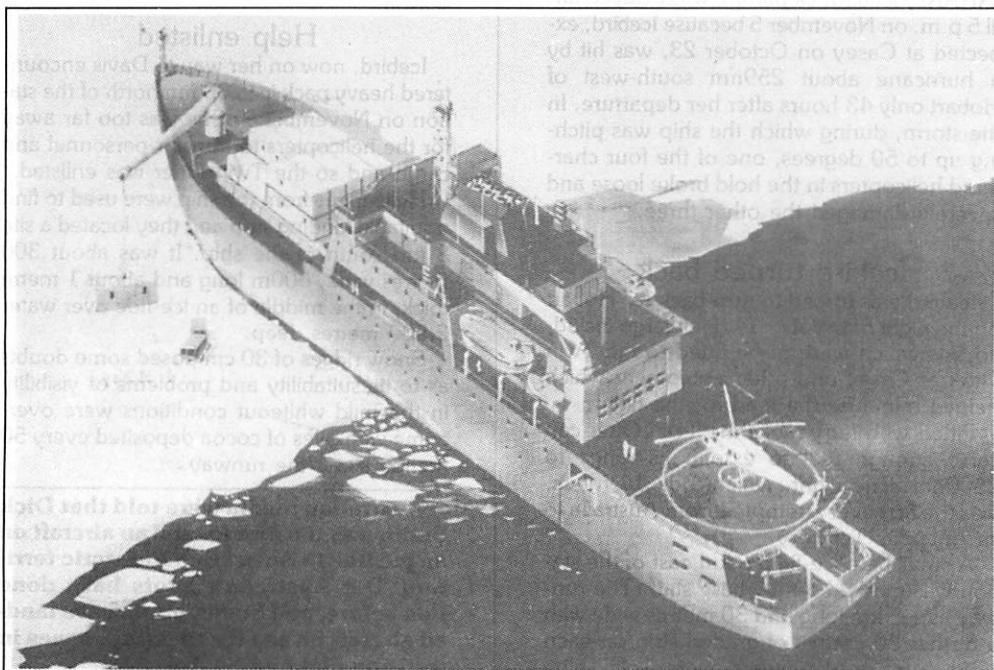
be used to transport cargo from the forward to the aft helicopter deck for aerial resupply operations. She will have a tank capacity of one megalitre for fuelling stations.

Ship turnaround will be speeded up by the use of two medium lift Seahawk type helicopters which can be located in the hangar and used for cargo and passenger uplift to stations.

Up to 70 expeditioners will be accommodated in self contained three and four berth cabins designed to meet the special needs of scientists. Cafeteria style catering and recreational facilities will be available to all.

A passenger on Aurora Australis's first voyage to Antarctica will be twelve year old Brett Webb of Jindabyne, winner of the national competition to name the vessel. One hundred and eight of the 2000 competitors chose 'Aurora Australis' but Brett won because of the quality of the explanation of his choice which was required as part of the competition.

Aurora Australis — artists impression — P & O Australia Pty Ltd.



Hobart to Casey flight by Twin Otter

Australian electronics millionaire and pilot Dick Smith postponed his plans to fly a Bell Jetranger helicopter from an Australian Antarctic base across Antarctica and chose instead to fly a wheeled Twin Otter 1850nm (3247km) to Casey Station in November. With him was the noted polar pilot, Captain Giles Kershaw, who was on leave from Cathay Pacific Airways in Hong Kong.

Recently the Australian Geographic Society bought the Twin Otter for its world-wide documentary film-making programme. As founder of the Society, Dick Smith made the aircraft available to the Australian Antarctic Division to support its research programme in November of the 1988-89 season.

Originally the flight was planned for November 1 after the arrival at Casey of the Australian National Antarctic Expeditions (ANARE) Icebird. Departure was delayed until 5 p.m. on November 5 because Icebird, expected at Casey on October 23, was hit by a hurricane about 259nm south-west of Hobart only 43 hours after her departure. In the storm, during which the ship was pitching up to 50 degrees, one of the four chartered helicopters in the hold broke loose and severely damaged the other three.

Icebird turned back

Icebird was forced to turn back for Hobart on the night of October 14. Her cargo included skis which were to be fitted to the Twin Otter at Casey and other equipment which helped minimize the load for the flight.

Fitted with ferry tanks the Twin Otter can carry enough fuel to extend its range to 2500nm. The flight, which took 14 hours, was the first ever attempted from Australia to its Antarctic Territory.

A small bare ice-field 6 km east of the station was marked out by base staff. The runway was 1.5 km long and 30 metres wide with a further 30 metres of graded strip on each side. Surface conditions were solid blue

ice overlain in places by up to 5 cm of snow. Emergency facilities included oversnow vehicles equipped with fire extinguishing equipment, cooking, toilet and sleeping accommodation for six, radio equipment, a windsock and electric power from a mobile generating unit.

No problems

The flight was completed without trouble and only a slight deviation for bad weather. Appropriately the aircraft was registered VH-SHW in recognition of Sir Hubert Wilkins, who pioneered aviation in Antarctica.

During the next day Robert Tomar, from the Canadian company Bradley Air Services fitted the skis to the Twin Otter for the rest of the programme. On November 8 Smith and Kershaw departed for Davis, via Edgeworth Davis, a small base unoccupied this season.

Help enlisted

Icebird, now on her way to Davis encountered heavy pack ice 200 nm north of the station on November 9. She was too far away for the helicopters to transfer personnel and cargo and so the Twin Otter was enlisted.

Helicopters from the ship were used to find a suitable landing strip and they located a site 8 nm south of the ship. It was about 300 metres wide, 600m long and about 1 metre thick, in the middle of an ice-floe over water 2,500 metres deep.

Snow ridges of 30 cm posed some doubts as to its suitability and problems of visibility in the mild whiteout conditions were overcome with piles of cocoa deposited every 50 metres along the runway.

Australian media were told that Dick Smith was the first to land an aircraft on an ice floe in Australian Antarctic territory. But Australian pilots have done this before, and Soviet pilots have landed aircraft on sea ice to relieve bases in territory claimed by Australia.

Whiteout conditions persisted and as the aircraft approached the ice-floe smoke cannisters were released to indicate wind speed and direction and expeditioners stood about 50 metres apart to enhance perception of the runway.

About mid-day the aircraft made a visual check from about ten metres and two drags with its skis lightly touching the bumpy surface. The tracks were inspected by the expeditioners and as no cracks were found the strip was declared fit for use and the aircraft landed in 150 m.

Passengers and freight were ferried from the ship by helicopter and from the strip to Davis by Twin Otter. It made six flights over two days to complete the transfer of 30 expeditioners and 3.5 tonnes of freight.

The Twin Otter was then used for glaciological work over a wide area of the polar plateau near the Amery Iceshelf and the Lambert Glacier. Operating out of Davis radar equipment was used to record the glacier's top and under surfaces and to collect data which will help ascertain the nature and extent of glacial flow.

Seasonal counting of crabeater seals was also undertaken from the Twin Otter before it flew onto Mawson. There Icebird managed to anchor adjacent to the fast ice within 39 nm of the station. Although the helicopters ferried the bulk of resupply and expeditioners they were assisted by the Twin Otter which carried 3 tonnes of cargo from the ice next to the ship to the station.

ANARE staff and five tonnes of cargo was also flown inland to the Prince Charles Mountains where a new summer station was being established at Farley Massif in the northern part of the range. The station has been named after Robert Dovers, leader of the winter party that established and operated Mawson Station, the first Australian Antarctic Base, almost 36 years ago. Geological survey teams worked from Dovers this season.

Having completed its work the Twin Otter left again for Casey on November 20. Subsequently Smith and Kershaw flew it across Antarctica. They went first to the Soviet Vostock Station for refuelling. The next stage was over the South Pole to the private base

in the Heritage Range area of the Ellsworth Mountains operated by Adventure Network International.

Next Smith and Kershaw planned to land the Twin Otter on the black volcanic scoria beach of Deception Island in the South Shetlands off the Antarctic Peninsula. This landing was intended to commemorate the 60th anniversary of the first aircraft in flight in Antarctica by the Australian explorer, Sir Hubert Wilkins. On 16 November 1928, Wilkins and his Canadian pilot Ben Eielson took off in one of the expedition's two Vega aircraft from the beach of the still active volcanic island. Most Antarctic chronologies, however, list the first flight as being made on December 20. Wilkins and Eielson were in the air for ten hours and covered 1042 nm across the Palmer Peninsula and along its east cost.

From Deception Island the Twin Otter was flown to North America to be in a position from which Dick Smith can make a flight from Point Barrow to the Spitsbergen Archipelago in the northern spring. This will commemorate the first trans-Arctic flight made in April 1928 by Wilkins and Eielson in the same Lockheed Vega they were to fly in the Antarctic nearly eight months later. The flight of 2778 nm was made north-eastwards across the Arctic Ocean.

Australian Director resigns

After nearly five years as director of Australia's Antarctic Division Mr James Bleasel has resigned rather than accept a transfer from Kingston, near Hobart, to the position of First Assistant Secretary in the Department of Arts, Sport, the Environment, Tourism and Territories in Canberra. His resignation became effective on December 3 last year.

Mr Bleasel, formerly director of the National Materials Handling Bureau in Sydney, took over as acting director of the division on February 20, 1984, when Mr Clarrie McCue, who had been director for five years, was appointed special adviser on Antarctic matters to the Secretary of the Department of Science and Technology in Canberra. Mr Bleasel spent nine years with the National Materials

Continued on page 395

India

New base to be centre for Indian research

India, which has had a research station in Queen Maud Land since the 1981-82 season, built a new permanent station this summer in the Schirmacher Hills. Maitree Station is about 80km inland from the present station, Dakskin Gangotri at 70deg 05min S/12degE on the Princess Astrid Coast, and will be the main base for all expeditions engaged in future exploration and research.

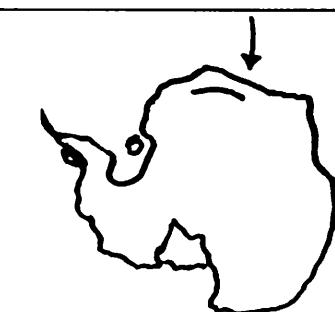
When geologists of the the third Indian expedition mapped the Schirmacher Hills and renamed them Dakskin Gangotri Hills an announcement that an area of 200 square kilometres had been earmarked for extension of the original station in future seasons gave the impression that the station was in the hills about 18.5km from the Soviet station Novolazarevskaya. Dakskin Gangotri, however, was built on the ice shelf about 15km southwest of Indian Bay, an area of coastal water through which the first expedition landed.

"Friendship"

Maitree (Friendship in Hindi) consists of three cottages located in a sheltered rocky valley adjoining a snowfed lake. The cottages are two storeyed and can comfortably accommodate 20 people. Flat ground nearby has been converted into helipads for expedition helicopters operated by the Indian Navy and Air Force. When India's seventh expedition sailed on March 1988 for Normugao, the port of Goa, after 70 days in Antarctica, it left behind the foundations and pillars of the new Maitree Station, which has been designed by the Defence by the Defence Research and Development Organisation. DRDO has been associated with the research programme since the first expedition, testing clothing, footwear, tents, field equipment, food, and other essential materials. It installed an accommodation complex at Dakskin Gangotri during the third expedition, and with India Army engineers was responsible for new construction and supervision at Maitree this summer.

Scientific programmes undertaken during

1988 included the continuation of a ground geological survey covering approximately 1000 square km in the Humbolt Massif of the Wohlthat Mountains; an airborne magnetic survey over the Gruber Massif and the low snow-bound area lying between the Schirmacher and Wohlthat ranges and collections of samples for subsequent investigation. Ozone studies were intensified with additional programmes and the network for the collection and observation of meteorological and upper atmospheric phenomena was extended to the Schirmacher and Wohlthat mountain ranges. Shipboard programmes continued to focus on the distribution, abundance and variability of living organisms, particularly krill, squid and fish. The evolution, cold acclimatisation mechanisms, physiology, energy fluxes, food chain dynamics and biomass production in glacial limnetic, oasis and littoral ecosystems of Antarctica were also studied.



Map indicating approximate position
Indian Antarctic activities.

Italy: Baia Terra Nova

Italians charter new ship: more helicopters

Italy's fourth expedition to the Ross Dependency sailed from Lyttelton on December 2 for Terra Nova Bay aboard the chartered cargo ship Barken. The Swedish-owned ice-strengthened Barken called at Hobart on November 22 and arrived at Lyttelton on November 28. She took 130 scientists, support staff, technicians, and mountain guides south and returned to Lyttelton about March 1, 1989.

In the 1987-88 season the third expedition concentrated on the extension and improvement of Terra Nova Bay Station. The base was established by the 1986-87 expedition along the coast of the Northern Foothills of Victoria Land, north-east of Gerlach Inlet at 74°42' S/164°07' E.

This season the fourth expedition again carried out a wide range of research projects from field camps in the Terra Nova Bay area with helicopter support. It also undertook a programme of meteorology, cosmophysics and radiation, and environmental monitoring, using four prefabricated huts which have been located some distance from the main station building.

Summer station

Baia Terra Nova has been designed as a summer station to accommodate research staff and equipment, and as a support centre for all scientists working from field camps in surrounding areas. It consists of a main building and two smaller buildings (power station and workshop) with a surface area of about 630 square metres.

Located in the main building, which is 42m by 14m, are two rows of 17 modules. Twelve of these provide sleeping accommodation normally for 24 people and up to 48 by using all four berths in each module. One module contains the desalination unit which can produce 7.2 tonnes of fresh water daily, using the reverse osmosis system. On the east side of the coast two small coves are used for the sea water intake and effluent discharge.

One module contains the radio communication equipment. The station has a satellite

communication terminal operating in the INMARSAT marine satellite network. This provides facilities for telex, telephone and facsimile traffic. For a wider use of VHF communication one repeater unit has been placed on Mount Melbourne.

An area for helicopter landing and takeoff is situated 70m from the main building. It is 12m square with a plank deck supported and surrounded by an area paved with freestones. For safety reasons the fuel storage area is 300m from the main buildings. About 250,000 litres of diesel, jet kerosene, and petrol are stored in drums.

Manager of the Antarctic Project and leader of the expedition was Dr Mario Zucchelli. He held the same position last season and is in charge of operations for ENEA, the Agency for Research in Energy, which set up the Antarctic Project to carry out the research programmes, and is responsible for the management and administration of expeditions, and the co-ordination of scientific activities, including co-operative programmes with New Zealand and the United States.

Marine operations

Responsible for marine operations on the ENEA management staff this summer was Rear-Admiral Alberto Tartarini, Ministry of Defence representative on the inter-ministerial committee for Antarctica. Last season he was also the Antarctic Project representative on the chartered Norwegian research vessel Polar Queen which was used by the Italian Navy's Hydrographic Institute for an oceanographic programme in Terra Nova Bay and the Ross Sea.

Once again air support for the Italian programme was given by Helicopters (NZ) Ltd, of Nelson. For the fourth summer the company has provided four helicopters — a twin-engined Bell 212 and three French Aerospatiale 350B Squirrels.

Leader of the helicopter team was the company's chief pilot Jim Wilson. With him was the operations manager, Andrew Brown, who was also a pilot. There were six other pilots, Reg Ellwood, Ken Tustin, Alfie Speight, Don Andrew, Tim Douglas-Clifford and David Henley, and two engineers, Mike Jackson and Duncan Atkinson.

Last summer the Italians chartered ships from Finland and Norway. This season they obtained the Barken (6850 tonnes) which was built at Dundee in 1972 as a Baltic newsprint pulp and paper carrier. She is an ice-strengthened general cargo vessel 122.6m long with a draught of 3.3m and has a 1A ice rating.

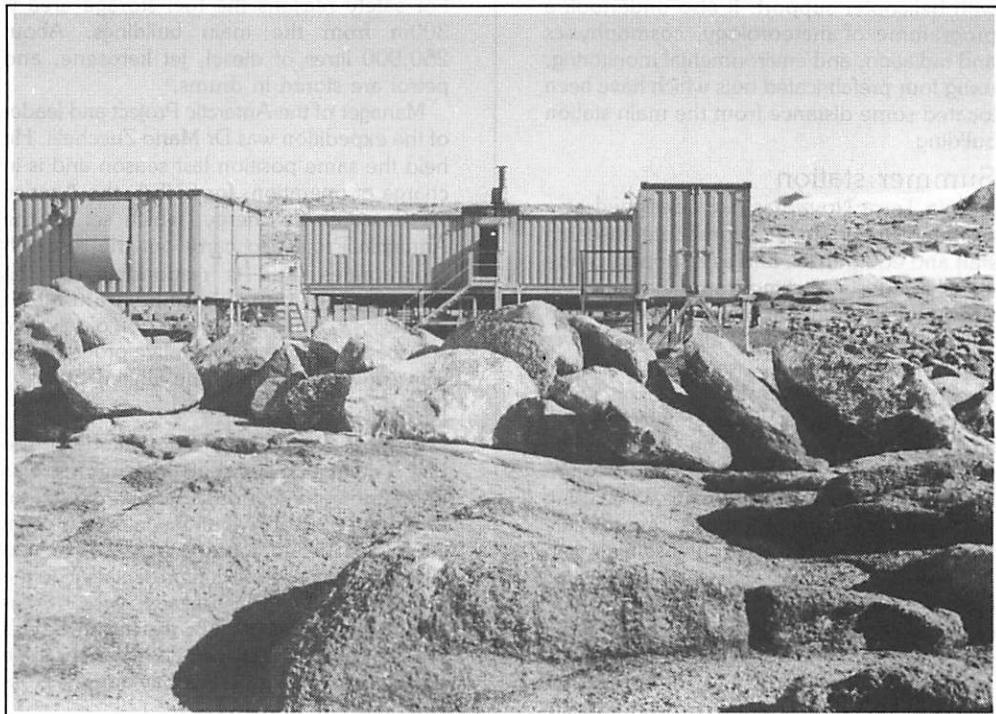
Since 1972 the Barken has changed name and ownership. She began service as the Ida

Lundrigan. Ten years later she was renamed A. C. Crosbie. Later in 1982 she became the Barken and kept the name until 1987 when it was changed to Baltwind. This year she is back to Barken.

Her owners are a shipping company in the industrial town and port of Karlstad and she is operated by its Dutch subsidiary company Ahlmarco BV. Karlstad is on the northern shore of Lake Varner, which is Sweden's largest lake, and is linked with the Kattegat and the Baltic by the Gota Canal system.

Eight New Zealanders worked in the Terra Nova Bay area late in the season with Italian support. A request for helicopter support for three groups was made to the Italians by the Antarctic Division DSIR. The groups are: Drs Colin Meurk and David Given, DSIR Botany

The Italian base Baia Terra Nova from two different angles. The base has been used for summer operations since 1986-1987 and will be occupied during the winter of 1989-90. — Photos: Colin Meurk.



Division (Christchurch), and Dr Martin Foggo, Central Institute of Technology (Wellington); Professor Rufus Wells and Dr John Macdonald, Zoology Department, University

of Auckland; Mr Bob Thomson, former director, Antarctic Division, Dr John Hay and Simon Towle, Environmental Science Department, University of Auckland.

Logistical contribution and air strip?

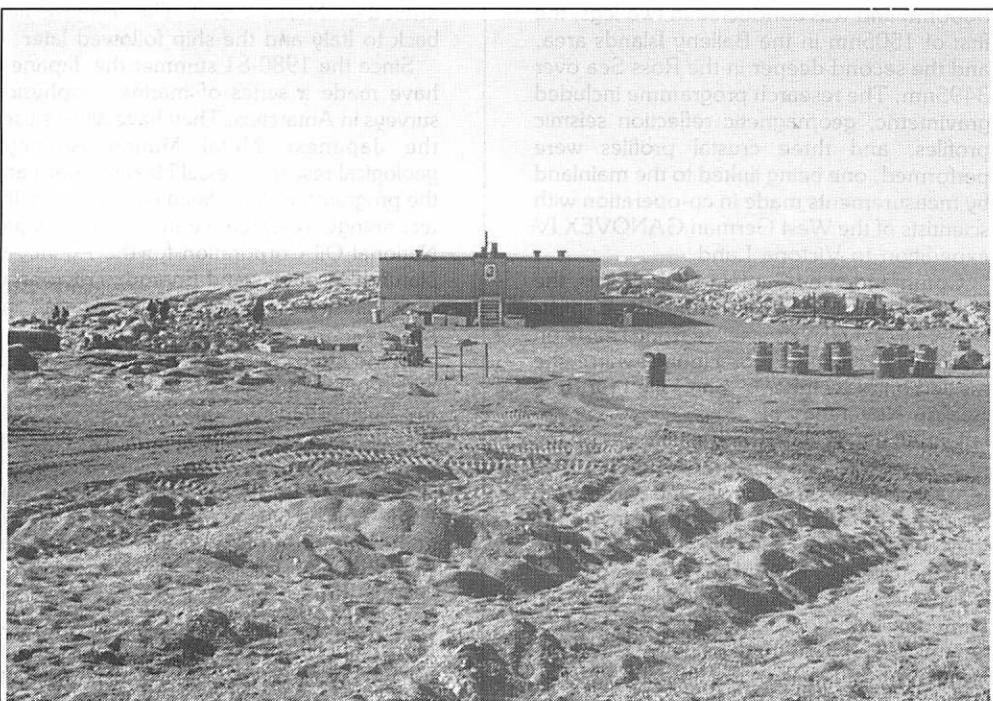
Italy may contribute in the 1989-90 season to the joint US-NZ logistic pool of aircraft which fly between Christchurch and McMurdo Station each summer to support the two countries' research programmes. The aircraft would come from an Italian Air Force Hercules squadron.

In the early 1990s Italy plans to occupy Baia Terra Nova in winter and summer. Eventually the possibility of putting in its own ice runway in the region may be considered to meet the demand for increased logistic support.

Preliminary approaches have been made

to the NSF and the Naval Support Force, Antarctica, and in October Lieutenant-Colonel Gino Proner, who commands an IAF Hercules squadron, and Major Sebastiano Vecchi (technical officer) spent two days at McMurdo Station. There they discussed Hercules operations in Antarctica and technical problems with NSFA representatives and the Navy's VX-6 Squadron which operates ski-equipped Hercules for NSF.

No decisions will be made until 1989. Any proposals will have to be considered first by NSF and ENEA, and the Italian Ministry of Defence and the US Defence Department.



Antarctic Oil

Italy and Japan continue seismic surveys

Italy and Japan both conducted marine geophysical surveys in Antarctica last season to investigate the geological structure of the continent and obtain information about its hydrocarbon potential. The Italians worked in the Ross Sea from the 978-tonne seismic survey ship Explora, now owned by the Geophysical Experimental Observatory (OGS), of Trieste; once again the Japanese used the geological survey vessel Hakurei-Maru, this time between 50deg W and 65deg W in Bransfield Strait.

In the 1987-88 season OGS scientists took part in a cruise of about 5935 nautical miles from the vicinity of South American along the Antarctic ice edge as far as the Ross Sea. They also completed a deep crustal exploration profile of about 540nm in the Ross Sea.

Last season's survey covered about 5000nm and was conducted in two legs, the first of 1505nm in the Balleny Islands area, and the second deeper in the Ross Sea over 3495nm. The research programme included gravimetric, geomagnetic reflection seismic profiles, and three crustal profiles were performed, one being linked to the mainland by measurements made in co-operation with scientists of the West German GANOVEX IV expedition to Victoria Land.

Commanded by Captain Silvio Valles, the Explora with a crew of 18 and 19 scientists led by Dr Daniel Nieto, sailed from Trieste on October 18 last year for Hobart where she arrived on November 6. She sailed for Ross Sea on November 11.

During the 34 days the Explora was on the first leg of the cruise she encountered gale force winds of 41 to 47 knots and waves from eight to 15 metres high. Because of the thickness of the pack ice the ship was unable to penetrate as far south as intended.

On January 8 the Explora arrived at Dunedin to refuel and take on supplies. Scientists and crew had a brief respite from ice and stormy weather until January 12 when the ship sailed for the Ross Sea to begin the

second leg of the cruise. This time the ship's complement was increased by one — an Italian journalist.

Planned to last 90 days, the second leg of the cruise included a visit to the Italian base in Terra Nova where the fourth expedition was at work. From Terra Nova Bay the Explora turned north for Lyttelton where she arrived on March 2 or 3. The scientists flew back to Italy and the ship followed later.

Since the 1980-81 summer the Japanese have made a series of marine geophysical surveys in Antarctica. They have always used the Japanese Metal Mining Agency's geological research vessel Hakurei-Maru and the programmes have been conducted by the technology research centre of the Japan National Oil Corporation for the Agency of Natural Resources and Energy, a division of the Ministry of International Trade and Energy.

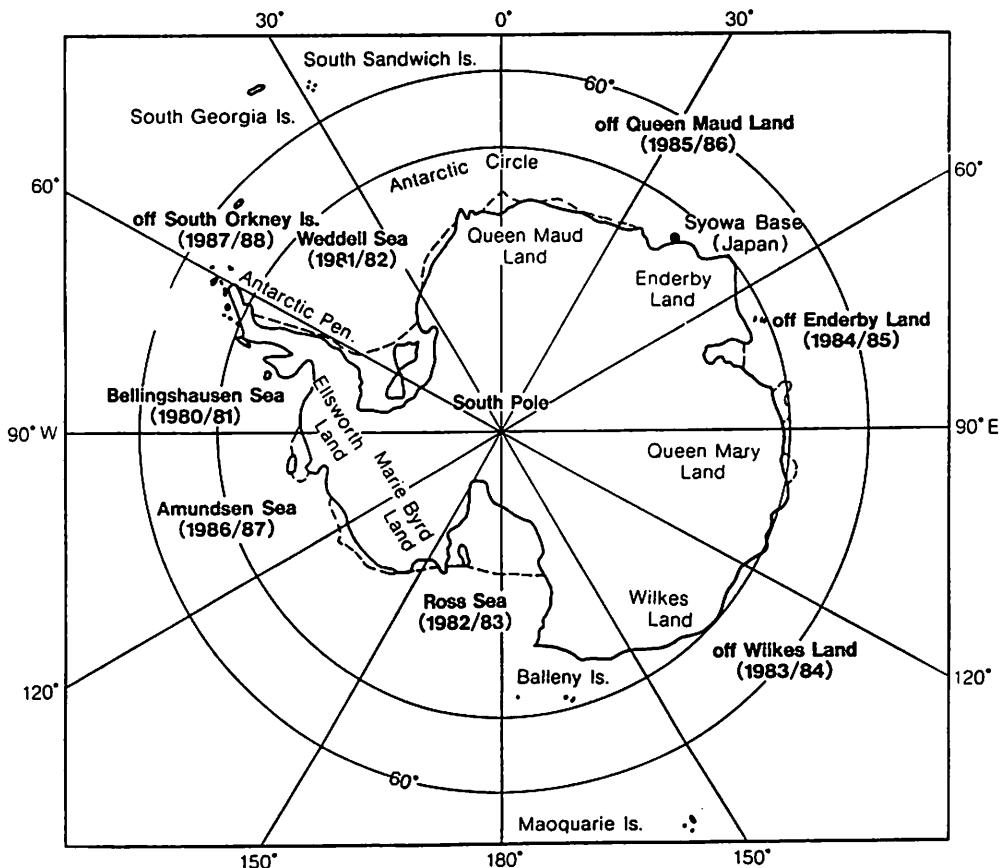
In the 1980-81 season the Hakurei-Maru, which has a range of 15,000nm, worked in the Bellingshausen Sea. She moved to the Weddell Sea (1981-82) and then to the Ross Sea (1982-83). In 1983-84 she worked off Wilkes Land, then off Enderby Land (1984-85), off Queen Maud Land (1985-86), in the Amundsen Sea (1986-87) and off the South Orkney Islands (1987-88).

For the Bransfield Strait programme a team of 18 scientists led by the chief scientist, Dr Morishima Hiroshi (geologist) and his deputy Mr Tsumuraya Yuji (geophysicist), carried out seismic reflection and refraction surveys,

depth sounding, geomagnetic and gravity surveys, bottom samplings, and terrestrial heat flow measurements.

Under the command of Captain Okumura Hideaki and with 34 officers and men, the *Hakurei-Maru* departed from Funabashi, east

of Tokyo, in late November for Papeete when she arrived on December 12. On December 16 she sailed direct to the research area, and returned to Valparaiso on January 31. She sailed again for Funabashi on February 4, arriving home in the first week of March.



The 1988-89 research programme took place between 50 degrees west and 65 degrees west in the Bransfield Strait. The areas and years where research has been conducted for the past eight years appear in bold type. — Ministry of International Trade and Industry, Japan.

Japan

Plans for fourth base under review

Japan, which has three bases in Queen Maud Land — Syowa, Mizuho and Asuka — and has been engaged in research there since the International Geophysical Year (1957-58) has plans for a fourth base nearly 1094km inland from its main base Syowa. Construction of the base is under review by the National Institute of Polar Research and university glaciological institutes.

Designed to serve the East Antarctic Inland Dome Glaciological Survey project the base would take two years to build, starting in the 1991-92 season. It is hoped to begin full-scale surveys by 1993 at the latest.

Japanese glaciologists intend to study an ice dome at 77 deg. S/39 deg.E which is 3800m above sea level. They propose to drill through ice 3000km thick to obtain meteorological information about the climate 150,000 years ago. Ice core sampling would be done at the 2500 to 3000 level.

... since 1957

Syowa station, located at 69 deg. 00'S/39 deg. 35' E on East Ongul Island, Lutzow-Holm Bay was established on 29 January, 1957 is occupied throughout the year and supports auroral, ionospheric, VLF wave, satellite data acquisition programmes as well as studies of geomagnetic variation. Meteorological observations include surface synoptic, aerological sounding, and solar radiation. Scientists have also installed a Dobson Spectrophotometer for ozone work. Other programmes include environmental monitoring focussing particularly on CO₂, studies of soil algae and bacteria and population census of penguins and Weddell seals. Natural earthquakes are monitored and tide observations made. Studies of terrestrial ecosystem and human physiology are also undertaken.

Mizuho Station, which is located at 70 deg. 42'S and 44 deg. 20' E and was established on 21 July, 1970 supports surface meteorological observations with an

unmanned system while at Asuka Camp which lies at 71 deg. 32'S and 24 deg. 08'E in the Sør Rondane Mountains region and was established on 1 January 1985 for year round operation. It supports regular auroral, geomagnetic and meteorological programmes as well as gravity and aeromagnetic surveys, airborne ice echo sounding and aerial photogrammetry. In the winter of 1987 seismic observations were also undertaken.

Recent summer programmes involving scientists and support personnel have included geological, geomorphological and aerial photographic surveys of the central part of the Sør Rondane Mountains. Physical, chemical and biological oceanographic observations were also taken from the expedition ship.

Japanese in crevasse accident

Three members of the 30th Japanese Antarctic Research Expedition (JARE-30) were seriously injured on January 13 when a snowmobile fell into a crevasse during an observation trip 200km from Asuka Camp (71deg 31min S/24deg 03min E). They were Keizo Yanai (47) deputy leader of the 1989 winter team at Asuka, Kunito Kami (45), of the Maritime Safety Agency, and Dr Masaaki Kawachi (35), the team's medical officer.

According to a statement from the Ministry of Education in Tokyo, which is responsible for Japan's Antarctic activities, there were two separate accidents. The snowmobile on which Messrs Yanai and Kami were riding plunged some 30 metres into a crevasse. Dr Kawachi also fell 25m into a crevasse while helping Mr Kami to a waiting snowmobile.

All three men were taken back to Asuka for preliminary medical attention. On January 19 they were picked up by helicopter from the ice-strengthened research and supply ship Shirase and flown back for medical treatment.

The Shirase, which had brought the new winter and summer teams, was berthed in Breid bay 140m north of Asuka on the

Princess Ragnhild Coast of Queen Maud Land.

First flight from Chile to Syowa

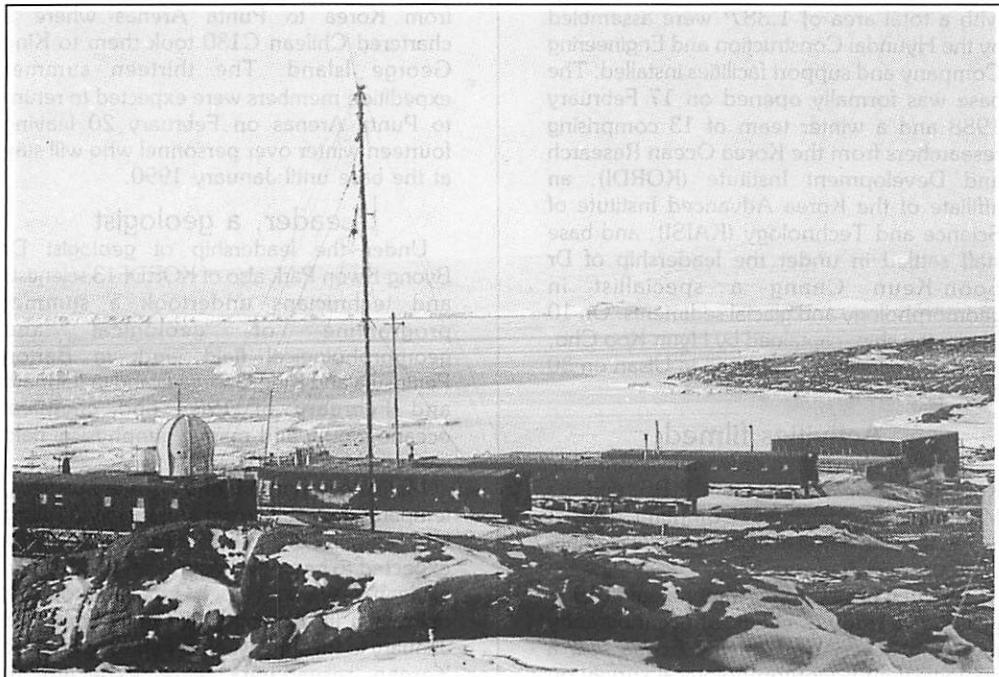
An airborne route to Japan's main Antarctic station Syowa from Chile was opened up last season. Sponsored by the Asahi Press and TV Asahi a chartered Twin Otter flew from Punta Arenas and returned on January 25 after a flight out and return which took more than 78 hours flying time.

Leader of the first flight between South America and Syowa, described as the Japan Antarctic Airborne Project 1987-88, was the noted Himalayan climber and Antarctic explorer, Masayoshi Murayama. He led the team from Syowa which reached the South Pole on December 19, 1968 after a 2570km overland trip.

There were six passengers on the Twin

Otter which was flown to Syowa by Russell Boomberry and J. O'Toole. The aircraft flew by way of the Chilean stations Rodolfo Marsh on King George Island and Carvajal on Adelaide Island. Calls were made at the British Halley Station and the West German George von Neumayer Station.

In Queen Maud Land the Twin Otter visited the three Japanese stations, Asuka, Syowa, and Mizuho. The last stop on the outward route was at the Soviet Molodezhnaya Station. A refuelling stop had to be made on the way back at the Argentine Marambio Station on Seymour Island because of an unexpected closing of the Rodolfo Marsh runway.



Japan's Syowa station in the summer of 1985. Photo: National Institute of Polar Research, Japan.

South Korea

South Koreans spend second winter on ice

Scientists from the Republic of Korea are spending their second winter on King George Island on which they opened their base King Sejong Station in February 1988. It is located at 62 deg. 13'15"S and 58 deg. 45'10"W and has emergency summer accommodation for up to 30 and 18 in winter. The base is indicative of Korea's formal commitment to Antarctica after involvement in the Commission for the Conservation of the Antarctic Marine Living Resources since March 1985 and accession to the Treaty on 28 November 1986.

Since 1978 the Republic has despatched eight expeditions to the Antarctic to undertake marine biology and chemistry studies in most Antarctic summers.

In 1986-87 a base site was identified and on 6 October 1987 the HHI 1200 departed Ulsan in Korea for King George Island with construction materials and a team of scientists and technicians. Seven separate buildings with a total area of 1,387² were assembled by the Hyundai Construction and Engineering Company and support facilities installed. The base was formally opened on 17 February 1988 and a winter team of 13 comprising researchers from the Korea Ocean Research and Development Institute (KORDI), an affiliate of the Korea Advanced Institute of Science and Technology (KAIST), and base staff settled in under the leadership of Dr Soon-Keun Chang a specialist in geomorphology and glacial sediments. On 10 March the ship, captained by Hyun-Koo Cho, left the site for Korea arriving in Ulsan on 30 May 1988.

Activities filmed

Twenty television crewmen from the Korean Broadcasting System (KBS) and the Munhwa Broadcasting Company (MBC) covered the building activities from December 1987 to mid January 1988.

Research programmes undertaken in 1988 included a study of chemical oceanography involving observations in the Scotia sea, a geological and geomorphological survey on Barton Peninsula and Marian Cove from

January to March, a marine biology programme focussing on algae and planktonic organisms near Marian Cove was undertaken periodically and routine geomagnetic, wind speed, pressure, temperature, humidity, visibility and solar radiation observations made.

This season 27 scientists and technicians comprising a summer and wintering party flew from Korea to Punta Arenas where a chartered Chilean C130 took them to King George Island. The thirteen summer expedition members were expected to return to Punta Arenas on February 20 leaving fourteen winter over personnel who will stay at the base until January 1990.

Leader, a geologist

Under the leadership of geologist Dr Byong-Kwon Park also of KORDI 13 scientists and technicians undertook a summer programme of geological and geomorphological field work in Barton Peninsula and King George Island in January and February of 1989 and chemical oceanography and marine geophysical field work in Maxwell Bay.

Marine programmes of sea-water sampling, temperature, sub-bottom and salinity profiling and sampling of sea bottom sediments were expected to be undertaken from the 836 ton Chilean research vessel Cruz de Froward, operating in Antarctic latitudes from mid January to the third week in February. Twelve Korean researchers were expected to participate in the voyage.

This winter's team, led by Dr Yea-Dong Kim, will undertake an environmental science study comprising observations of micro-climate around and in the moss cushion and an ecological study of mosses and algae in the area surrounding the station and on Barton Peninsula. Other work will include an upper atmosphere physics programme using

a high resolution interferometer which was expected to be installed at the station during the summer to enable study of thermospheric winds and temperature. Routine observations at the station include geomagnetism, surface observations of wind speed pressure, temperature, humidity, visibility and solar radiation.

Sweden

Sweden establishes second base in Queen Maud Land

Sweden, once expected to co-operate with New Zealand on research in the Ross Sea region of the Ross Dependency, chose to establish a scientific station in Queen Maud Land early last year and has now built a second station on the continent.

One of the first countries to send an expedition to Antarctica in the Heroic Age of exploration, Sweden acceded to the Antarctic Treaty on 24 April, 1984 and achieved consultative status on September 21, 1988. The choice of Queen Maud Land for its research programme is not surprising.

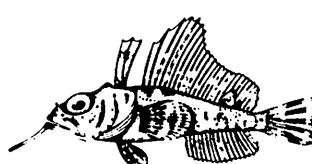
Swedish scientists and airmen were in Queen Maud Land as members of the Norwegian-British-Swedish Expedition which worked there from 1949 to 1952. A noted Swedish glaciologist, Hans Ahlmann, inspired the project which was the first large-scale international expedition. A Swedish scientist, Valter Schytt, was chief geologist and second-in-command of the expedition.

With logistic support by the West German Antarctic research programme a joint West German/Swedish team made a traverse from Georg von Neumayer Station last year to the Heimefrontfjella (Homefront Range) and established at 74 deg. 35min. S/11deg. 13min. an advance base called Svea (Sweden) for glaciological and geological investigation of the region. The Heimefrontfjella (74deg. 35min S/11.00 W) consists of three mountain groups running north-east by south-west for 104.6km. It is 80km west-south-west of the Kirwan Escarpment.

This last summer a Swedish expedition in its own ice-strengthened ship went to western Queen Maud Land to build another station temporarily called Basen (Base) at 73 deg. 02min S/13deg. 25min W in the Vestfjella (West Range) of the Kraul Mountains. This will become the main Swedish base for wintering capacity and Svea a satellite.

Swedish research is concentrating mainly on climatic and environmental change. Special attention is being given to the fast ice age and the period following, and to sedimentary and tectonic history.

The Kraul Mountains (73 deg. 30min S/14 deg. 10min W) are a chain of mountains and nunataks which trend north-west from the Veststraumen (West Stream) Glacier for about 112km. South African, Norwegian and West German scientists have worked in the area in recent seasons.



USAP in 1990s

All-season airfields and blue ice runways

A plan for the construction and maintenance of an all-season airfield suitable for wheeled aircraft on the Ross Ice Shelf being developed this summer by the United States Army's Cold Regions Research and Engineering Laboratory (CRREL) for the National Science Foundation. The agreement between the two organisations for CRREL to provide engineering consultation for Antarctic operations includes a study of possible development of a sealed gravel surface runway at Marble Point, the rocky promontory about 80km from Ross Island on the western side of McMurdo Sound.

Also related to the development of hard-surface runways in Antarctica is a survey of potential blue ice sites in the region 86deg to 87deg S to 165deg W and the region 85deg to 86deg S and 160deg to 175deg E. A small CRREL team will make air reconnaissances and preliminary ground surveys, using a chartered Twin Otter aircraft from the South Pole.

One of the greatest future needs for the US Antarctic programme (USAP) is a year-round hard-surface runway and an accompanying base likely to cost \$US500 million and \$US1 billion. This opinion was expressed in 1987 by a special committee which reported to the US National Science Board on the future role of NSF in the polar regions. In the same year a special panel was convened to assess safety in the USAP and ways in which it could be improved. Last year the panel recommended to Mr Eric Bloch, director of NSF, that the foundation should consider evaluating blue ice areas as potential Hercules landing sites to provide greater flexibility for science and operational purposes.

Since 1957

Since the International Geophysical Year (1957-58) the United States has made several feasibility studies to determine whether a permanent all-weather airfield could be built on the Antarctic Continent. Marble Point was the only suitable site found in a 10-year search of Antarctica.

A feasibility study of the area was made by a survey team in 1957 and 1958, and a 548m

strip was bulldozed from the gravel by Seabees for use by light aircraft. The first landing of a wheeled aircraft on the gravel strip was made by a VX6 Squadron single-engined Otter on January 31, 1958.

Otter aircraft used the strip in the early years of Operation Deep Freeze and a small maintenance unit remained at Marble Point to look after the tractors and earth-moving equipment.

Survey done

After the survey, which included collection of data for the siting of buildings, power plants and electronic equipment, reports suggested that the United States planned to spend between \$US25 million and \$US100 million on an all-weather commercial airfield to provide an air link on routes between South America, Australia, and New Zealand. But by 1960 the results of the survey disappeared into the files in Washington, and later the equipment was brought back to McMurdo Station across the McMurdo Sound sea ice.

In the 1971-72 season NSF, by then responsible for financing and managing American Antarctic activities, arranged for the Bechtel Corporation to report on the feasibility of establishing a new base at Marble Point. The study covered the research and logistic needs of NSF between 1971 and 1991, and included not only a study of the Marble Point airfield but also a re-evaluation and operational cost analysis of the McMurdo Station runways for wheeled and ski-equipped aircraft.

Nothing more was heard of the Marble Point proposal after the Bechtel Corporation reported that the cost of a new base, airfield, and harbour would be close to \$US1000 million. The move could be made but the major costs could not be recovered before the year 2000.

Staging point

Since then Marble Point has been used as a staging point by US helicopters supporting field parties operating on the western side of McMurdo Sound and on the Polar Plateau. Early each season, providing the sea ice is thick enough tractor trains from Scott Base take supplies and equipment across McMurdo Sound to support Vanda Station and New Zealand research projects.

In the 1987-88 season, Dr Michael Mellor, leader of the CRREL team and two of his colleagues made a preliminary study of Marble Point and the Ross Ice Shelf and sea ice runways. This summer CRREL has been concerned with a number of projects ranging from solar and wind energy at the South Pole to waste management practices at McMurdo Station, Palmer Station on Anvers Island off the Antarctic Peninsula, and on the NSF research vessel Polar Duke.

Phased programme

Construction plans and schedules will be made for a phased building programme at Marble Point. The first phases, construction of a limited length gravel runway, would extend over two to three seasons. In the second phase the runway would be lengthened and auxiliary facilities built, and the last phase would concentrate on paving the runway, taxiway, and parking apron with low-temperature asphalt. A report will be made to NSF by June this year.

A site for one or two runways on the Ross Ice Shelf will be selected somewhere near the site of the old Outer Williams Field. The present skiways on the ice shelf are 3048m and 2438m long. On the annual ice in McMurdo Sound the runway for wheeled aircraft until mid-December is 3048m, and there is also a helicopter pad.

As the accessibility of the airfield to McMurdo Station will have a significant impact on its successful operation CRREL will study

ground transport between the two points. Related to the operation are studies made in the last two seasons by other scientists of methods of developing snow roads and airstrips in the Ross Island area and at the South Pole.

A conceptual design for a new station at the South Pole will be developed to prepare for the next phase of planning for replacement of the present Amundsen-Scott South Pole Station. Previous surveys and studies of the structure of the geodesic dome at Pole Station have been made by the Naval Civil Engineering Laboratory (NCEL) and CRREL will be extended this year. The purpose is to provide guidelines on what (if anything) needs to be done to keep the dome "safe to live in" through the mid-1990s.

Solar and wind energy work at the Pole will include compiling and analysing site data for the station, and reviewing photo-voltaic and wind generator technology. CRREL will also examine the economics of conventional electric power generation.

U.S. Navy support commander

Captain Joe Mazza, a former commanding officer of the U.S. Navy's VX-6 Squadron, has been appointed Commander, Naval Support Force, Antarctica (CNSFA). He will take over his new command from Captain Dwight Fisher towards the end of June.

In the 1984-85 season Captain Mazza, then a commander, was posted to VX-6 as operations officer. He served as executive officer the next season, was appointed to command the squadron in the 1986-87 season.

Captain Fisher, who has been appointed Navy liaison officer with the National Science Foundation's Division of Polar Programme, assumed the post of CNSFA in 1987. He was operations officer of VX-6 in 1982-83 and commanded the squadron in 1984-85. A naval aviator since 1966, he has served in the United States, Iceland, the Azores, Sicily, and Crete.

Conceptual designs for new facilities at Williams Field will also be developed. Field modules, which could be used as a construction/emergency camp at the Pole, are expected to be two-storey steel frame elevated buildings which could be moved every few years by tracked transporters.

Waste management

A report on waste management was submitted to NSF by CRREL last year. This will be followed up and the team will inspect the old seaside dump at McMurdo Station and advise NSF on future action. It will also advise on waste management practices at Palmer Station and on the Polar Duke, consider improvements at the Fortress Rock solid waste site behind McMurdo Station, and the feasibility of a closed incinerator system.

Another waste management project will determine the useful life of waste water disposal pits at Williams Field and Pole Station. CRREL will design a system for installation by the NSF contractor to predict the useful life of the waste water discharge points in the snow pack at the two areas.

In its engineering survey of Palmer Station CRREL will review available information and conduct a site investigation. It will prepare a report on the condition, use, and suitability of the station buildings; water supply and waste management; the dock and waterfront facilities; and potential air operation sites.

Patriot Hills

Increasing use of a bare ice runway near the Patriot Hills (80° 19.5' S / 81° 16' W) in the Heritage Range of the Ellsworth Mountains by private tour operators who have flown tourists to the South Pole and mountain climbing parties to Vinson Massif, the highest peak in Antarctica, is one reason for the evaluation of blue ice areas as potential Hercules landing sites. The NSF safety panel says in its report that as private tour operators will probably expand their operations in Ellsworth Land it is likely that the US Antarctic programme will eventually be called upon to provide emergency assistance.

A second reason according to the panel is that in combination with the refuelling capability at Byrd Surface Camp the positioning of

fuelling and other field supplies at locations such as the Patriot Hills would provide considerable added capability for meeting operational and scientific needs. The third reason is that the Chilean Air Force which supports the Chilean Antarctic programme, is reported to have expressed an interest in flying its wheeled Hercules aircraft into the Patriot Hills field.

A recent report by CRREL to NSF's Division of Polar Programmes on hard-surfaced runways in Antarctica refers to a study of blue ice runways between South America and the South Pole made by CRREL staff in 1974 when the reorganisation of US air operations in Antarctica was suggested. Dr Michael Mellor, author of the report, also refers to the discovery of extensive bare icefields south of the Ellsworth Mountains suitable for use by wheeled Twin Otters.

Bare icefields in Ellsworth

This discovery was made by the British Antarctic Survey also in 1974 when Captain Giles Kershaw flew an extensive echo-sounding programme under the direction of Dr Charles Swithinbank, an internationally-known glaciologist, who retired in 1986 as head of earth sciences for BAS. Dr Swithinbank is now taking part in the CRREL survey of blue ice runways this summer.

When he retired Dr Swithinbank joined Giles Kershaw in a search for a suitable icefield large enough for wheeled heavy transport aircraft. Using NASA Landsat imagery they located the Patriot Hills field and laid out two runways for the private Canadian company, Adventure Network International and its subsidiary, Antarctic Airways. The first flight to the airfield was made with a wheeled DC-4 chartered from Kenn Borek Air Ltd, of Calgary, in November, 1987.

Many other blue ice areas exist in the interior of Antarctica, and it is possible that there are suitable locations on the Ross Sea side of the Pole, according to the DPP report. A satellite airfield within 250 nautical miles of the Pole could be useful. Supplies and passengers could be flown in directly from New Zealand or South America in large wheeled aircraft. This airfield could also support inland stations as well as field sites in East Antarctica. — J. M. C.

Treaty Inspections

British-New Zealand team visits 14 bases

Fourteen Antarctic bases occupied by ten nations in the Antarctic Peninsula area and the South Orkneys were inspected by a joint British-New Zealand team in January. In February a United States team visited four stations in the Ross Dependency (one abandoned) and two in East Antarctica.

Both inspections were carried out in accordance with Article VIII of the Antarctic Treaty which provides for complete freedom of access and periodic formal inspections of stations, installations and equipment. This was the first time since 1963 that New Zealand was able to send observers to so many stations and cover such a wide area.

Transport for the British-New Zealand team was provided by the Royal Navy's ice patrol ship, H.M.S. Endurance and her two Lynx helicopters. The American team travelled aboard the United States Coast Guard icebreaker Polar Sea, using helicopters and inflatables to visit some bases.

NZ Observers

New Zealand's observers were Mr Gerard van Bohemen, who deals with polar affairs in the legal division, Ministry of External Relations and Trade; Mr Denis McLean, a former Secretary of Defence and Mr David Geddes, operations controller, Antarctic Division, Department of Scientific and Industrial Research. The British members were Dr John Heap, who deals with polar affairs in the Foreign and Commonwealth Office; Mr W. Nigel Bonner, acting deputy-director of the British Antarctic Survey at the time of his retirement; and Captain Thomas Sunter, commander of H.M.S. Endurance. Because of his shipboard duties Captain Sunter was able to visit only one base, and the FCO interpreter, Mr John Penny, became the sixth member of the joint team.

In late December last year the New Zealanders flew to London to meet their

colleagues. Then on December 28 they had their first experience of the Royal Air Force "Air Bridge" across the South Atlantic to the Falklands from its station at Brize Norton. The journey was made in two stages, each of 7412km by a Lockheed Tristar which landed first at Ascension Island, and then made a second 7412km hop to the Falklands.

H.M.S. Endeavour

H.M.S. Endeavour sailed from the Falklands on January 2 for King George Island in the South Shetlands where she arrived on January 5. Inspections were made of the Chilean station Teniente Rodolfo Marsh and the Soviet Bellingshausen Station. The next day (January 6) the team visited Great Wall (People's Republic of China), Artigas (Uruguay) and King Sejong (South Korea), all in the Fildes Peninsula area. On January 7 the team flew straight to Henryk Arctowski, the Polish station in Admiralty Bay.

Deception Island

Deception Island in Bransfield Strait southwest of the South Shetlands was the team's next destination. For nearly 20 years from 1912 to 1931 the island was the base for a shore whaling station and factory ships used anchorages there.

British, Argentine, and Chilean bases were established there in 1944, 1948 and 1957 respectively. From 1944 to 1967 the British base near the site of the disused whaling station in Whalers' Bay was occupied continuously. But it and the Argentine and Chilean bases were evacuated because of a disastrous eruption on December 4, 1967. All

the bases were undamaged but covered by volcanic ash.

In 1968-69 the British base was re-opened as a summer air facility. In February, 1969, however, another violent eruption destroyed the old hut, half-filled the new hut and the diesel fuel shed with a mud flow caused by the volcanic ash melting a glacier. Mud flows also carried away part of the old whaling station and two old tractors. The whalers' cemetery was covered with ash. The Chilean base was completely covered by mud and ash. All three bases became inactive after this eruption. Later scientists from the three countries worked on the island in summer. Whalers Bay with the remains of the whaling station, sulphurous hot springs, and beaches warmed by volcanic heat, have made Deception Island a tourist attraction in the last 25 years, and cruise ships call there each summer.

Tourists

There were tourists going ashore the day after H.M.S. Endurance arrived on January 8. She anchored outside the bay because the Argentine Navy's polar transport Bahia Paraiso was in the entrance and the next day was busy ferrying tourists to the old whaling station by inflatable boats. During her stay the Argentine ship also transferred fuel to the Spanish Navy's ocean tug Las Palmas for transport to the new Spanish base King Carlos 1 on Livingston Island, South Shetlands.

SSSI's

On January 9 the Endurance entered Whaler's Bay and the team went ashore in inflatables to inspect the British base and the aircraft hangar, now more than 20 years old and viewed the remains of the whaling station. It also inspected a Site of Special Scientific Interest (SSSI). The ship departed the same day for the BAS Faraday Station in the Argentine Islands, arriving at 8 a.m. on January 10 to offload staff and equipment.

In the afternoon of January 11 the team flew to Teniente Carvajal originally Base T, the old British base on Adelaide Island, established in 1961 and closed in 1977. Britain transferred the base to Chile early in 1983. When the inspection was completed

the team returned to the Endurance which headed south for the most remote base to be inspected.

This was General San Martin (68deg 08m/S /67deg 06m W) in Marguerite Bay. It was established on Barry Island in the Debenham Islands on March 21, 1951, temporarily reactivated in the 1973-74 season, and became a permanent station on February 22, 1976.

When the observers arrived on January 12 they were warmly welcomed by the San Martin staff who rarely have visitors. The base can be relieved and supplied only by sea and there is only one ship a year. The British-New Zealand team was the first to sign the station visitors' book which was opened five years before.

Historic links

Barry Island has an historic association with British exploration on the Antarctic Peninsula before the Second World War. In 1936 it was the site of the southern base established by the British Graham Land Expedition (1934-37) led by the South Australian explorer John Rymill. The New Zealanders found that San Martin had a link with Scott Base — one of its 16 huskies was born on Ross Island.

In the 1983-84 season Vega was sent to the BAS Rothera Station on Adelaide to introduce new blood in the British dog teams. It was flown by the U.S. Navy's VXE-6 Squadron to the Thiel Mountains where the ski-equipped Hercules made an open field landing on bare ice. Vega was picked up by a BAS Twin otter operating in the Martin Hills, and arrived at Rothera in February, 1984. Now the husky is on loan to San Martin to improve the station's dogs.

When the joint team returned to the Endurance the New Zealanders flew to Adelaide Island on January 12/13 to inspect Rothera. They returned to the ship by boat on the afternoon of January 13.

The "Gullett"

As ice conditions on the west side of the Antarctic Peninsula were favourable Captain Sunter decided to take his ship through the narrows between Hanusse and Laubeuf

Fiords. The Gullet, first named Loubet Strait by the French explorer Charcot, separates the ice cliffs of Adelaide Island and the high slopes of the Loubet Coast. The passage through The Gullet was an exciting experience for all aboard as the narrows were less than 365 metres wide and the only ice free channel was 35 metres wide. This was only the second or third time a ship had made the passage.

On the morning of January 14 the New Zealanders flew 25km to inspect Faraday. Then the joint team flew to Anvers Island to inspect the United States Palmer Station. There the New Zealanders encountered Dr Tony Inderbitzen, who was the NSF representative in Christchurch during the 1987-88 season.

Cruise ships

From Palmer Station the Endeavour sailed to Wiencke Island and on January 14 anchored in Dorian Bay which is on the north-west side of the island. There the six men were able to have a break for two days and nights from their arduous programme, but they could not get away from the outside world. Two cruise ships, the World Discoverer and the Lindblad Travel's chartered Soviet ship Antonina Nezhdanova, arrived in the bay with their quota of tourists.

Dorian Bay is not far from Port Lockroy, site of the British Base A. established by the wartime Operation Tabarin in 1944. During their stay some members of the joint team inspected two old BAS refuge huts in the bay and went over the hill to examine the remains of the Port Lockroy Base as part of a survey to decide the future of abandoned bases.

Mail drop

Endurance left the peaceful bay on January 16 and sailed for Deception Island where she arrived at 8 a.m. the next morning to pick up a party of Royal Marines who had been engaged on a survey on the island. The observers were there for only two hours and a half. Lunch-time aboard the ship was marked by a mail drop made by an RAF Hercules from the Falklands.

From Deception Island the Endurance returned to King George Island on January 17. In the afternoon the joint team inspected

the Brazilian base Comandant Ferraz on the Kellar Peninsula at the head of Admiralty Bay. The old British Base G nearby was also inspected to decide on its future.

When the team returned to the ship she headed for the South Orkneys on the final stage of her mission. Her progress was made difficult by the movement of the Weddell Sea ice north across her track but on January 19 the New Zealanders were able to fly to Signy Island to inspect the British base. After the inspection the Endurance anchored in the harbour.

Scottish origin

Orcadas, the Argentine base on Laurie Island was the last on the joint team's list, and the oldest. A weather station was established on the island on February 22, 1904 by the Scottish National Expedition (1902-04) led by Dr W. S. Bruce. The Argentine government agreed to take it over, and it has been manned continuously ever since. When the joint team arrived the station residents were busy preparing for the 85th anniversary celebrations.

After the inspection of Orcadas on January 20 the team had one more task — inspection of Specially protected Areas (SPA's) on Moe, Lynch, and Powell Islands. It was still summer in the South Orkneys but the temperature was down and snow was falling while the inspection was under way.

Mercy dash

H.M.S. Endurance headed for the Falklands on January 21. She was well on her way when a message was received that a seaman on a Polish fishing trawler had been injured. The Endurance went about, and in the middle of the night the two Lynx helicopters picked the man up and flew him back to the ship. When the Endurance was about 200 nautical miles from the Falklands the helicopters completed their mercy mission by flying the seaman to hospital. Top cover was provided by an RAF Hercules based in the Falklands.

On January 23 the Endurance anchored in East Bay at 11.30 p.m. Four of her passengers flew back to London on January

25 again on the RAF "Air bridge". Captain Sunter, who had been able to visit only the Chinese — Great Wall Station — on King George Island because of command responsibilities, continued his ice patrol duties.

Early in February the three New Zealanders flew home. In a month they had clocked up more than 74,127 kilometres of flying, including 29,650km on the "Air Bridge".

Environmental standards

In addition to checking the environmental standards observed at the bases they visited the New Zealanders and their British colleagues were concerned with the ecology of the area and the effect of logistic and scientific activities on flora and fauna in specially protected areas and sites of special scientific interest. These have been declared by the consultative members of the Antarctic Treaty in the terms of the Agreed Measures for the Conservation of Antarctic Fauna and Flora agreed to in 1964. Most of the King George Island bases are concentrated on the Fildes Peninsula. During its visits there the joint team made a general assessment of the environmental impact of these bases. It also reviewed the position of old bases in the South Shetlands and elsewhere — some 30 to 40 years old — to decide whether they should remain abandoned or be demolished and the remains removed from the sites.

SPA's

Deception Island is a Site of Special Scientific Interest (SSI) because of its volcanic activity and the presence of small colonies of Chinstrap and Macaroni penguins which have survived natural disasters and human predators in the past. In addition to Deception Island the joint team visited eight Specially Protected Areas (SPA's) which have been designated because of their penguin, seal or seabird populations.

On the list in the first stage were Coppermine Peninsula (Robert Island) and Cape Shireff (Livingston Island), both in the South Shetlands; the Dion Islands in Marguarite Bay south-west of Adelaide Island; Lagotellerie Island, one of the Debenham Islands near the Argentine San Martin base, and Green Island, one of the Berthelot Islands near the BAS Faraday Station.

Lagotellerie Island has an extensive Adelie penguin rookery on its lower terraces and the Dion Islands are the site of the only Emperor penguin rookery on the west side of the Antarctic Peninsula.

On the final stage of the mission in the South Orkneys the team visited SFA's on Moe, Lynch and Powell Islands.

Soviet inspection of Ross Island bases

A Soviet inspection team made a formal visit to McMurdo Station and Scott Base in November. The inspection in accordance with the terms of the Antarctic Treaty was the last in a series to scientific stations manned by other nations in Antarctica.

For its mission the inspection team of eight, which left Kiev for Buenos Aires on November 2 used a ski-equipped twin-engined Ilyushin 500.

200 flights

The team's agenda entailed 200 flights in all and included visits to fourteen stations operated by 13 consultative members of the Antarctic Treaty. Of these five are on King George Island in the South Shetlands. They were Artigas (Uruguay), Henryk Arctowski (Poland), Great Wall (People's Republic of China), Comandante Ferraz (Brazil) and Jubany (Argentina). In the Weddell Sea region and East Antarctica are Georg von Neumayer (West Germany), George Forster (East Germany), Halley (Britain), Dakshin Gangotri (India), Syowa (Japan), Mawson and Davis (Australia) and USA's Scott-Amundsen's South Pole Station.

Team of eight

Leader of the inspection team was Mr A. N. Chilingarov, deputy-director, committee of the Soviet Department of Hydro-meteorology. Other members were E. S. Korotkevich, deputy-director of the Arctic and Antarctic Research Institute, Leningrad (AANII); G. E. Grikurov, head of department in the All-Union Scientific and Research Institute of Geology and Mineral Resources; V. I. Bardin, deputy-chairman of the Inter-departmental commission for Antarctic Studies

of the Soviet Academy of Sciences; G.M. Muradov, general director of the Production Association of North-Western Aero-geodesy; B. V. Pikhonov, officer in the Directorate for International Technical Co-operation, Soviet Department of Hydro-meteorology; V. G. Savenko, senior research scientist AANII; O. A. Troshichev, head of the physics department of AANII.

McMurdo

Flying direct from Molodezhnaya the Soviet inspection team arrived at McMurdo Station on November 27. The next day the eight members flew to the Pole in a National Science Foundation Hercules aircraft for their formal inspection of the American Station.

On November 29 the team went to Scott Base where it spent the night. It arrived in Christchurch aboard an RNZAF Hercules early on the morning of December 2. With the crew of the Soviet aircraft and three members of the Soviet Antarctic Research Expedition. Ross Island had an addition of 15 Russians to its population. The three expedition members returned to Molodezhnaya in the illusion.

When its inspection was completed the team was flown from McMurdo Station to New Zealand by a Royal New Zealand Air Force Hercules and spent four days in Christchurch and five in Wellington before returning to the Soviet Union.

Periodic inspections

Periodic formal inspection of station installations and equipment are permitted by Article V1 of the Antarctic Treaty but the complete freedom of access principle has not been exercised more than a dozen times since 1961. The United States inspections (1964, 1967, 1971, 1975, 1977, 1981 and 1983) have each covered from three to 14 stations over a wide area. Inspections by New Zealand, Australia, the United Kingdom and Argentina, have usually covered fewer stations and a smaller area. In 1981 a team of five from the United States Arms Control and Disarmament Agency inspected Antarctic Peninsula stations. It joined the United States Coast Guard icebreaker Polar Star at McMurdo Station and sailed for the Antarctic

Peninsula on January 18.

Fourteen stations of eight nations in East Antarctica and the Weddell Sea area were inspected by an American team in 1983. Four of them in East Antarctica between Victoria Land and Queen Maud Land are Soviet stations: Leningradskaya, Mirny, Molodezhnaya and Novolazarevskaya.

The team joined the Coast Guard icebreaker Polar Star at McMurdo Station on January 23 and completed its task early in March. The icebreaker was supporting three scientific projects by marine biologists off the coast of East Antarctica during its voyage which ended at Palmer Station on Anvers Island off the Antarctic Peninsula, and completed a circumnavigation of the continent.

U.S. inspects four bases in Ross Dependency

Five United States observers flew south from Christchurch on February aboard a ski-equipped Hercules aircraft to begin their inspection of bases, historic sites, and specially protected areas on Ross Island. They were Mr Raymond V. Arnaudo, of the State Department; Dr Sidney Draggan, of the National Science Foundation's Division of Polar Programmes, and NSF representative in New Zealand last season; Commander Donald Pennit, of the Arms Control and Disarmament Agency; Commander Kazanowska, U.S. Navy; and Mr Thomas Laughlin, of the National Oceans and Atmospheric Administration (NOAA).

On February 9 the team inspected New Zealand's Scott Base, and then the hut built for Scott's 1901-04 Discovery expedition at Hut Point, which is one of the historic sites approved by the Antarctic Treaty consultative members, and New Zealand's responsibility. From McMurdo Station they flew by helicopter on February 11 to Cape Bird which is a Specially Protected Area (SPA) and contains a Site of Special Scientific Interest (SSSI).

On the way back visits were made to Cape Royds which is an SSSI because of its Adelie penguin colony, and contains another historic monument — Shackleton's

1907-09 expedition hut. The hut built at Cape Evans for Scott's last expedition (1910-13) was the third historic site inspected.

Before the observers boarded the United States Coast Guard icebreaker Polar Sea for the journey up the Victoria Land coast, they flew to Cape Crozier which is an SSSI because of its Emperor and Adelie penguin rookeries. It is also the site of an historic monument — the remains of the stone hut constructed in July 1911 by Edward Wilson's party during the historic winter journey ("The Worst Journey in the World") undertaken with Apsley Cherry-Garrard and Henry Bowers to collect Emperor penguins.

Two summer stations in Terra Nova Bay were inspected on the voyage north. The first visited on February 16 was the Italian Terra Nova Station which was established in the 1986-87 season on the coast of the Northern Foothills at the north-east end of Gerlache Inlet. Gondwana, the small West German base was the next to be visited on February 17. It was established in January, 1983, in Gerlache Inlet near Mt. Melbourne by GANOVEX III, the Federal Bureau of

The tiny West German station of Gondwana visited by the team on February 17. It lies in Gerlache Inlet beneath Mt. Melbourne. Photo — Dr Franz Tessensohn.

Geoscience and Resources (BGR) expedition.

These visits of three hours to Terra Nova and two to Gondwana were made using the Polar Sea's helicopters. But when the ship arrived off Cape Hallett on February 18 bad weather made it necessary to put the observers ashore by landing craft. They inspected the former joint US/NZ Hallett Station, established in 1957 and closed as a permanent station in the 1973-74 season.

Rounding Cape Adare the Polar Sea headed for the Soviet station Leningradskaya on the Oates Coast. The inspection team flew to the station on February 19. This was the third time Commander Kazanowska had been there. She was a member of two earlier inspection teams in 1982 and 1983.

By February 21 the Polar Sea was off the coast of Adelie Land, and the team flew off to inspect the French Dumond d'Urville Station situated on l'Île des Petrels in the Pointe Geologie Archipelago. From Dumont d'Urville the icebreaker then headed direct for Adelaide where she arrived on the morning of February 25. Commander Kazanowska had seen the French station for the third time.



Tourists by land, sea and air

Close on 4,000 Antarctic tourists and support staff were expected to go south this summer. Of these up to 3,000 travelled by ship from South American ports, mainly to the Antarctic Peninsula area.

More than 60 mountaineers, skiers, and other hardy souls, plus guides and air crews arrived to climb the Vinson Massif, Antarctica's highest peak, reach the United States Amundsen-Scott South Pole Station by Twin Otter aircraft or ski 600 nautical miles there from the Patriot Hills (80 deg. 19.5 min S/81 deg. 16 min W) in the Heritage Range of the Ellsworth Mountains.

Between late November and early March two cruise ships carried tourists to South Georgia, Elephant Island, the South Orkneys and the Falklands. They were the World Discoverer (120-130 passengers) which was to make seven trips and the Society Explorer (90-100 passengers) which was to make eight trips. Both are operated by Society Expeditions, based in Seattle.

Lindblad Travel, which operates from Westport, Connecticut, chartered the Soviet Cruise ship Antonina Nezhdanova which was at the New Zealand port of Lyttelton early last year. The ship, which can carry a maximum of 90 passengers, was to make six trips to the Antarctic Peninsula area, calling at research stations on the coast or offshore islands.

Travel Dynamics, of New York, entered tourism in the 1987-88 summer when it charted the Illyria (125 passengers, maximum). The ship was to make six trips.

Built in Italy in 1962 the Illyria (3755 tonnes) is now Greek-owned and registered at the port of Piraeus. She was rebuilt in 1982 and refurbished in 1985 to carry cruise passengers.

Cruises

Both Chile and Argentina provided Antarctic cruises for smaller numbers of passengers aboard two of their research and supply ships. The Argentine Bahia Paraiso and the Chilean Capital Luis Alcazar have been available for charter by organisations, and have taken limited numbers of tourists on short visits. They combine supply operations with the tours.

Since the summer of 1985 mountaineering groups have been able to fly from Punta Arenas to the Ellsworth Mountains where a

base camp has been established for ascents of the Vinson Massif or other high peaks. Adventure Network International, a Vancouver-based company, pioneered the route with a chartered ski-equipped Twin Otter and a Chilean Air Force Hercules which was hired to airdrop drums of fuel at the selected site. The first round trip was made by Captain Giles Kershaw for Antarctic Airways, the privately-funded flying arm of ANI.

Antarctic Airways now operates two Twin Otters leased from Calgary-based Kenn Borek Air Ltd. A Californian company, Mountain Travel, co-operates with ANI in the promotion and organisation of trips to the Ellsworth Mountains, and this summer organised the ski journey to the Pole Station.

Flights

Tourist flights to the South Pole became possible in 1986 when an extensive bare icefield close to the Patriot Hills was found to have a suitable area for use by wheeled aircraft. After Kershaw had surveyed the icefield and made a series of landings on it with a Twin Otter ANI decided that it would have to set up a base, mark out a runway, and land a large wheeled aircraft on its own before the Chilean Air Force could be persuaded to land a wheeled Hercules there.

Kenn Borek Air bought a 43-year-old Douglas DC-4 and leased it to ANI with a crew of three pilots and three engineers, all with Arctic experience. The aircraft was modified with long-range fuel and oil tanks, fitted with long-range navigation equipment, and provided with 20 passenger seats. After weather and other delays the aircraft left

Punta Arenas on November 15 for the 1700nm flight to the icefield where the two Twin Otters were stationed to provide ground support and emergency backup.

After the inaugural flight in November the next month was spent flying fuel and equipment to the icefield and building up route experience. The field was developed as a reception centre for passengers and freight to be flown on to base camps, including the South Pole using the two ski-equipped Twin Otters.

With Society Expeditions ANI then offered passenger flights to the Patriot Hills and onward travel to the Pole, starting in January 1988. On January 11 the first tourists arrived and nineteen altogether were shuttled to the Pole in three flights on January 11 and 12.

This summer only two flights were to be made to the Pole with eight paying passengers in each Twin Otter. Two climbing groups of eight Americans and eight Norwegians were booked to fly to the Ellsworth Mountains. In addition to guides ANI provides a doctor and a support staff at the base camp which could have a moving population of up to 50 people during the season.

Ski-journey

Mountain Travel has organised the most unusual and most expensive Antarctic tour — the cross-country ski journey to the South Pole from the Patriot Hills. Originally eight serious candidates put down US\$5,000 in advance for an adventure which would cost them \$69,000, apart from paying their air fare to Punta Arenas and the cost of a 10-day training session in the Canadian Arctic.

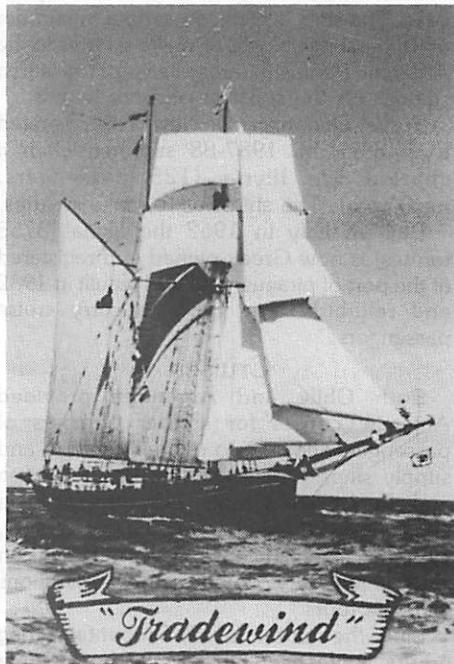
Planned to begin on November 26 and take up to 50 days of skiing, the expedition finally comprised five people. The basic fee charged by Mountain Travel included food and other supplies, the services of guides and other support staff who accompanied the trekkers on snowmobiles and unloaded and packed the sledges carrying the gear during the camp stops en route. The costs of the whole operation was reported to have risen to US\$100,000.

New Zealanders ran four tourist cruises to sub-Antarctic Islands, and on a much more modest scale. Rodney Russ, who was with the

New Zealand Wildlife Service for ten years, chartered a Tasmanian-built oyster boat from a Bluff fishing company for a 16 day cruise to the Auckland Islands and Campbell Island.

When the 113-tonne Cindy Hardy sailed from Bluff on January 22 she carried ten passengers with a sense of adventure and an interest in natural history. Each paid NZ\$4823 for the trip. The Cindy Hardy is 23.7m long, fitted with a 200 hp diesel motor and operated by its own crew.

Tradewind, a company which owns a 77-year-old former Dutch topsail schooner which was restored to sail from England to Australia in the First Fleet bicentennial re-enactment in Sydney Harbour, is slightly more ambitious. Mark Hammond, skipper of the Tradewind, once the Willem, and his fiancee, Alison Brown planned three voyages to the Auckland Islands and Campbell Island this summer. The first started from Hobart on December 18.



A postcard of the Tradewind.

After the first island visit the Tradewind arrived in Dunedin on January 15, and departed January 23 and February 15 on the second and third cruises. Twenty berths were available on each trip at a cost of \$3,564 each. A 37m long steel-hulled vessel, the Tradewind has a professional crew of eight and is fitted with modern navigation and safety aids, single and double bunks and a saloon

bar.

In 1985, Mark Hammond and Alison Brown, who is a director of Tradewind, started a world-wide search for a suitable sailing ship which they wanted to own and operate as a commercially profitable business. They found the Wilem in Amsterdam, and after it had been restored, it was sailed from London from where it left on the voyage to Sydney.

Argentina's Bahia Paraiso sinks off Anvers Island

Argentinian vessels carrying oil containment equipment and experts to operate it were ordered from the site of the sunken Bahia Paraiso by government authorities on March 23 as the weather closed in for the winter. American, Chilean and Spanish vessels and personnel have also left the site.

Ironically translated as Paradise Bay the Bahia Paraiso sustained a 10 metre gash in its hull when it ran aground on shoals off the south-western end of Anvers Island in the Bismarck Strait, 565 km from the tip of South America on January 28 discharging diesel oil into the pristine Antarctic environment. It was subsequently partially refloated and stabilised with a list of 25 degrees and water up to the helicopter deck. The oil leaking from the ship's tanks was reduced to a flow of 7.75 litres per minute and contained by a light inflatable boom put around the ship by the Chilean vessel Yelcho.

High winds then put a stop to salvage work and three days later the vessel sank in 15 metres of water rolling on its starboard side leaving about 20 percent of the port side visible above the water. The wreck can be seen 1.1 US mile from the communications room of Palmer Station to which the vessel had made an unscheduled visit.

Palmer Station

Palmer Station is on the southwestern coast of Anvers Island off the Antarctic Peninsula. It was completed in 1968, stands on solid rock and consists of two major buildings and three small ones plus fuel tanks, a helicopter pad

and a dock. About 40 people can be accommodated in the summer and the winter population is usually ten.

Access to the station is known to be difficult with submerged shoals, small islands and icebergs occasionally appearing in the area — usually ice free in summer. Rich in wildlife, scientists say it is ideally suited for biological studies of birds, seals and other components of the marine ecosystem. A regular meteorology programme is run with occasional work on upper atmosphere physics, glaciology and geology. This year an ozone study focussing on the effects of the depletion on marine organisms was being undertaken. The National Science Foundation has invested over \$US80 million (\$NZ127.2 million) in the work of the station over 20 years and many of the programmes associated with wildlife have been long term.

The 9,600 tonne, diesel-engined, ice strengthened polar transport Bahia Paraiso is 132.7m long and has a beam of 19.5m and draught of 9.7m. Built by the Spanish firm Astillero Principe y Menghi SA she was launched on July 3 1980 and commissioned for service by the Argentinian Navy in July 1981. Her captain on this voyage was Juan Carlos Sampietro. She requires a crew of 124

and is capable according to published sources of taking 44 personnel in transit and 82 seagoing passengers whose fares help defray running costs. There were 316 people on board at the time of the accident.

When fully loaded the Bahia Paraiso is able to carry dry cargo of 3,500 cubic metres, 250 cubic metres of refrigerated cargo and 1200 tonnes of fuel which on this voyage comprised 950,000 litres of diesel and aviation fuel as well as petrol and bottled gas. Much of the diesel was carried in drums strapped to the decks. The fuel was destined for the resupply of the Argentinian Base Esperanza.

Shortly after she ran aground the mainly American and European passengers and Argentinian crew were taken to the nearby Palmer Station. A few minor injuries were treated and within a short time the US tourist vessel Society Explorer took 132 passengers, the Russian chartered Greek vessel Illiria 80 and the Chilean ship Cruz de Froward took 40, relieving the overcrowded station. Most of the passengers were offloaded in the South Shetlands at Tiente Marsh and flown back to

Buenos Aires by the Chilean airforce and to their subsequent destination by the Argentinians. Five days later the Spanish Royal Navy tug Las Palmas, which had been used to support the Spanish expedition to King Carlos 1 Station off Livingston Island, took off the remaining 44 crew members.

Observations from the various ships created a confusing picture of the oil flow from the vessel shortly after the damage was sustained. Local personnel say oil poured from the ship when it capsized. A plane from the Chilean Antarctic Institute overflying the wreck later in the day calculated a slick of 700 metres extending back from the boat. The Argentinians claimed that no oil leaked at all while the captain of the Las Palmas near the accident site three days later (and after containment measures had been implemented) said there was no sign of oil escaping from the sunken vessel but patches had spread up to a mile from the accident.

Measures to contain oil spilling from the damaged vessel were taken quickly as the crew of the Chilean navy oceanographic ship



The Bahia Paraiso — Photo: Colin Monteath

big news about your last will and testament

Yelcho surrounded the wreck with a light boom. Staff from Palmer Station used their fleet of zodiacs and the ship's lifeboats to recover drums, CNG cylinders and other floating debris. In the United States the National Science Foundation assembled a team of 15 experts and 52 tonnes of equipment subsequently flown by the giant transport, C5 Galaxy, to Buenos Aires for their research vessel RV Polar Duke. They arrived within about eight days and installed a heavier boom around the Bahia Paraiso. Two 36 foot skimmer boats collected surface oil and pumped it into inflatable tanks and chemical dispersants were used to break up patches of oil.

Work on the vessel has continued until the retreat of the teams during the middle two weeks of March. The Americans then returned to the States via Buenos Aires. Two Argentinian vessels, one of which was the Bahia San Blas, and the Chilean vessel the Cruz de Froward have assisted with operations including the sealing of the Bahia Paraiso to stop further leaking. Approximately 170,000 metric tonnes of oil are thought to remain on the vessel but are inaccessible.

The Argentinians invited experts from the Dutch Salvage firm the Wijsmuller to advise on the vessel's recovery and they arrived at the site about 21 February but, with only a month to complete operations before the winter set in, no such work was possible and future plans are uncertain.

Impact

Shortly after the vessel grounded preliminary observations made by the staff at Palmer Station revealed dead and dying krill washed up in tidal pools along the coast of the island.

Subsequently skuas and penguins which are both regurgitating feeders were affected. The normally aggressive skuas became lethargic and failed to protect the chicks in their nests. In one study area of 54 pairs an entire generation of chicks have been lost. Chinstrap and Adelie penguin young, due to go to sea for the first time within days of the grounding, had to make their way through contaminated waters and the affect this season is unknown although a small number of adults had been found dead.

Scientists studying cormorants, the blue eyed shags, in another nearby colony observed birds suffering from internal haemorrhaging evident from anal bleeding.

A team of scientists from the United States were subsequently flown to the site to make baseline studies of the damage. They will return again next season. A preliminary report is expected to be published in late May.

Australian flag flown on Vinson Massif

Antarctica's highest peak, 4,897m Vinson Massif, in the Sentinel Range of the Ellsworth Mountains, was climbed by two Australians and a New Zealander on December 10. They were Greg Mortimer (36) and Mike McDowell (42), both of Sydney, and Colin Monteath (40) of Christchurch.

Since 1966 when an American Alpine Club expedition made the first ascent the peak has been climbed by Americans, Canadians, Japanese and West German and Soviet scientists. Mortimer, McDowell and Monteath are the first climbers from their two countries to accomplish the feat.

There was a double celebration when the team completed its five-day climb from the base camp to the summit where they planted an Australian flag in the ice. December 10, was Mortimer's birthday, but with temperatures of minus 40 deg celsius no champagne corks were popped. They made do with frozen chocolate bars.

Because of the delay in their flight back to Punta Arenas the climbers spent a cold Christmas at their base camp. But all three have climbed at high altitudes in Antarctica before and are used to ice and cold.

Mortimer, a geologist, was in the Australian team which climbed Mt. Everest in 1984 and led the Australian Bicentennial Antarctic expedition on the first ascent of Mt. Minto (4165m) in the Admiralty Mountains of North Victoria Land on February 18 last year. Monteath, a photo-journalist, has climbed in Antarctica, the Himalayas, Africa and the

Soviet Union. McDowell, an adventure travel company owner, has had ten years experience in Antarctica as cruise director of

the Lindblad Explorer, now the Society Explorer.

Six skiers arrive at Pole

Six skiers, four men and two women, and four guides reached the Amundsen-Scott South Pole Station on January 18 at 9.45pm local time after travelling more than 300 nautical miles (559km) from the Thiel Mountains (85 deg 15min S/90 deg W). Shirley Metz, (37) an American businesswoman and freelance journalist and Victoria Murden, a 24-year-old Harvard theology student, were the first women to reach the Pole by land.

Of the four men, three were Americans, Jerry Corr (56), a property agent, Ronald Milmakir (45), a US airforce dentist and Joseph Murphy (55), a writer. The fourth man was Colonel J. K. Bayad (45), Director of the Indian Army Mountain Institute at Kashipur, Uttar Pradesh. The party also comprised the first Americans and first Indian to reach the pole by ski.

Party of 11

Leader of the party of 11 was Martyn Williams, who founded Adventure Network International. He is English-born, but has lived in Canada since 1969. The four guides were Stuart Hamilton (Canada), Jim Williams (USA), Alejo Contreras (Chile) and Michael Sharp (Britain).

A Californian Company, Mountain Travel, organised the tour and the Canadian based Adventure Network International was responsible for the planning logistics and operations. Air support has been given by ANI's subsidiary Antarctic Airways.

Blue-ice runway

From Punta Arenas the party was flown to the ANI base on a lateral moraine at the foot of the Patriot Hills by an ANI chartered wheeled DC4 which landed on the blue ice runway established by ANI in the 1987-88 season. There the tourists were housed in a

comfortable camp which can accommodate up to 40 people.

When the tourist began their journey they were preceded by professional guides who drove snow-mobiles hauling sledges packed with food and supplies. At each halt after 10 to 15 miles of skiing over the 740 miles to be covered the guides set up camp, pitched tents and prepared meals for their six charges.

Extensive training

The team had undergone extensive training and attended two camps prior to the trip and except for a few cases of frostbite all were fit and well when they reached the Pole to be welcomed by the station leader. On the way they had to cope with winds rising to nearly 54 knots and temperatures down to minus 40 degrees celsius.

When the party flew back to Patriot Hills on January 18 it left behind two skidoos, two Eskimo type sledges and supplies for the east-west traverse to be undertaken next season by Will Steger and Jean-Louis Etienne.

Champagne celebration

The chartered Twin Otter, on which the tourists returned, spent one and a half hours at the Pole before taking off at 2.21 a.m. on the morning of January 18 with the expedition members. Bad weather on the return flight forced the pilot to land in the Thiel Mountains when the aircraft was 500 km north of the pole. The party camped 32 km from the supply depot until the weather cleared and then flew onto Patriot Hills to be welcomed with champagne. By January 19 they were back in Punta Arenas.

For the privilege of being the first tourists to ski to the Pole they paid \$US69,500 plus their airfares to Punta Arenas and the cost of their training.

Dick Smith twice at Pole

Dick Smith reached the South Pole at last on November 24 and spent two hours there. He and Giles Kershaw flew the "Australian Geographic" Twin Otter Sir Hubert Wilkins from Casey on November 22 to the Greenpeace World Park Base at Cape Evans.

With two members of the Greenpeace winter team, Keith Swenson (leader) and Wojciech Moskal (oceanographer) and drums of fuel the Twin Otter left Cape Evans at 8.30 p.m. local time on November 23, arriving at the Pole at 2 a.m. the next morning to establish a fuel depot. The aircraft returned to World Park Base at 9.45 p.m. on November 24.

Early on the morning of November 26 Smith and Kershaw flew back to Casey where they arrived just before 7 p.m. after half an hour at Dumonte d'Urville. On November 28 the aircraft made a reconnaissance of the submarine Petersen Bank and the coast towards the Baleana islands and also surveyed possible landing sites for Hercules aircraft.

By November 30 Smith and Kershaw were back at the Pole again. They flew from Casey to Vostok on November 29, departing at 4.31 a.m. on November 30.

Hoisted flag

Five and a half hours later the Twin Otter landed near Pole Station. Dick Smith hoisted the Australian flag, the aircraft was refuelled and after a stay of an hour and 20 minutes the flight was resumed to the blue ice airfield near the Patriot Hills of the Sentinel Range of the Ellsworth Mountains where the Twin Otter landed at 3.40 p.m. Early in December the Antarctic crossing was completed by way of King George Island. The last landing was at Punta Arenas.

Lent to ANARE for scientific and logistic support of this summer's programme the Twin Otter and its pilots covered a wide expanse of territory and were employed on a major radio echo-sounding project in the Prince Charles Mountains, and surveys of Emperor penguins and Weddell seals. In less than three weeks the aircraft and its crew were at Casey, Mawson and Davis, Edgeworth David Base

in the Bunker Hills, Law Base in the Larsemann Hills and Dovers in the Prince Charles Mountains.

Flights were also made to Molodezhnaya, Mirny and Vostok and the new Soviet base Progress in the Prydz Bay area. November 18 the Twin Otter made a 9 hours 22 min demonstration flight from Mawson to Japan's Syowa Station by way of Proclamation Island and Molodezhnaya. Between November 11 and 19 Smith and Kershaw also ferried passengers and cargo from the ice edge to Davis and Mawson when the Icebird was blocked by heavy ice.

Continued from p. 369

Handling Bureau, a national development agency concerned broadly with the physical movement of goods.

Australia's Antarctic research programme is now the responsibility of the Department of Arts, Sport, the Environment, Tourism and Territories. Formerly the division was part of the Department of Science and Technology.

Snowmobile accident at Davis, two hurt

Two men in the summer team at Davis who were injured in a snowmobile accident near the station on January 6 were flown to a hospital in Buenos Aires on January 9. One man broke both ankles; the other broke the lower part of one leg.

When they lost control of the snowmobile on hard, blue ice the men were thrown off and fell five to seven metres onto more blue ice. They were able to radio Davis for help and were taken by helicopter to the station hospital. There it was decided to evacuate them rapidly for specialised treatment.

From Davis, the men, unnamed by the Australian Antarctic Division, were flown first 110km by helicopter to the Soviet Base Progress, and then another 1200km north to Molodezhnaya. A Soviet aircraft flew the men, accompanied by Australian and Soviet

doctors, to Bellinghausen, King George Island, landing on the Chilean airfield at Rodolfo Marsh Station.

On January 10 the Australians arrived in

Buenos Aires and were admitted to hospital. A Hobart report said it would be decided later whether they would be treated there or returned to Sydney.

Historic Chapel of the Snows rebuilt again

Antarctica's first church — the tiny Chapel of the Snows on Ross Island where Americans from McMurdo Station, New Zealanders from Scott Base, and visitors, have worshipped irrespective of religious denomination, since 1956, was rebuilt last summer and dedicated in January this year. Built in the winter of 1956 from surplus materials by volunteers, the chapel has been rebuilt three times since then.

In the early hours of August 23, 1978 the first chapel was destroyed by fire. All that was rescued from the ruins were the chapel bell, small religious items damaged by the flames, and two stained glass windows. Lost in the fire were the chapel organ and records of United States activities on Ross Island since 1955.

After the fire services were held first in the National Science Foundation administration building. Then a quonset hut similar in age and size to the original chapel was provided as a temporary place of worship. The 1979 winter team volunteered to do the necessary modifications, working each day after normal duties. In December the chapel was dedicated.

Finally another Chapel of the Snows was built close to the original site exactly as it was in 1956. The final stages were completed in the winter of 1982 by volunteers when off duty, and the chapel was in use by last August.

The chapel was rebuilt for the third time during the four summer months. The building, which is 190 metres square, is constructed from materials salvaged from the station rebuilding which is yet to be completed. It was constructed by ITT, Antarctic Services, the NSF contractors and contains office space, a central worship area that normally seats 63, and the station's only organ.

It is situated on a knoll that overlooks McMurdo Sound and the peaks and glaciers of the Transantarctic Mountains. It

is close to the shore of the Sound and near Winter Quarters Bay. Just 840 miles from the South Pole, the Chapel of the Snows is the world's southernmost building erected primarily for religious services. It is the only known house of worship in Antarctica.

The hour-long dedication ceremony attracted an overflow crowd from McMurdo Station and from Scott Base. It included piano music, hymns and bible readings and was conducted by Lt. M. Brad Yorton, chaplain of the U.S. Naval Support Force Antarctica. During the ceremony Ronald R. La Count, a National Science Foundation Official and the senior U.S. representative in Antarctica described the construction of the new chapel and recalled how volunteers had erected the earlier chapels in their spare time. He cited official reports that documented the significance of worship for those at the station, whose work took them far from their families and their home communities.

Father Gerard Creagh, Hoon Hay Parish, Christchurch an invited speaker said in his address "Another chapter in the history of a unique operation is about to begin — a unique operation in peaceful co-operation and coexistence on the only continent that has no weapons, and known class struggles or wars and from which nuclear explosions and waste are banned by treaty."

The 38-nation Antarctic Treaty encourages international co-operation in scientific research and states "it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes". It prohibits military fortifications and maneuvers, sets aside the issue of territorial claims, and guarantees free access for observation and inspection of facilities.

Scott Base husky centre of new museum display

Jens, oldest of the last 14 Scott Base huskies flown to the United States early 1987, died of natural causes in Alaska in February 1988. He was nine years and five months old.

Born at Scott Base, Jens will be the centrepiece of a new display in the Canterbury Museum which will illustrate the role of dogs in Antarctica. His cured skin, leg bones and skull, plus a plastic dog mould, will be used in the display expected to be completed in 1990. They have been given to the museum by a New Zealander, Brian Lawson, and his American wife, now living in Fairbanks, Alaska.

In late 1986 the remaining Scott Base huskies were presented by the DSIR to the Stegar Outdoor Centre in Ely, Minnesota, which has been breeding polar huskies for more than 20 years. One, Stareek, born in December, 1979, died on the flight to the United States. A second, Footrots, born September, 1981, died this year when he was poisoned by the spines of a porcupine which he tried to eat.

Will Steger, co-leader of an expedition

which reached the North Pole with dog sledge teams in the northern summer of 1986, sold three of the Scott Base huskies to the Lawson. They were Jens, and Nimrod and Julick, who were both born in June, 1979.

Brian Lawson, who was a Royal New Zealand avionics technician at the time, wintered at Scott Base in 1985. His wife wintered twice at McMurdo Station, first in 1983 and again in 1985.

This year Will Steger and a French doctor, Jean-Louis Etienne, who made a solo ski journey to the North Pole in 1986, will begin the first stage of an east-west traverse of Antarctica. They and four companions will start from Hope Bay at the tip of the Antarctic Peninsula and plan to reach Mirny by March, 1990.

Some of the remaining Scott Base huskies at Ely may be used by the expedition on one of the stages. Five or six of the younger dogs took part in a preliminary training expedition which crossed the Greenland icecap between mid-April and mid-June last year. The dog teams covered 1389 nautical miles in 62 days.

"South Polar Times" sold for \$8600

Three volumes of the facsimile edition of "The South Polar Times", the illustrated magazine of Scott's two Antarctic expeditions were sold for \$NZ8600 at an auction of rare books in Christchurch on December 9. The first volume had been autographed by Sir Edmund Hillary.

Started on the Discovery expedition with Shackleton as the first editor, followed by Edward Wilson and Louis Bernacchi, "The South Polar Times" was continued on the Terra Nova expedition with Apsley Cherry-Garrard as editor. The original three volumes are now in the British Museum. in 1914

Smith, Elder published the facsimile edition which was limited to 350 copies.

FOOTNOTE: Volume III (June to October, 1911) was sold for \$NZ110 in 1977 at a Wellington auction of Antarctic rare books, prints, and maps. A copy of "Aurora Australis", one of the rarest books about Antarctica, brought \$NZ2400 at the same auction and remained in New Zealand. Another copy owned by a Christchurch resident was sold to a Melbourne rare book dealer in August this year for \$AUS40,000. It was bought at auction in London 18 years ago for 450 pounds (then \$NZ61).

'Discovery's' restoration progresses

More than fifty thousand visitors are expected on board the Discovery this summer. The ship, built for Captain Scott's 1901 expedition to the Antarctic, returned to Dundee in March-April 1986 as part of a major redevelopment project in the city using the waterfront and some waste land.

The return of Discovery was a complex operation which depended on her being floated out of St. Katharines Dock in London within 30 minutes of the high water of the equinoctial tides; a level reached only twice a year. Restorative work is now in the third of a five year programme and is expected to cost over one million pounds.

The Discovery was launched in Dundee on 21 March in 1901. She was welcomed by a crowd of thousands on her return to Victoria Dock, only yards from where she was built eighty five years earlier. During the 10 weeks that she was open during the summer of 1986 she was visited by 32,500 people.

It is the first of three major projects being organised by the Heritage Trust operating through its charitable subsidiary Dundee Industrial Heritage Ltd. The Trust is an association of the Scottish Development Agency, the Dundee District Council and the Tayside Regional Council. It was established in January 1985 and involves the local community with its various trades, businesses and industries. The restoration of Discovery is being funded by individual philanthropy, grant aid, company donations, trust grants and public subscription. It is part of a 30 million pound development on Dundee's waterfront between the Tay Rail and Road bridges.

The National Antarctic Expedition of 1901 for which Discovery was built, was sponsored by the Royal Society, the Royal Geographical Society and the British Government.

The two societies formed committees to obtain a ship and to plan the work of the scientists going with the expedition who were to conduct full magnetic surveys, measure ocean depths and temperatures and take samples for analysis, and collect biological specimens. They were to assess the nature, condition and extent of the South Polar Lands within the scope of the expedition and, if

wintering over, to advance into the western mountains, to the south and explore the volcanic region. Such sledging parties as may therefore be organised were also to observe the nature and the size of the Antarctic continent, the thickness of the ice and to take samples of the rocks and fossils which it covered.

Sir Clements Markham, president of the Royal Geographic Society was appointed chairman of the expedition and worked hard to raise 100,000 pounds to equip it properly. The Admiralty agreed to pay those Royal Naval officers and men volunteering for the expedition of which Robert Falcon Scott was appointed Commander in 1900.

In October 1899 the ship committee, a subcommittee of the organising committee, and comprising several distinguished admirals and arctic explorers, called tenders for the building of a ship. There were few replies and among them only one company with recent experience of building ships considered suitable. The Dundee Shipbuilder's Company was commissioned, and the construction of the vessel designed by W. E. Smith, Chief Constructor to the Admiralty, was overseen by members of the party to go south. The keel was laid in March 1900 and the vessel built at a cost of 51,000 pounds.

The Dundee Shipbuilder's Company Ltd had taken over the business of Alexander Stephen & Sons in 1894. The company, with yards in Aberdeen and later on Clydeside, had specialised in wooden whaling ships but later used iron and steel in its clippers, one

of which, the Maulesden, in 1874 made a record breaking voyage to Sydney in 69 days. As gas lighting caused a decline in the demand for whale oil the last of the stout wooden whalers built by the company is thought to have been the Terra Nova used by the Government to rescue Discovery in 1904 and later by Scott when the Discovery was not available for his second expedition in 1910.

"Sixth" Discovery

Finally named in June 1900, Scott's Discovery was thought to be the sixth vessel of that name. The first made six Arctic voyages from 1602 to 1616 to the regions of the Hudson and Baffin Bays, commanded, on one, by William Baffin. The second also voyaged to Hudson Bay in 1719 and the third, a small collier, belonged to the Admiralty and accompanied Cook's Resolution on his voyage to the Pacific. A fourth was used by George Vancouver on his voyages of exploration in 1791 and 1795.

The fifth, a Dundee whaler built for the Greenland whale trade and originally named Bloodhound, was renamed Discovery and sailed on a Royal Naval expedition to the North Pole in 1875-76, successfully navigating through ice. Considered the best ship ever employed in the Arctic service the design of the renamed ship influenced the construction of Scott's vessel.

The organising committee completely rejected the newer type of Arctic vessel, Amundsen's Fram. With her sides inclined until her shape was similar to that of a saucer, she was designed to withstand the north polar pack, a feature believed to have been achieved at the expense of her sea worthiness and powers of ice penetration. (Today yet another RRS Discovery is being used by the Natural Environmental Research Council, of which the British Antarctic Survey is part, for its oceanographic studies.)

Using the general design of the 1875 Discovery, Smith added 10 feet amidships and strengthened the hull structure by placing the frames, which were of solid English oak 11 inches thick, close together. Inside the frames was an inner lining — solid four inch

planking of Riga fir, pitch pine, Honduras mahogany or oak. Outside were two layers of planking of English elm or greenheart. In total the sides were 26 inches of solid timber.

Glide and crack

The massive side structures were stiffened and strengthened by three tiers of beams running from side to side and at intervals with stout transverse wooden bulkheads; the beams of the lower tiers spaced at three feet were 11 inches square in section.

The bow comprised numerous and closely spaced girders and struts and like the stem was further protected for three or four feet on either side with numerous steel plates. The stem comprised several pieces of wood scarfed together to the equivalent of an almost solid block of 11 feet and, in addition to strong fastenings, bolts up to 8½ feet ran fore and aft holding all together. The heavy stem was designed to glide up on icefloes, the weight of the ship cracking them, while the stern, with its uniquely designed and pronounced overhand protected the rudder, stern post and screw propellor.

Detachable screw

Like other ships of the time the screw could be detached and lifted up through the deck but unique to Discovery was a rudder which could also be lifted, offering greater facility for repair.

Discovery's load displacement was 1620 tones at 16 ft mean draft, her overall length of 226 ft with a beam of 34 ft. She could steam or sail. The ship was undermasted and in Scott's opinion the masts were placed too far back. The mainmast from trunk to keelson was only 112 feet, which he described as being extremely short for such a vessel; the yards were square, the mainyard being 60 feet long. Being stiff she could have carried larger sails and the small spread of sails made her sluggish in slight winds; but provided useful supplement to the engines in strong breezes while, contrary to normal sailing practice, in heavy gale conditions, the mainsail and the jib were all that were removed.

Two cylindrical boilers arranged to work at 150 lbs per square inch drove a triple

expansion steam engine provided by Gourlay Bros engineering works also of Dundee. They were designed to give 450 horsepower but on trials delivered 500 hp. The main coal bunkers held 240 tons, the smaller pocket bunkers 53 tons. When steaming economically Discovery used 4-6 tons per day but in heavy seas under sail she rolled heavily and the cruiser type stern with its overhang made steering difficult.

A steam driven dynamo provided electric lights, a small condenser fresh water stored in tanks of non-magnetic zinc each holding 25 tons. A strong deck winch installed amidships, an auxiliary engine and a powerful capstan engine under the forecastle were part of the new ship's equipment.

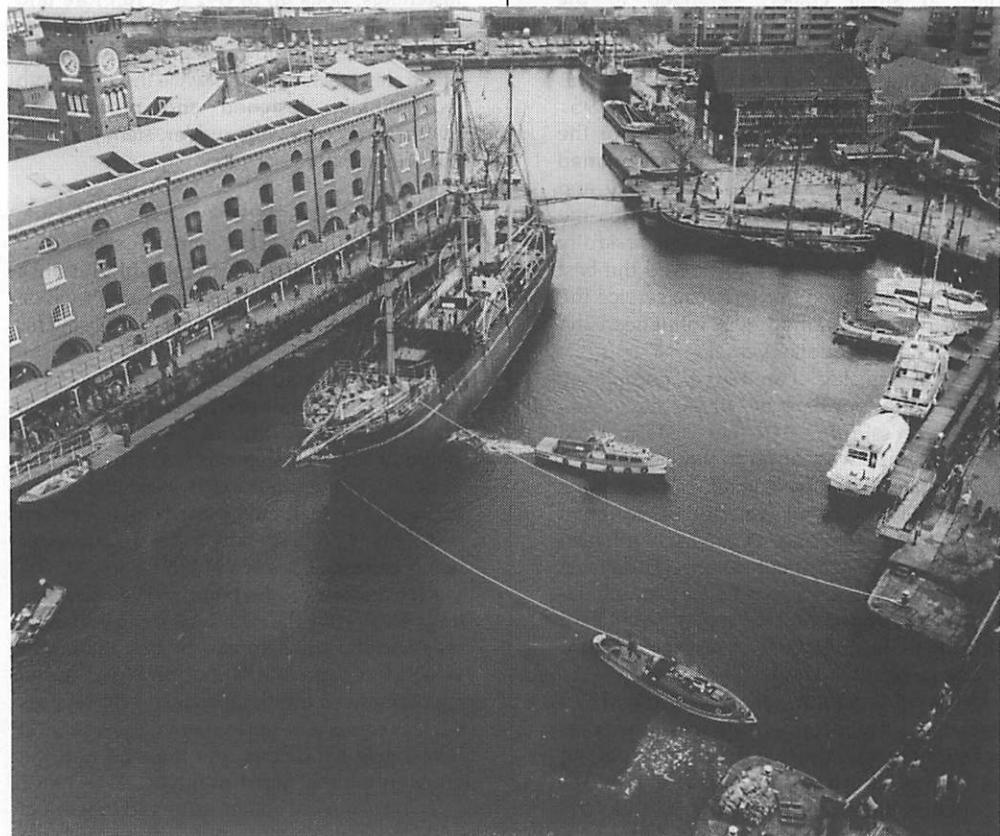
Officer and crew accommodation below decks was designed for life in the Antarctic

with fitted double doors and skylights. Thick lagging was installed as insulation below the main deck.

Provisions for 43 men for two years could be carried in the holds which contained many separate water tight compartments. One galley with a large cooking and water heating stove served both the officers and crew — the officers' cabins opened from the main ward room 30 feet long by nearly 20 across. The

The journey begins on March 27, 1986 as "Discovery" is towed to the entrance of St. Katharine's dock within 30 minutes of the high water of the equinoctial tides.

Photo: Industrial Heritage Trust Limited.



crew enjoyed less privacy in the general shorter but wider accommodation area. When the main engine and boilers were shut down to save coal during the Antarctic winter, the crew lived more comfortably than the officers whose main cabins were furtherest away from the warmth of the galley stove, although there were originally four smaller stoves of French design installed at each end of the two accommodation areas.

A scientific-chemical laboratory was built into the design. The magnetic observatory on board caused special problems as everything within a 30 feet circle sweeping down by the foremast, under the bottom of the ship and up in front of the mainmast, had to be of brass or other non-magnetic material.

Discovery was launched on March 21, 1901 when Lady Markham, wife of Sir

Clements, cut the white ribbon, holding back a bottle of Australian wine wreathed in flowers. Following the launch a celebratory lunch was held at the Queen's Hotel in Dundee while workmen received and installed the engines prior to sea trials. By July she was in the East India Dock in London ready for the voyage to the Antarctic. The ship was swung at Spithead to correct the compass on August 1, and inspected by the King and Queen at Cowes on August 5, leaving England the following day.

"Discovery" is towed into the Port of London to await the arrival of "The Happy Mariner" and begin the long voyage to Dundee.

Photo — Dundee Industrial Heritage Limited.



On December 24, 1901 she left Port Chalmers, New Zealand, and on January 4 the first icebergs were sighted. She made her way through the pack ice and into the open water beyond. After landing at Cape Adare, Scott coasted along Victoria Land to McMurdo Sound, arriving there on January 21, 1902 surveying 500 miles of the ice barrier and discovering King Edward VII land before returning to McMurdo for the first of two winters she was to spend trapped in the ice. In danger of a third, her crew, assisted by men from her sister ships Terra Nova and Morning sent into the rescue, blasted a passage for her to escape on February 14, 1904.

Returning to England in September 1904, Discovery was sold to the Hudson Bay Company, converted for general purposes and sailed the Atlantic as a stores ship. From 1912-14 she was idle and during 1915-16 was chartered by the French government to carry arms and ammunition to Russia.

The ship was laid up again from 1919-1923 and in 1924 after an extensive refit at Vosper's yard she again became a research ship involved in the investigation of the whaling grounds of South Georgia, South Orkney and Deception Island. Later she was used by the British, Australian and New Zealand (Banzare) expedition led by Sir Douglas Mawson.

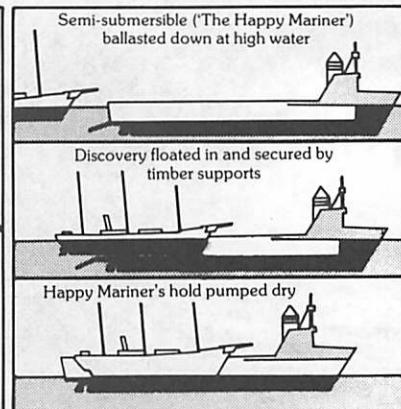
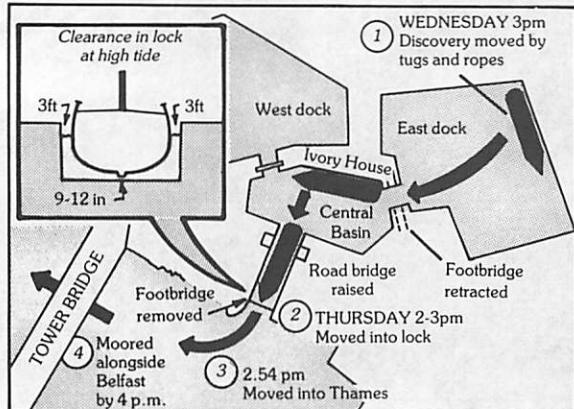
In 1931 she was laid up in the East India

Dock in London and between 1937 and 1954 the Boy Scouts Association ran the ship for use by the Sea Scouts following which she was commissioned by the Admiralty as a drill ship for the London Division of the Royal Naval Volunteer Reserves, now the Royal Naval Reserve.

Discovery remained the property of the Admiralty until April 2, 1979 when unable to maintain the ship or meet the cost of a major refit and to arrest suspected deterioration of the inner hull caused by a fungus growth, her ownership passed to the Maritime Trust.

Founded in 1969 with the aim of restoring, maintaining and exhibiting historically and technically significant British vessels of all types together with maritime equipment, the trust planned to assemble its collection in association with St. Katharine by the Tower Ltd and arranged with the National Maritime Museum at Greenwich to establish a museum of exploration and discovery in the vessel. Between 1980 and 1986 the Maritime Trust raised about £500,000 by public subscription and began restoring the ship after her many alterations. She was fully rigged, her hull and interior repaired; skylights and compass re-installed, rails and the bowsprit replaced and the galley refitted. With displays detailing her construction Discovery was again opened to the public as part of the Historic Ship Collection at St. Katharine's Dock in London.

March 26-27



In 1985 an agreement was reached between the Maritime Trust, the Dundee Heritage Trust and the public authorities in Dundee for the return of the ship to her home city on a twenty year lease.

Two-thirds of her masts, her yard spars, jib boom and lifeboats were removed to lower her centre of gravity. The lock which joined her berth with the Thames and for which she was too long with both gates closed, was dredged of two feet of mud and the Discovery was edged out using small tugs and seamen who volunteered to haul on the ropes anchored to the quay.

There were only twenty minutes from 2.30 p.m. on March 27 when the tide was high enough to give the Discovery with her 13 ft 6 in. draught a bare 6-12 inch clearance in the lock connecting the picturesque old dock and the Thames. Once in the Thames larger tugs towed her through Tower Bridge to a temporary mooring by Tower Steps.

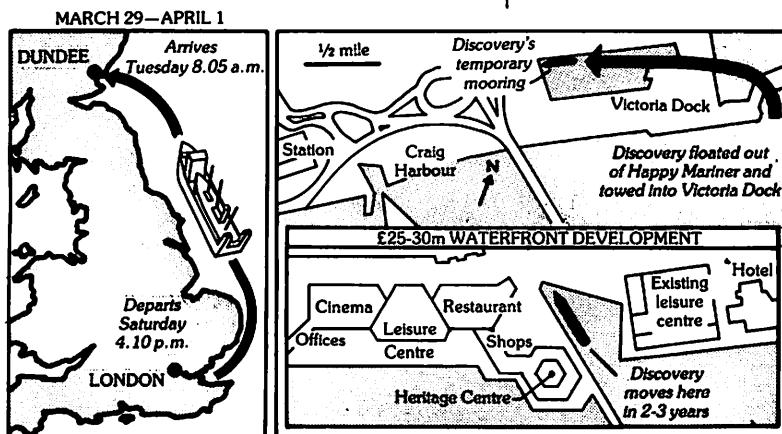
The Happy Mariner, a semi-submersible ship, operated by Mammoet Shipping of Amsterdam in Holland, specialists in transporting large and unusual loads, took on water from the Thames to sink low enough for the Discovery to be hauled aboard. With the water pumped the ship left London on the two day 500 mile voyage to Dundee which passed without incident. This phase of the operation cost 140,000 pounds.

Discovery is to be restored to her 1924

condition using a Vosper's refit specification for which full working plans and drawings exist. This mainly incorporated changes to the bridge layout, the officers' ablutions area at the stern. The French-made fires used to warm the officers and crew quarters were also removed and replaced in the wardroom by a mirror and a chiffaneer. One of the four original fires is in Dundee and has been located in the office of the Governor of the Falklands and information about its presence is obscure.

Since her return the spars and the yardarms, many of which were cracked have been taken down and restored, and work on cabins and wardroom has been completed. The deck has been recaulked and the after steering position restored. Last year restoration work focussed on the starboard side and the stern and cost approximately 90,000 pounds. The stern, which was riddled with rot, has been virtually rebuilt requiring skilled work from the shipwrights who have had to carve the timber before fitting it. All timber replaced is of the same kind as the original.

The dock in which Discovery will finally rest has been completed and the gates are being fitted. Final clearance for the overall Heritage Project to proceed was given on February 6 and the building of the centre, due for completion in 1991, will begin this year.



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Discovery was officially opened by Sir Peter Scott on Tuesday April 21, 1987 and an international membership scheme launched. Membership will provide for free entry onto *Discovery*, a trust magazine and subsequently a programme of events and activities, a personal membership card and a reduced rate on souvenir items. Fees are £8 for a working adult, £5 for pensioners and others obtaining concessions and £12 for a family. Company membership is

available for £50. Subscriptions are welcome and should be sent to the Dundee Heritage Trust, Maritime House, 26b East Dock Street, Dundee, Scotland.

This season the ship will be open for visitors from Saturday April 1 to the end of October. Hours are afternoons and weekends only from April 1 to May 30, all day, everyday from June 1 to September 1 and afternoons and weekends only from then to the end of October.

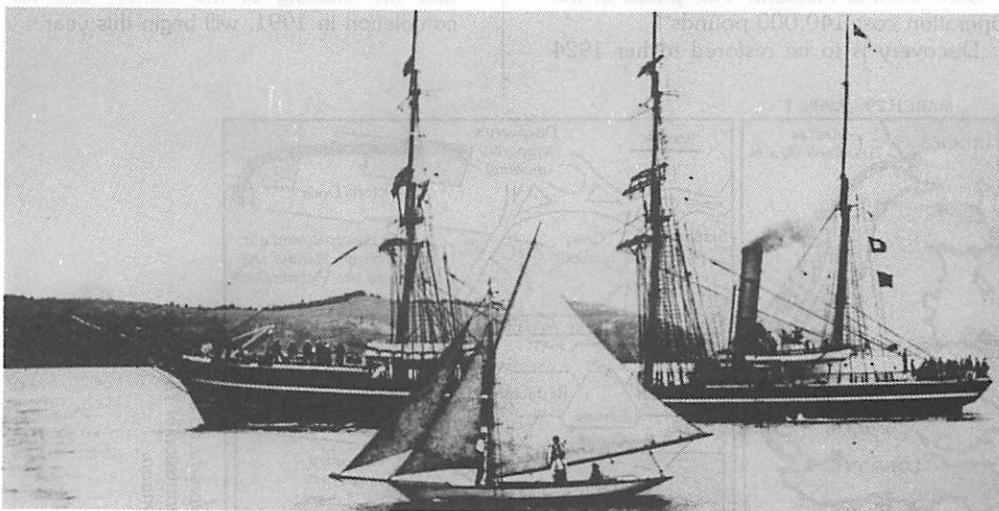
NZAS produces new postcards

The New Zealand Antarctic Society has produced a new set of six sepia postcards depicting the vessels of the early expeditions which visited Lyttelton, the port of Christchurch New Zealand, on their way to or from the ice.

The first in the series shows *Discovery* departing for McMurdo Sound on 21 December 1901 on the National Antarctic Expedition of 1901-1904. Morning departing Lyttelton on 6 December 1902 as part of the *Discovery* relief expedition features in the second while the third shows Morning, *Discovery* and *Terra Nova* moored at Lyttelton soon after their return from McMurdo Sound on 1 April 1904. The fourth shows *Nimrod* departing for King

Edward VII land on 1 January 1908 while the fifth in the series shows *Terra Nova* departing Lyttelton for Victoria Land in 1910 and the sixth features *Aurora* berthed at Lyttelton in 1911 after returning from BANZARE in July 1911. The cards are from originals held in the Canterbury Museum Archives and in the I. W. Harkess collection and were printed by Outreach press in Christchurch.

They are available from the Society at \$NZ1.80 a set plus postage (70 cents in New Zealand and \$1 Australia and South Pacific, \$1.50 North America and Asia and \$1.80 South America, Africa, Europe and Middle East). Please write to the National Treasurer, P.O. Box 1223, Christchurch or to your branch treasurer.



Terra Nova departs Lyttelton.

The New Zealand Antarctic Society Inc.,



The New Zealand Antarctic Society was formed in 1933. It comprises New Zealanders and overseas friends, many of whom have seen Antarctica for themselves and all of whom are vitally interested in some phase of Antarctic exploration, development or research.

The annual subscription is NZ\$35.00. This entitles members to:

- *Antarctic, published quarterly in the autumn, winter, spring and summer. It is unique in Antarctic literature as it is the only periodical which provides regular and up to date news of the activities of all nations at work in the Antarctic and sub-Antarctic. It has a worldwide circulation. (Airmail postage is extra for overseas members.)*
- *Newsletters for New Zealand members and an annual newsletter for overseas members. Regular meetings are held by the Auckland, Wellington, Canterbury and Otago branches.*

Subscriptions are:

- N.Z. \$35.00 in New Zealand
- N.Z. \$43.00 in Australia and South Pacific*
- N.Z. \$48.00 in North America and Asia*
- N.Z. \$52.00 in South America, Africa, Europe and the Middle East*
- * Includes airmail postage overseas.

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Overseas residents should write to the:

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P.O. Box 1223,
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Bulletin only membership is available to libraries and other institutions at NZ\$30.00 for organisations in New Zealand; NZ\$37.00 to those in Australia and the South Pacific; NZ\$41.00 in North America and Asia and NZ\$44.00 in South America, Europe, Africa and the Middle East. (These prices include airmail postage.)

Student membership: NZ\$26.00 plus postage for overseas members.

Advertising rates

Full colour (outside back page only)	\$400
Whole page (b & w only)	\$200
Half page (b & w only)	\$100
Quarter page (b & w only)	\$35

The rates are negotiable for regular placement.

Deadlines: The first of December, March, June and September.

Enquiries to the Treasurer, New Zealand Antarctic Society, P.O. Box 1223, Christchurch, New Zealand.

Fliers and other advertising material can be inserted at cost of \$150 per issue plus any additional postage incurred through any such insertions. Enquiries should be made to the editor whose address, telephone and fax numbers appear in the front of this issue.

