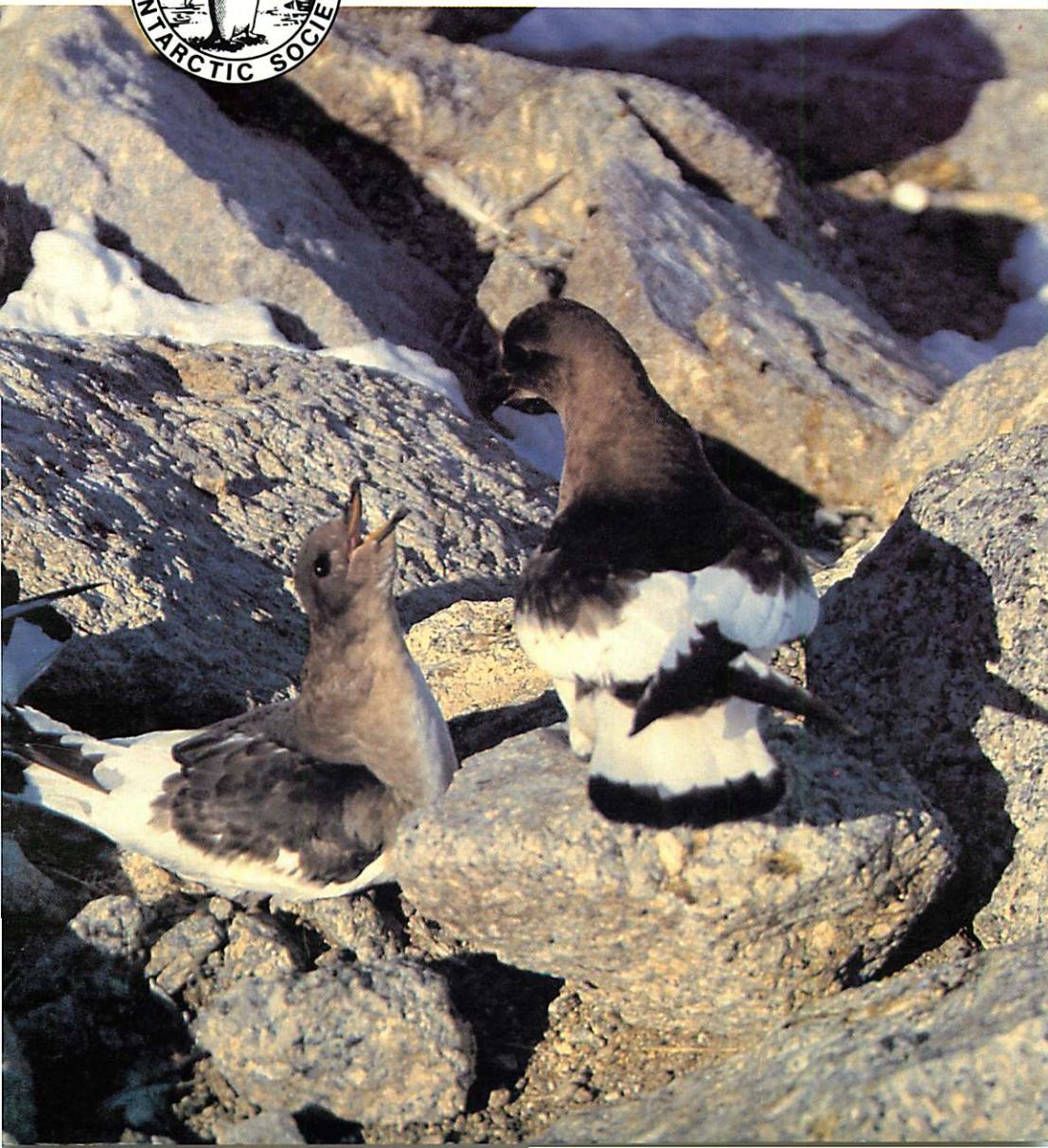


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Cover: A colony of Antarctic petrels, described by earlier expeditions, in the Rockefeller Mountains was located by a New Zealand field party last season. This photograph of two of the birds was taken by Dr Paul Broady.

NZARP: *Rockefeller Mts*

N.Z. team finds plane wreck on frozen lake

Nearly 60 years ago a Fokker Universal monoplane named Virginia became the first aircraft casualty in Antarctica. It was damaged beyond repair in a blizzard which tore the plane from its moorings on a frozen meltwater lake in the Rockefeller Mountains of Marie Byrd Land.

On December 24 1987 a New Zealand geological and biological expedition which worked in the Alexandra and Rockefeller Mountains for 53 days last summer found the wrecked plane still on the frozen lake below the southern slope of Washington Ridge. It was upside down and only the tail and the lower part of the wing were buried in the ice. Most of the fabric had been torn off by fierce winds in the past 59 years but the stainless steel parts of the airframe were still gleaming. The cold, dry climate had preserved the wooden wing spars and the remains of the skis.

Dr Chris Adams, of the Institute of Nuclear Sciences, leader of the New Zealand expedition, and his companions, Dr Steve Weaver (biochemist), Dr Paul Broady (botanist) of the University of Canterbury, and Peter Cleary, an Antarctic Division field leader, were working on nearby Mt Nilsen when they picked up with binoculars a dark object at the base of Washington Ridge. They moved down to the meltwater lake, which was showing signs of summer warmth, and inspected the remains of the high-wing Fokker, one of three planes used on Byrd's first expedition (1928-30).

There was no sign of the 425 h.p. Pratt and Whitney Wasp engine which had taken the plane on its first and last flight of 217km from Little America I in the Bay of Whales. There was a good reason for its absence. Other visitors to the scene of the power crash had removed the engine, instruments, and the three-bladed propeller.

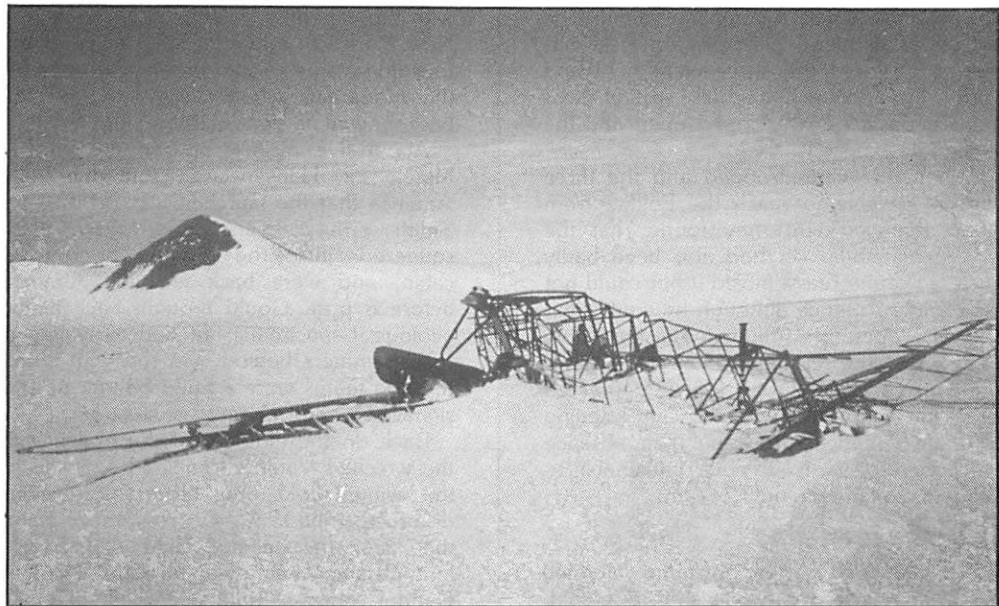
Virginia was flown to the Rockefellers on March 7, 1929, because Dr Laurence Gould, second-in-command of the expedition, wanted to make a preliminary geological survey of the mountains which had been discovered on January 27 during Byrd's flight to the Alexandra Mountains in Stars and Stripes, the expedition's smallest plane, a Fairchild folding wing monoplane also powered by a 425 h.p. Pratt and

Whitney Wasp. The pilot of the Fokker was Bernt Balchen, and another pilot, Harold June, acted as radio operator.

In the mid-afternoon of March 7 Gould, Balchen and June flew to the Rockefellers, landing on the frozen surface of the meltwater lake which was actually hard blue ice thinly covered by snow. The three men were able to start survey work the next morning but had to halt it by noon because of high winds. Heavy snow and winds of 28 to 46 knots made work extremely difficult and the party had to build a wall of snow blocks in front of the plane and pile more blocks on the skis and in front of the fuselage.

On March 13 the party was able to complete triangulation of a peak and collect geological specimens. But the winds were stronger than ever, reaching a peak of 78 knots in one gust, and finally a sudden violent gust, estimated to reach 130 knots tore the Fokker from its moorings. It burst clear, rose into flight and flew backwards for more than 480m and then crashed on the blue ice, landing on its skis. The force of the wind was so great that the spinning propeller kept turning the engine over, and the ends of all three blades were curled like corkscrews at the tips — clear evidence of a power crash.

Although the plane had landed on its skis and the wing was undamaged except



Two views of "Virginia", a Fokker Universal Monoplane, which became the first "air" casualty in Antarctica nearly 60 years ago. Today she still lies on her back, with her fabric torn away but her structure, though buckled is in good condition. Photos: Peter Cleary.



for the tips, it was a complete wreck. The ski pedestals were split open, one ski was ripped off, and the struts were bent and torn. In addition the tail section was broken, fuselage was ripped open and the cabin was exposed.

When the wind dropped and the three men were able to reach the Fokker from their damaged tent they found that the emergency radio set had also been badly battered. June reassembled it but could not raise Little America although he could hear the base operators sending. The final blow fell when the crankshaft of the hand-cranked generator broke. Three depressed men sat in the shattered fuselage listening to Little America discussing their absence with operators in New York, but unable to send an explanation only 217km.

Landing marked

By March 17 Byrd became alarmed about the lack of messages from Gould. But the weather at Little America was bad for flying so while the Fairchild was grounded the base radio operators kept an emergency schedule, sending frequent weather reports and repeating every hour a message that the plane would fly out at the first break in the weather. June received one of these messages just when the party was considering trying to walk back to Little America.

A long-awaited break in the weather came on the afternoon of March 19. The Fairchild, flown by Dean Smith with Byrd and Malcolm Hanson as radio engineer took off for the Rockefellers at 5 p.m. Two surveys failed to reveal any trace of the party or the Fokker. Then Smith sighted a column of smoke and a flashing light.

Balchen and June had marked out a landing T with flags on the ice which was rough. But Smith made an excellent landing and kept his engine idling while Balchen and June were ordered to return to Little America. Food and a small sledge were removed from the plane and Smith took off into the gathering twilight.

With improved radio communications Byrd, sitting in a small tent in the Rockefellers, was able to keep in touch

with the expedition's ships at Dundee, his New York office, Little America, and the four dog teams he had ordered to head for the mountains when the weather at the base showed no signs of improving.

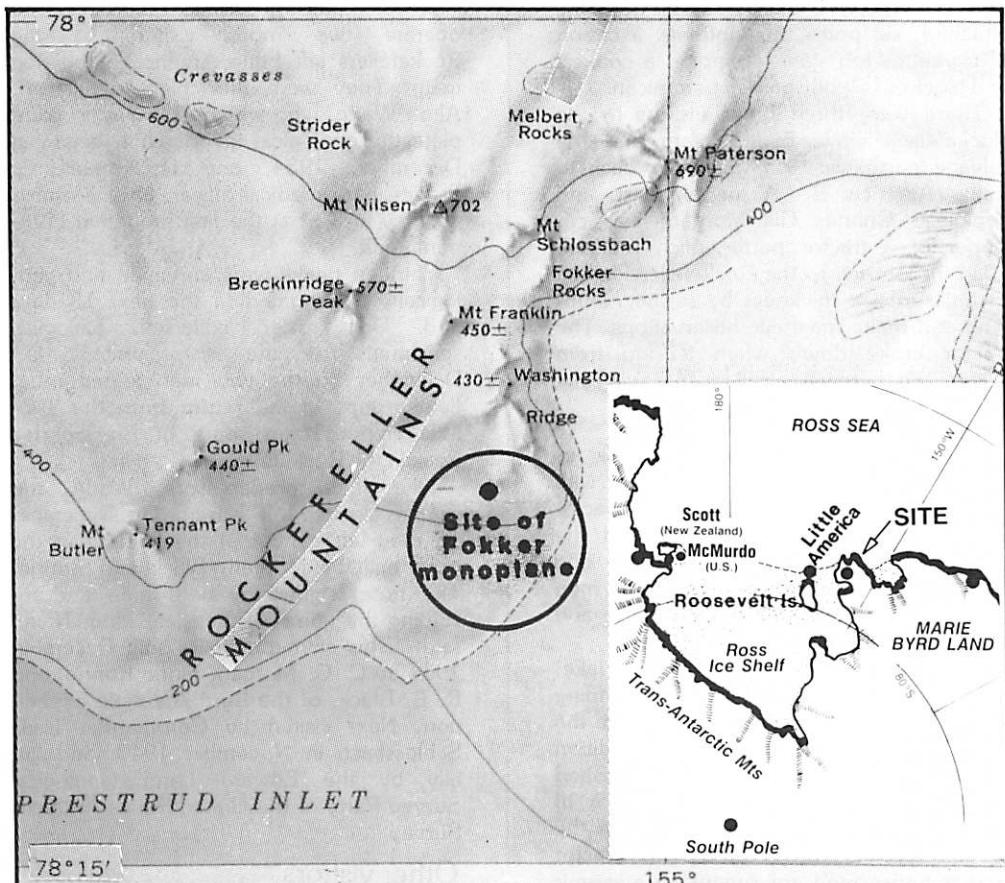
About five o'clock on the morning of March 22 Hansen was told by Little America that the Fairchild was on its way. Smith arrived with June; three men squeezed into the equipment-crowded cabin, and were back at Little America before 8 p.m. Gould brought back a few geological specimens but had to leave his rock hammers behind. On the way home the dog teams were sighted 88km out and signalled to return home.

Back on the blue ice of the frozen lake the wrecked Virginia remained exposed to the winter cold and blizzards and undisturbed until 1934. On November 15 of that year the second Byrd expedition's long-distance twin-engined Curtiss-Wright Condor biplane named William Horlick took off from Little America II on an exploration flight of 1250km which enabled Byrd to study again the mountains of Marie Byrd Land discovered in 1929. The plane had a flight crew of six with Harold June as chief pilot.

Wreckage

Late in the afternoon the William Horlick was on the homeward leg to Little America II. As the plane drew near the Rockefellers Byrd remembered the destruction of Virginia and suggested to June that the wreckage might still be visible. June was the first to sight the Fokker which, from the air, looked like a twisted, crumpled ball of metal locked in the blue ice. Remarkably it was not completely buried in snow after nearly six years of blizzards because of steady down-drafts of wind.

As the Condor flew on Byrd had an idea. The Fokker had an excellent engine which could be salvaged when a small party was available and sold in the United States. The Great Depression had not lifted, and that morning Byrd's New York manager had advised him that "rocks were showing in the bottom of the expedition treasury". With Washington Ridge



PRESTRUUD INLET

78°15'

well behind them Byrd shouted to the navigator, Kennett Rawson "maybe it's rather odd to end a flight of exploration with a junk survey but in these times an explorer can't be fastidious".

So early in December two dog drivers, F. S. (Duke) Dane, an insurance broker in private life, E. L. (Ed) Moody, who described himself as an agriculturist, and Paul Swan, of the aviation unit, set out by dog team to recover the Fokker's engine. They arrived at Washington Ridge on December 18 and found that blizzards had hurled the plane another 182m, tossed it on its back, and blown the fabric of the fuselage away.

It took the salvage party several days to chop away the hard blue ice in which the

engine was sealed. Then it had to be sawn from the fuselage and lifted onto the dog sledge. Four other Americans who had arrived at Washington Ridge several hours before helped to put the engine on the sledge. They were the Marie Byrd Land Party — Paul Siple, biologist and leader, F. Alton Wade, geologist; Stevenson Corey and Olin D. Stanchfield (dog drivers) — who had been in the field for more than two months, and had made a detour to visit the Rockefeller Mountains.

When Dane, Swan and Moody returned to Little America II early in January, 1935, they brought the Fokker's engine, rusty in spots but still in good condition, and also the plane's instruments and propeller. They reported that traces of the camp

were still visible — tent poles with no fabric attached, ski poles, fur clothing, a carton of cigarettes too stale to smoke, a cooker, and blocks of slightly gamey pemmican.

There were three other visitors to the Rockefellers while Siple's team and the salvage party were on their way back to Little America II. A geophysicist and geologist, Charles Gill Morgan, was co-leader of a tractor party which made a 1311km journey to the Rockefeller Plateau to measure ice thickness by seismic sounding and make magnetic observations. The tractor broke down when 217km from home, and there was a call for spare parts.

Cairn

Finne Ronne and Richard B. Black arrived on December 30 by dog team with the parts and by the next day the tractor was running again. But Morgan left the party and made a side trip with the dog drivers to the Rockefellers. The three men climbed Mt Nilsen, built a cairn there, and returned to base on January 6.

Nearly six years later the blue ice lake, Washington Ridge, and the surrounding peaks had more visitors, this time from the United States Antarctic Service Expedition of 1939-41 which early in 1940 established West Base, designated Little America III 9.6km north of Little America I-II. In the spring three sledging and two tractor parties transported equipment for a seismic station to a site on Mt Franklin not far from Washington Ridge.

Seismic station

This seismic station was completed on November 17 and was operated continuously for 41 days by a physicist, Roy G. Fitzsimmons, who was assisted by Raymond A. Butler and Lieutenant-Commander Isaac Schlossbach, a veteran of Byrd's second expedition. The party had no dogs but Fitzsimmons and Butler, backpacking their equipment and supplies, made a triangulation of every peak in the Rockefellers except the northern group. Fitzsimmons also collected gulls, Snow petrels and Antarctic petrels during his stay.

A week after the seismic station began to operate two more visitors to the Rockefellers left Little America III by dog team. They were the chief scientist, F. Alton Wade, who was on his way to complete the geological investigation begun in December, 1934, and Dr Russell G. Frazier, base medical officer. On December 10 they arrived at the first mountain, Tennant Peak.

Thirteen peaks were surveyed and geologically investigated in the next 18 days and Dr Frazier collected biological specimens at the sites visited. On December 30 the two men joined other field groups in the return from the 105-Mile Depot 16km south of Breckinridge Peak in the Rockefellers.

Like their predecessors, Wade and Frazier climbed Mt Nilsen. On December 15 they left a note at the summit in the cairn built by Morgan, Black and Ronne. The note, signed by both men and including the name of their lead dog, Navy, said: "This cairn originally built December 1934 by C. G. Morgan, Finne Ronne, and R. B. Black, of the Byrd Antarctic Expedition. Next visited by Commander Isaac Schlossbach in November 1940, and finally by the Edward Land Geological Survey Party of the United States Antarctic Survey."

Other visitors

There were other visitors to the Rockefellers in the years after the departure of the U.S. Antarctic Service expedition. A fuel depot was placed on the blue ice lake for an aerial photographic mission some time before 1964, and a U.S. Geological Survey team was in the area in the 1966-67 season. It placed a geociever on Mt Nilsen, and one of the topographic engineers, Charles E. Morrison, made a visit on December 31, 1966 to the Fokker Rocks. These rock outcrops were named to recall the Fokker's backward flight and crash.

An earlier visitor returned to the Rockefellers at the same time. It was F. Alton Wade, now leader of a geological party in an air-supported traverse of the

Marie Byrd Land coast. He was a passenger in the helicopter which landed the Geological Survey party on the blue ice lake.

Soon after the New Zealand expedition was put into the Rockefellers 10km north of Mt Frazier Drs Adams, Weaver, Broady and Peter Cleary, came across many traces of the men who had worked in the Rockefellers since 1929, some for only a few days, others for several weeks. They climbed 13 peaks or mountains — Mts Frazier, Jackling, Fitzsimmons, Shideler, Paterson, Nilsen, Schlossbach, Franklin, Washington Ridge, Breckinridge, Gould and Tennant Peaks, and Mt Butler. Not far from Washington Ridge they inspected the Fokker Rocks.

Ascent masked

On Mt Nilsen the party found a granite boulder which marked the ascent in 1934 by Morgan, Black and Ronne. The two Americans and the Norwegian had cut an inscription in the granite and built their cairn. Stuck between two boulders of the cairn was the crumpled note written 47 years ago and bearing the names of Wade, Frazier and Navy. Peter Cleary, who found it, made a copy and replaced the original. A similar note was found in a cairn on Tennant Peak but there was nothing in little cairns on Mt Schlossbach and Gould Peak.

About 400m from the wrecked Fokker the fuel depot contained eight fuel drums, five jerrycans, and two boxes of emergency ration packs. The jerrycans were stamped with the letters USMC, suggesting that an aircraft or helicopter flown by a Marine Corps crew might have put in the depot.

Fitzsimmons, Butler and Schlossbach were in the Rockefellers longer than most of the visitors and naturally left much more material behind in 1940. The New Zealand party found the but floor and four corner posts still standing. Scattered around a depot site 100m away were a box of batteries, a caribou skin sleeping bag, two fuel barrels, blocks of dog pemmican, and rusted tins without labels to indicate what food they contained. Two stainless steel

cookers also used as containers for Primus stoves were dug out of the ice, and one was brought out.

Washington Ridge is a rock ridge surmounted by three peaks. Drs Adams, Weaver, Broady and Peter Cleary, did not climb the central peak. Had they done so they might have discovered an historic document — a claim sheet designed to assist in supporting a sovereignty claim by the United States Government. On December 12, 1940 the Rockefeller Mountains seismic station team raised the United States flag and witnessed and deposited a claim sheet in a rock cairn built on the central peak at 78deg 06min S/ 154deg 48min W.

This claim sheet and others deposited in areas explored by the Antarctic Service expedition were put in place on the instructions of President Roosevelt. His order to Byrd as commanding officer of the expedition outlined the duties and the activities to be undertaken in Antarctica.

Never recognised

Byrd was told in the order, dated November 25, 1939, that the United States had never recognised any claims of sovereignty over territory in the Antarctic regions asserted by any foreign state. But, in Roosevelt's words "members of the Service may take any appropriate steps such as dropping written claims from airplanes, depositing such writing in cairns etcetera which might assist in supporting a sovereignty claim by the United States Government".

Antarctic petrels

A colony of Antarctic petrels described by earlier expeditions at Washington Ridge was not found but on the last day of this expedition a large colony of Antarctic petrels containing up to 20,000 birds was located at Paterson Ridge in the Rockefeller Mountains. The closest possible feeding grounds for the birds is open water 85 km to the west. On the cliffs above the easily accessible rookery were nest sites of several hundred snow petrels. Further details of the scientific work carried out by will appear in our next issue.

Iceberg update

B-9 moves more slowly than expected

B-9, one of the longest icebergs ever recorded, has been moving more slowly and in a more complex path than expected. After breaking away from the eastern Ross Ice Shelf in early October 1987, B-9 began to accelerate in a west-north-westerly direction until mid-November when it collided with the ice-shelf. This collision, and possibly some forcing by a suspected current flowing from under the iceshelf, caused a deflection of B-9 towards the north-north-west until early January 1988 and a slow counter clockwise rotation.

Position data

Position data derived from weather satellite imagery obtained by the US Navy/National Oceanic and Atmospheric Administration Joint Ice Centre between January 6 and March 23 are grouped within an area 46km across. This grouping is not much wider than the accuracy of geographically locating the berg's position (which is twice the single positioning error of $\pm 10\text{-}15\text{ km}$). It may mean that B-9 was caught in a strong current eddy or pulse opposing its northward movement, and is now caught in the eddy or area of sluggish water movement. The other possibility is that the berg was temporarily grounded on the sea floor, although the water depth here (77deg 35min S/166 W) is probably about 450 metres, probably more than 140m deeper than the maximum draft of the berg. Because B-9 has not been drifting in a straight line it moved only 170km from its birthplace in four months making good only 1.3km per day. The

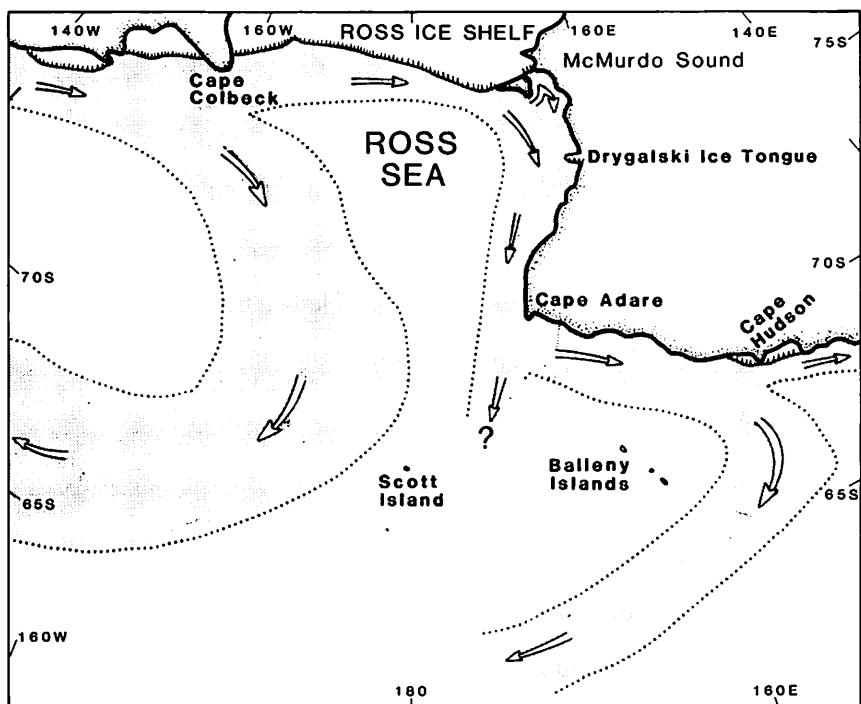
super-berg is still 500km from Ross Island.

Meanwhile several smaller bergs less than 20 km in length have been moving much faster along the front of the Ross Ice Shelf. These bergs originated in the same calving event as B-9, and on February 23 the western-most was only 80km west of Ross Island. It is travelling up to 10km per day and could have drifted into McMurdo Sound by now. The disparity in speed of these bergs and B-9 may be due to differences in current flows within the Ross sea. The sheer size of B-9 means that it is probably subject to different currents working on it from different directions at the same time.

There have been suggestions that B-9 is breaking up. Some confusion has arisen because, as it spawned B-9, the ice shelf developed two parallel fracture systems about 10 km apart and about 40 km south of the former ice shelf coastline. The southern-most fracture became the new front of the ice shelf, while the northern-most fracture became the southern side of B-9. The ice between the fractures broke into several bergs or "cohorts" of B-9. These bergs, some of which are still near B-9, have continued to break up. In addition, B-9 had areas of sea ice frozen to it when it calved and these have also been drifting away.

Dimensions

As with all icebergs, small amounts of B-9 have cracked off around the sides.



The dimensions of B-9 were given by the Joint Ice Centre as 86 x 22 nautical miles (160 x 40 km) until January 21 when it was listed as 83 x 19 nm (154 x 35 km). The accuracy of these measurements is about ± 4 km so while there may have been some loss of ice from the edges the area of B-9 has not decreased sufficiently to be able to say it is breaking up. The most precise measurements of B-9 are 154 x 30 km derived by Jay Zwally of NASA from LANDSAT images early in 1988 and they are accurate to within a kilometre.

B-9 will sooner or later fracture into two or more large bergs, probably across a narrow crevassed portion about 40 km from one end. Meanwhile it will probably continue generally west. It may take some months to reach Ross

Main drift paths of icebergs in the Ross Sea sector deduced from known drifts of icebergs, current patterns and iceberg sources.

(Copyright: Dr Harry Keys, Department of Conservation, N.Z. and International Glaciological Society.)

Island before turning north and finally east into the Southern Ocean. Although little impeded by the pack ice that covers the Ross Sea for most of the year it may take one or two years to reach open water. If it does not break up B-9 may run aground on Ross Bank in the central Ross Sea or collide with the Ross Sea Ice Shelf again, producing other large bergs.

"Antarctic" thanks Dr Harry Keys, Science Directorate, Department of Conservation, Wellington for this contribution.

ANARE

Further studies on Law Dome

For six months in 1985/86 basal water was discharged from under cold ice in an area of Law Dome. The phenomenon known as a "jokulhlaup" event, derived from the Icelandic "jokull" or small icecap, is common in many glaciated areas, especially in Iceland but this was the first time it had been recorded in Antarctica. However convincing proof has recently come from the Antarctic where radio echo sounding traces have shown extensive sheets of water. Seventeen sub-glacial lakes have been plotted beneath one segment of the East Antarctic Ice Sheet and a lake, at least 15 km long has been discovered beneath the outer part of the Lambert Glacier running out on the Amery Ice sheet between the Mawson and Davis draining area to the east of the Prince Charles Mountains.

Preliminary investigations in 1985 inferred the existence of a sub-glacial lake in a large bedrock depression immediately upstream of the water outburst on Law Dome. Isotopic and chemical analysis confirmed the basal origin of the water.

Working in a zone extending 20 km inland from the ice margin and adjacent to the Clarke, Bailey and Mitchell Peninsulas scientists sought information on the morphology and extent of the sub-glacial lake, the supposed presence of which may provide information about the nature and regime of the former Law Dome thermal area.

Detailed topographic, gravity and ice-sounding surveys were carried out to locate the boundaries of the sub-glacial lake and its immediate catchment area. The basal ice sequences were mapped and samples of ice and debris cored and collected from exposures and pits for subsequent analysis of the ice crystals, entrapped air, oxygen and hydrogen isotopes and chemical solutes. The sizes and shapes of particles of debris and their disposition within the ice will also be studied.

From morphological analysis including the character and origins of the ice-cap and surrounding structures such as the Loken Moraines adjacent to the outburst scientists hope to be able to calculate the basal thermal, hydraulic and hydrolic mechanisms controlling the jokulhlaup

events. By analysis of the character and origins of the debris and ice bands the role of sub-glacial hydrology may be deduced while spatial analysis of oxygen isotopes will be used to map the emergent basal ice and help identify the transport paths and flow patterns.

Morphological and other analyses help scientists understand the sequence of patterns during the recent holocene when the ice cap margins fluctuated. The study will complement other work on Law Dome's glaciology and response to climatic change.

Ice core

drilling programme

The first stage of a three year programme designed to obtain a continuous core to 1,200 metres beneath the Law Dome ice cap was completed this season. Analysis of the core will help scientists understand the present state and past history of the ice sheet, its flow characteristics and reaction to climatic variations, and a wide range of environmental data that is archived in the ice.

Scientists have deduced that glacial movement is attributable to ice deformation at the lowest layers. Samples from the deep ice at the centre of the Dome will be measured for crystal structure which is intrinsic to ice sheet dynamics. This will be combined with deformation data obtained by accurately surveying the bore hole soon

after drilling and by remeasuring it several years later.

As drilling proceeds the ice sheet temperature profile will be measured. Climate history and prior ice sheet extent will be investigated by measurements of the oxygen-isotope ratio of the ice. Analysis will be made of gasses trapped in bubbles in the ice to determine past atmospheric concentrations. Other chemical particulate and isotopic species in the ice will be measured to give information on the earth's climate, atmosphere, cryosphere and oceans in the past.

Paleo-environment

The chronological deposition of ice-layers in the core will provide information which can be used for dating the paleoenvironmental records. Annual cycles of some isotopes and impurities will be used to accurately determine the age, depth scale which can be checked by stratigraphic horizons of volcanic and nuclear fallout.

The bottom of the core is expected to be up to 50,000 years old with accurate dating from annual cycles possible to about 10,000 years. After that the layers become too distorted and other dating methods such as isotopic delay will be used.

During the last year Australian scientists have been developing a mechanical ice drilling facility which will be shipped to Casey on board the Icebird and installed inside a specially constructed building. The 18 metre steel arch building rests on an integral sled and will be "drifted in" at the drillsite. The drill and field camp comprising living cars with accommodation for up to ten people, a kitchen-mess area, power generating modules, and facility for core analysis, storage and transport will be towed to the site by bulldozer in December 1988. It will take several days, depending on the weather, to travel the 110 km from Casey to the drill site.

Last summer a pilot hole was thermally drilled and cased to 94 metres. Mechanical drilling, core logging and analysis will proceed during the next two years with the core being returned annually to the Glaciology section in Melbourne.

Another aspect of the work at Law Dome last season was a study of the properties and structure of snow and ice. The distribution of surface snow properties covering the full range of glaciological and climatic conditions found on Law Dome were mapped in cross-section by Anare scientists who are seeking to reconstruct a history of changes in surface conditions.

Measurements of the physical properties of snow and ice from surface samples and cores drilled from the ice sheet are used to investigate the development of the crystal structure found within the ice sheet. Because such structures are modified by natural deformation they influence the rate of movement. Measurements of surface samples provide ground truth information for calibration and validation by other surveys of the starting conditions from which the characteristics observed in deep ice cores can be established.

Changes of visible features such as past melting reflect the transformation from snow to ice while studies of the physical properties help scientists to evaluate which other analyses may be usefully employed in ice core studies and to understand why records indicated by cores have been modified. This is a long term project being carried out in collaboration with the Lanzhou Institute of Glaciology and Geocryology, PRC.

Communications upgraded

Communications between Australia and Antarctica advanced last summer when Mawson became the second station to join the ANARESAT network. ANARESAT is a dedicated satellite communication system installed by the Overseas Telecommunications Commission, linking the Antarctic Division's headquarters at Kingston, Tasmania with Antarctic Stations. The service from Davis Station began operating last year, and the remaining continental station, Casey is scheduled to join the network at the end of this year.

BAS

Diverse programme for British in summer season

The start of summer activities, for which preparations were underway early at the five British bases, were hampered by some of the coldest temperatures on record with heavy ice and snow conditions and strong winds delaying resupply. Diverse scientific activity over a wide area is however reported with filming for a new television series, seal and penguin counts and base reconstructions completed early.

Faraday

Faraday experienced weather worse than usual with a record minimum temperature for October of -31.8deg C. Because of bad weather and ice conditions the West German research and supply vessel *Polarstern* abandoned a planned visit in late November after several attempts to reach the base. One of its helicopters reached Faraday on November 27. Some BAS personnel flew to Beascohea Bay to help locate suitable camp sites for West German programmes. Four scientists were put ashore at Faraday to undertake some biological and geological work assisted by three BAS personnel.

RRS John Biscoe's planned call at the end of November was rescheduled to December 4 by which time the remaining sea ice in the channel caused no problems and she made a safe mooring surrounded by fast ice. The relief began at 0500 hours and took several days. Stores and provisions included 14 tons of concrete. The Biscoe departed on December 8 at 0400 returning BAS personnel to the U.K. after their tour of duty.

Several other attempts to visit Faraday were thwarted by ice conditions; The World Discoverer, the Society Explorer and the Ecuadorian ship Orion failed during January and February while the yacht Kotich succeeded at the end of January.

The new director of BAS Dr David Drewry, accompanied by the deputy

director Dr Nigel Bonner visited by helicopter from HMS Endurance bringing mail from the UK. The director then visited the Berthelot Island depot to check and renew the contents. An Anglia TV crew also came ashore from the Endurance.

A count of skua nests and eggs were undertaken on the local islands and the programme of ozone observations has continued.

Halley

At Halley preparations for the summer programme began early and by November 6 all field skidoos had been serviced and sledges packed. Departure was then delayed by six days of snow and wind causing havoc among the recently constructed posts supporting aerials and cabooses which are raised once or twice a year because of snow accumulation. The perimeter and airstrip drumlines were raised above the snowline, repaired and cleared of snow ready for the first aircraft.

Scientists gave a live interview to Swiss Television on ozone and the 77th and final balloon associated with the research programme was launched on November 23.

Several visits were made to the coast and the old base and the ramp between the sea ice and the ice shelf at Mobster which is required for successful relief was checked.

Penguin counts made at the coast by the team waiting for the arrival of RRS

Bransfield revealed 14,300 chicks counted in the colony of about 40,000 birds. The fast ice broke and receded rapidly and by November 27 only Mobster and Windy Creek were obstructed.

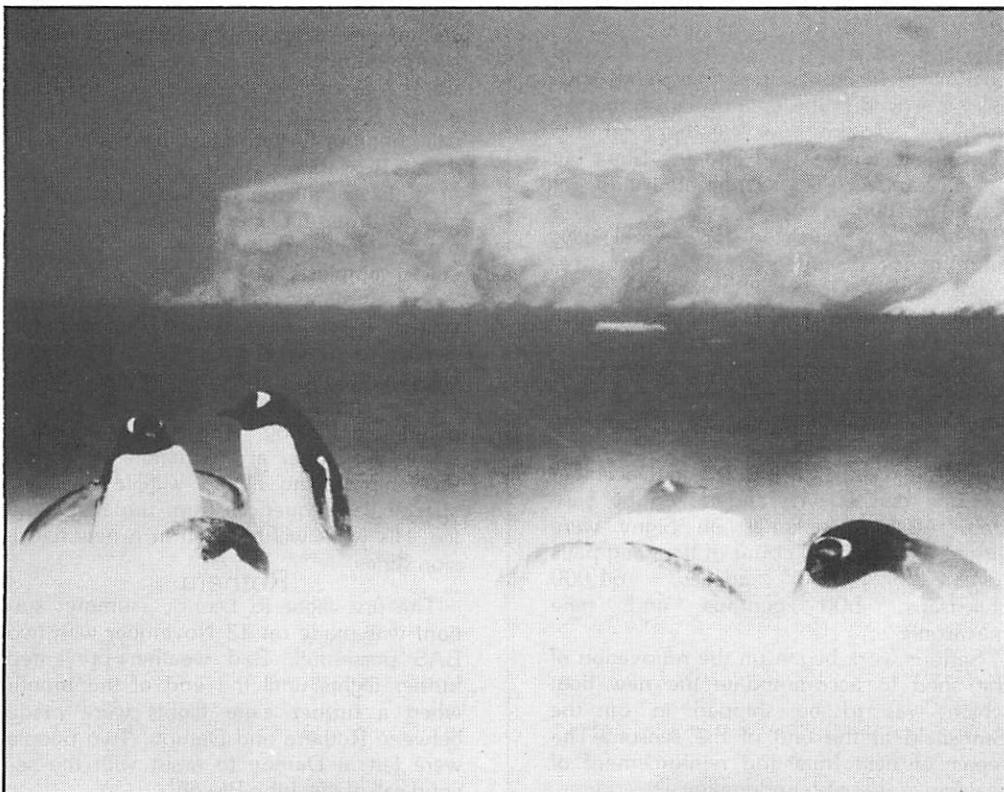
By December 1 the last of the field parties left for the emperor penguin colony at Windy Creek as the warm weather caused new problems as the ice melted around the base requiring a constant watch of the building voids.

RRS Bransfield arrived on December 21 in fine conditions with high temperatures. Relief began on December 22 with a series of 12 hour shifts operating almost non-stop for two weeks. Winds of 40-50 knots then however delayed the programme as the vessel had to stand off for three days. Fuel in 3,700 drums was unloaded and moved within a week from the ship to the base 13km away.

Drs Drewry and Bonner of the Survey spent a week on the base during the relief before flying to Rothera in one of the BAS Twin Otters on December 30.

The relief included the redeployment of an ionospheric radar, the AIS equipment and the establishment of a new, over-the-horizon radar. The Polar Anglo American Conjugate Experiment (PACE) is a joint UK/USA project designed to give information on ionospheric conditions over a large area of the continent. In conjunction with the Twin Otter being operated in Canada where programme personnel are looking at the Arctic ionosphere, it forms a unique facility for simultaneous study of the two polar ionospheres.

Gentoos penguins coming ashore at Damoy Pt, Wiencke Island. — Photo: L. D. B. Herrod/BAS.



On January 5, the West Germans deployed a field party, 1/4 mile away from Halley station with the help of helicopters and large snow vehicles. They were supporting a field party, some 250 miles south using two Dornier aircraft. All left late in February on the Polarstern.

A Japanese Twin Otter refuelled and stayed overnight at the airstrip at the same time as two West German aircraft were visiting.

Signy

After a record low temperature in October of -24.1deg C, the base prepared for relief and staff made several spring journeys.

Weddell seals and their pups were filmed diving on the west coast. Visitors to Coronation Island observed a number of silver-grey fulmars, rarely seen around Signy and a pair of Antarctic petrels were also observed in late winter around North Point.

In spite of strong winds the fast ice and pack ice held firm around the island. RRS Biscoe arrived in the area on November 14 in heavy ice and poor weather. For two days she sought a lead into the Strait but on December 17 she retreated and returned to Stanley.

High winds persisted for several days and the ice disappeared. The Biscoe returned on December 23 and in spite of conditions put a launch ashore with mail and the summer Base Commander.

Unloading proved difficult with winds still up to 50 knots. The ship sailed two days later leaving two limnologists to study the lakes and streams during the summer.

As the weather improved in December penguin census was undertaken by base staff. All the rookeries on Signy were visited and the final count of breeding pairs revealed 40,000 adelles, 64,000 chinstraps, 500 gentoos and nine macaronis.

Serious work began on the renovation of the shed to accommodate the new boat which was to be shipped in on the Bransfield at the end of the season. The repair of field huts and reinforcement of seal fences was also undertaken.

RRS Bransfield arrived on December 10 in good weather bringing the Directors. After a short stay she sailed to revisit again on January 27 when she took several members of the base staff to Atriceps and Grey Island, east of Coronation Island to count shags. The programme on the breeding success of the blue-eyed shag ended during the summer. Icebergs were encroaching on the area when the ship sailed on January 28.

Many visits were made to North Point, the Gourley Point and the Foca huts where new aerials were fitted. During the summer travel across the lowland areas was made difficult by the increasing fur seal population and 13,000 were counted.

A data logging system was installed at Pumphouse Lake to record temperatures and light levels. A portable infra-red gas analyser (IRGA) was used to measure photosynthesis in stream algae and another system was used in a controlled environment chamber to measure the effects of water loss on photosynthesis in terrestrial algae. Research on algal photosynthesis will continue further south next season on James Ross Island.

Studies of microbial activity in sediments in and around Borge Bay continued with regular diving throughout the winter to collect samples.

An automatic weather station was installed at the base during the summer. Similar to those at Halley and Faraday it will provide more data on weather patterns than previously. An ex-Bas staff member commissioned by Anglia Television to spend the winter at the station left on the first ship having filmed wildlife including spectacular sequences from under the fast ice. His work will be used in a new television series.

Rothera

The first flight to Damoy (summer station) was made on 13 November with two BAS personnel. Bad weather prevented further flights until the end of the month when a further eight flights were made between Rothera and Damoy. Two people were left at Damoy to assist with the second call of the John Biscoe.

A Chilean aircraft which flew in on November 13 developed engine trouble and assistance was given by base mechanics. It flew out on December 7. Bad weather in November prevented any field parties being deployed by air; three were deployed however from the John Biscoe.

Damoy

Early December saw movement again and several flights were made to Damoy to uplift personnel to Rothera and flights from Fossil Bluff to Ronne Ice Shelf to deploy a field party intending to traverse from the ice front across the featureless Ronne Ice Shelf to the Ellsworth Mountains. This was part of a continuing glaciology programme.

Further south in the Pensacola Mountains the Americans deployed two British and four American geologists from McMurdo Station as part of a joint BAS/USARP project. Three flights from Rothera brought further supplies for them, and the last Twin Otter, with two British field assistants remained with them to give close support.

Two Bulgarian geologists worked with a British geologist on Alexander Island.

At the end of December another geological field party was deployed at Seal Nunataks on the east coast using hovercraft instead of skidoos because of problems with melt pools.

With the improvement in the weather a glaciological party was landed near Fossil Bluff to work before moving further south where they were joined by another glaciological team. Anglia Television filming the base and new buildings at Rothera were able to go out into the field towards the end of December before joining HMS Endurance at the beginning of January.

A glaciological field party was airlifted to its worksite at the north end of George VI sound and another was taken to just south of Fossil Bluff from where they travelled south down to George VI sound to the Eklund Islands. The final field party to leave Rothera was put into Cetus Hill in Palmer Land where a geological project is being undertaken.

Two West German aircraft arrived on

December 26 for two days before leaving via Halley for Neumayer. The BAS director and deputy arrived in a Twin Otter from Halley to spend a few days on base before joining HMS Endurance.

HMS Endurance with the Anglia television crew aboard called in at Faraday and Palmer Station and uplifted a field party from Deception Island before visiting the Chilean base Marsh on King George Island.

A BAS twin otter aircraft also visited Marsh at the beginning of January to rendezvous with an RAF Hercules taking out an injured man, originally flown to Rothera from Halley. Fully recovered he has since returned to winter at Faraday.

Bird Island

Bird Island experienced the coldest snowiest winter since recordings began. Fur seals which normally haul out of the Island for breeding did not arrive in the usual numbers while elephant seals staked early claims on the deserted beaches and more than 20 elephant seal pups were born with sizeable harems. The first fur seal pup was born on November 13 and on 24 twins, a male and female were recorded for the first time since 1978. Altogether 757 pups were born, weighed, sexed and numbered and counts were made of the leopard seal population. Biological work continued with the checking of the macaroni penguin eggs and monitoring the seasonal changes of hormone levels.

Early nesting birds were also affected by the weather. The majority of the northern giant petrels were unable to build nests because of heavy snow cover and most eggs were deserted after laying. Some birds tried to sit out the bad weather with snow drifting over them completely covered. Black browed and grey headed albatrosses returned to the colonies in large numbers but egg losses were disastrously high. Many confused birds laid their eggs only to be left to the skuas. Gentoo penguins were a month late laying eggs with the macaroni penguins extending their winter stay. By the end of October the numbers of penguins had built up, but there were far fewer than usual.

RRS John Biscoe successfully anchored after a difficult night on high seas; the relief took two days to complete but not two consecutive days. Biscoe had to shelter because of bad weather. Eventually 17 tons of cargo was landed and stored.

Damien II arrived on November 19, and sailed the following day with two BAS scientists who were to study burrowing

petrels. She returned for Christmas, leaving again on Boxing Day for further biological studies.

RRS Bransfield called in for a short stay. On board were the BAS directors who visited the albatross and macaroni penguin colonies. A British warship brought mail and food at Christmas.

USARP

Wilkes Land Hercules will be modernised

Juliet Delta 321, the United States ski-equipped Hercules which crashed in Wilkes Land on December 4, 1971, and remained buried in the snow and ice of East Antarctica for 15 years, should be back in the United States early next year. Covered by 10m of snow, the aircraft was brought to the surface on December 25, 1986, and last season, after major repairs, it was flown 750 nautical miles to McMurdo Station on January 10, and then to Christchurch on January 16.

Air New Zealand engineers at Christchurch are now engaged in repairs to Juliet Delta under the airline's contract with the National Science Foundation. When the work is completed the Hercules will be flown back to the makers, Lockheed-Georgia, who will modernise it and fit it with new wings, new skis, and new communication systems. Recovery of the aircraft over two seasons cost less than US\$3 million, and another US\$7 million will be needed to make it fully operational. A new Hercules complete with spares costs US\$38 million.

Preparations for the repair of Juliet Delta began in mid-November last year, when the camp used in the 1986-87 summer was re-opened and the 2438m skiway at D59 (68°20' S/137°21' E), a staging point for French geological traverses, was prepared for flights by Hercules aircraft from McMurdo Station. No. 321 was badly damaged on takeoff after resupplying a French traverse party heading towards D59.

Major repairs to Juliet Delta included

replacement of all four engines and propellers and installation of flight instruments removed after the 1971 crash. Main and nose struts were also replaced and damage to the fuselage repaired or patched. By the first week of January the aircraft was almost ready for the flight back to Williams Field from which it had departed more than 16 years earlier.

On January 10 Juliet Delta was flown back to Williams Field in about five hours by Commander Jack Rector commanding officer of the U.S. Navy's VXE-6 Squadron, and his crew of five. Dr Peter Wilkness, director of the NSF Division of Polar Programmes, and Mr Ron La Count, senior US representative in Antarctica last summer, were in another Hercules which maintained visual contact with No. 321, flying under a deck of clouds, as the repaired aircraft still needed navigational support.

There were some anxious moments just before the flight when a start device in the salvaged No. 4 engine had to be removed to stop an oil leak. But the crew of No.

321 brought the aircraft with three engines running behind the escort plane on the skiway. The escort Hercules revved its engines, creating a "prop wash" which activated No. 4 engine on Juliet Delta.

With all four engines running the crew made an ice speed taxi run down the skiway to see how the plane handled and whether any problems would become apparent at takeoff speed. But everything went well and a second trial run was not needed.

"Boring"

Juliet Delta came back to Christchurch just after 4.30 p.m. on January 16. Commander Rector, who had the same crew, described the eight-hour flight "as boring as could be, just as we wanted it". The aircraft flew to New Zealand in company with another Hercules which acted as a navigation and communications craft. Its landing gear fully extended because the old hydraulics system needed to be checked out. Juliet Delta had to fly lower and slower because of this so an extra 3600 gallons of fuel were carried in a tank installed in the cargo compartment.

Recovery of Juliet Delta cost the U.S. Navy and the National Science Foundation much more than money. Two lives were lost and another Hercules bringing a new engine, propeller, and starting equipment to D59 on December 9 was destroyed. The aircraft, flown by a VXE-6 Squadron crew of seven and carrying four passengers, crashed when attempting to land on the skiway, and then caught fire.

But for the heroism of three men who pulled out nine shocked and injured survivors from the aircraft while fires from leaking fuel burned all around the wreckage, and the medical care given at the recovery camp under the direction of U.S. Navy Corpsman Second Class Barney Card, of San Diego, others might have died.

Barney Card, the only man with medical training at the camp, which is 1.59km from the skiway, heard shouts of "crash" just after 8.30 a.m. He jumped on a snowmobile to get to the skiway where all

that could be seen was smoke and twisted metal.

With Brad Honeycutt and Johnny Howard, of the Naval Air Rework Facility, Cherry Point, North Carolina, Card ran to the cockpit of the plane to see if anyone was alive or conscious. Howard sighted the crew members on one side of the plane and shouted to Card and Honeycutt that he had found them.

Then the three searched for a way into the plane. Inside the trapped survivors were also looking for a way out. Time was vital — fuel was leaking into the cockpit and electrical power was still on. A small hole leading into the cockpit fuselage was found and enlarged, and one by one the victims were pulled out.

After all the men had been removed from the wreckage Card and others at the skiway loaded them on sledges for the 1.59km journey to the camp. The sledges were only 5m from the crash site when the first of several explosions rocked the Hercules.

When the sledges arrived at the camp Card turned the living tent into a makeshift emergency room. His first task was to determine the extent of each victim's injuries and find out which were the most serious. Nine men from the recovery and support teams were assigned to sit with the survivors, observe their condition and let Card know what was going on.

Bad weather

Because of bad weather a medical emergency team did not reach the crash site for almost eight and a half hours. During that time Card's organisation and calm kept at least one man alive. Lieutenant David S. Kermode, a Navy doctor who cared for the survivors at McMurdo Station, said later that the situation at D59 would have taxed a hospital emergency room. "Card had nine cases — four of them serious. One would have died without him. He really kept his wits about him."

After preliminary treatment in the McMurdo Station dispensary four of the injured were flown to Christchurch on

December 10 and admitted to hospital. They were Lieutenant-Commander Einar L. Corelli (Bremerton, Washington State), Lieutenant-Commander David Ogden, Lieutenant Carlton Byrd, and Aviation Machinist Mate First Class John Jaenish (Saratoga Springs, New York State). In January they were transferred to Hawaii for medical observation.

Five men remained in Antarctica and returned to the United States towards the

end of the season. They were Lieutenant-Commanders Richard Potter, Maurice Spence (Camarillo, California), and David Coggan, Aviation Machinist Mate Second Class Marvin Staton (Point Mugu, California), and Aviation Mechanic Airman Michael Callahan (Harleville, Pennsylvania).

Reference: "Antarctic", No. 6, Winter, 1987. Pages 258-259.

New West German station on ice shelf

West Germany now has two summer research stations in the Weddell Sea area. Filchner, the first, at 77° 08' S/50° 34' W, was set up in 1982 on the Filchner/Ronne Ice Shelf. In 1986 Drescher was opened on the Riiser-Larsen Ice Shelf at 72° 53' S/19° 10' W for summer biological and meteorological observations.

Drescher Station, which consists of three prefabricated huts, is 1km north of the mouth of Drescher Inlet, an ice-covered bay south of Cape Vestkapp (72° 40' S/19° 00' W), a prominent westward projection of the ice shelf front which was named Vestkapp (west cape) by Norway. The cape is midway along the ice front and 96.5km west of the Kraul Mountains, Queen Maud Land.

In 1986 the Alfred Wegener Institute for Polar and Marine Research sent its research and supply vessel Polarstern to cruise in Antarctica for the whole year. The cruise, made in three legs between May 6 and December 14, included the first all-winter operation of a research vessel moving freely in the pack ice zone of the Weddell Sea.

On the third leg of the cruise, which was the second leg of the Winter Weddell Sea Project (WWSP 86) the Polarstern sailed from Capetown on September 28 for the permanent Georg von Neumayer Station on the Ekstrom Ice Shelf. It reached Atka Bay on October 12 and the station was visited briefly.

Then the Polarstern headed for the Vestkapp area to carry out oceanographic

research. The first priority was to erect Drescher Station. It took 36 hours of helicopter flights and construction work in which members of the ship's crew took part before a team of West German and Dutch biologists and meteorologists moved in.

Because transport over the sea ice was not possible the ship's two helicopters had to fly building material and equipment to the site in crates each holding 600 to 800kg. In two days the two living huts and the stores hut were ready for use by five to six biologists and two meteorologists.

For six weeks the group operated as an independent unit, investigating the breeding and feeding biology of Weddell seals and Emperor penguins. The meteorological observations yielded valuable data on the structure and dynamics of the planetary boundary layer over the edge of the shelf ice and supplemented simultaneous measurements made on board the Polarstern and by meteorological ARGOS buoys placed on large drifting floes from the vessel or by helicopter.

On her return to pick up the field party the Polarstern stopped in Drescher Inlet from November 22 to 24 to load cargo

from the station and enable working groups aboard ship to study the fast ice. When the vessel sailed the huts were left with a supply of petrol and kerosene for future science activities and for refuelling aircraft and helicopters engaged in flight operations.

Using two large and two small snowmobiles, each with Nansen sledges for transport across the inlet, the scientists worked on the ice from mid-October to late November. Their project was interrupted by 13 days altogether of drifting snow. Four breeding sites of Weddell seals were found, and the population in the Drescher Inlet amounted to about 250 individuals, including 68 pups.

Adult Emperor penguins and chicks were counted by direct and aerial census. The direct census on October 24 yielded a total of 6660 chicks, 6890 breeding birds, and 630 non-breeders present in the colony at that date. The number of chicks indicated a total of about 13,300 breeding

birds in the inlet.

Drescher Station's three huts, each measuring 6.5 x 2.5 x 2.5m, are of lightweight design with insulated walls 10cm thick. The field party praised the excellent insulation properties of the walls which kept the station warm despite strong gales and temperatures down to minus 32deg Celsius, and even when generators were not running at night.

Each living hut has four bunks in the back section, a combined cooking and work area in the middle, and a separate entrance with sink and snow melting apparatus. The huts are parallel to each other in a distance of 35m and the store is located between them. Cooking is done with propane gas; frozen meat and other frozen supplies are stored outside in wooden boxes. Electricity is provided by three petrol generators of 4.5 kW AC each. Main power consumers are five electric heaters and the two snow melters.

Antarctic Treaty

Italy and East Germany full members

Italy and the German Democratic Republic are now consultative parties to the Antarctic Treaty. They were admitted to full membership at the 14th meeting of consultative parties held in Rio de Janeiro between October 5 and 16. Ecuador's accession to the treaty, announced at the same meeting, brought the membership to 36. Of these 20 are consultative parties and 16 acceding countries. Since that meeting Switzerland and more recently Austria have also acceded and the membership now stands at 38.

South Korea was the first country to accede last year, and with Ecuador's accession the 16 members who, since 1983 have been able to participate in treaty meeting as observers, are: Bulgaria (1978), Czechoslovakia (1962), Cuba (1984), Democratic People's Republic of North Korea (1986), Denmark (1965), Ecuador (1987), Finland (1984), Greece (1986), Hungary (1984), Netherlands (1967), Papua New Guinea (1981), Peru (1981), Republic of South Korea (1987), Romania (1971), Spain

(1982) and Sweden (1984). Late in 1987 Switzerland also acceded as did Austria in early 1988.

Between 1977 and 1985 six countries were admitted to full membership by the 12 original signatories of the treaty — Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, USSR, UK and USA. Poland was the first in 1977 and was followed by the Federal Republic of Germany (West Germany) in 1981, and then by Brazil and India (1983) and the People's Republic of China and Uruguay (1985).

East Germany, which acceded to the Antarctic Treaty in 1974, and was accepted as a member of the Scientific Committee on Antarctic Research, has been engaged in Antarctic research as far back as 1959 when the first group of scientists took part in the 5th Soviet Antarctic Expedition. Since then GDR scientists and technicians have worked within the framework of Soviet expeditions, carrying out independent but fully integrated research in meteorology, geodesy, glaciology, geophysics, biology, isotope physics and medicine.

Antarctic oil

More countries making seismic surveys

Italy, now a consultative member of the Antarctic Treaty, has followed the example of West Germany and France by chartering the research vessel Explora for a marine geological survey to investigate the geological structure of the continental margin of Antarctica and obtain information about its hydrocarbon potential. The 978-tonne ice-strengthened Explora, which called at Wellington late in February, was chartered for the survey by the Geophysical Experimental Observatory of Trieste.

Consultative parties to the Antarctic Treaty engaged in scientific research in Antarctica are required to exchange information about their programmes. Each party also has to give notice of any expedition to Antarctica not in the official programme but organised in, calling at or proceeding from the area in which the party is operating.

Last season's Italian expedition to the Ross Dependency carried out an oceanographic programme from the chartered Norwegian research ship Polar Queen in Terra Nova Bay and the Ross Sea, and the National Institute for Hydrocarbons was represented in the field teams. The third expedition also extended and improved the Terra Nova Bay Station established in 1986-87 and carried out a wide range of other research projects.

Notice was given in the exchange of information that the Geophysical Experimental Observatory (OGS) planned an independent research expedition to acquire geophysical data from the vicinity of South America along the Antarctic ice edge as far as the Ross Sea — a distance of about 5935 nautical miles. In the course of its cruise OGS planned also a deep crustal exploration profile of about 540nm in the Ross Sea. The Explora was in the Terra Nova Bay area early in February and was associated with the Italian programme before heading for Wellington.

Built in 1983 the Explora is registered in Bremen and owned by Sloman-Nettun Schiffarts. In the 1977-78 season she was chartered by the West German Federal Bureau for Geosciences and Natural Resources. Scientists led by Professor K. Hinz made geophysical studies in the Weddell Sea and the South Atlantic.

Described as an investigation of the geological structure of the continental margin the programme was continued during the 1979-80 season from the Explora in the Bellingshausen and Ross Seas. In the 1981-82 season the Explora was chartered again by the French Petroleum Institute for a marine geophysical survey in the Adelie Land sector and the Ross Sea.

One French publication described the purpose of the survey, conducted in January and February as oil research. From Hobart the Explora sailed to work in the Dumont d'Urville Sea. She continued her survey in the Ross Sea and returned to the New Zealand port of Bluff by way of Macquarie Island on her way back to Bremen.

Since 1976 Norwegian, German, and Soviet ships have collected seismic reflection profiles over the continental margin in the Weddell Sea area. The Soviet Union has used ice-strengthened research ships for this work, but last season, for the first time, it sent one of its recently-built icebreakers south on a scientific mission.

A week before Christmas the Finnish-built icebreaker *Vitus Bering* set out on its first voyage to Antarctica to conduct seismic and gravimetric experiments in the Lazarev and Sodruzhestva Seas. The icebreaker, named after the greatest Arctic explorer of the 18th century who led two Russian expeditions and discovered the strait which bears his name, has been designed for Arctic and Antarctic service. She carries aircraft and helicopters and is equipped with cargo handling gear.

United States

United States scientists have made marine geological surveys from Coast Guard icebreakers, particularly the *Glacier*, for the last seven or eight summers. The work has been done by field teams from Rice University, Houston, Texas, in the Ross and Bellingshausen Seas and off the Antarctic Peninsula.

In the 1981-82 season the *Glacier* took a Rice University team from Punta Arenas, Chile, to the Weddell Sea for a short marine geological survey of the continental margin. Last summer the project was continued from the National Science Foundation's research vessel *Polar Duke* along the continental slope and margins on the west side of the Antarctic Peninsula.

Australia

Investigations of the hydrocarbon potential of the East Antarctic continental margin were conducted during the 1981-82 summer programme of Australian National Antarctic Research Expeditions (ANARE). Marine geological studies were carried out from the *Nella Dan* by scientists and technicians from the Australian Bureau of Mineral Resources. They worked offshore from the Amery Ice Shelf in the Prydz Bay/Lambert Glacier region which is considered to be a prime hydrocarbon exploration area.

Japan

Areas in the Ross Sea and off Wilkes Land adjacent to French, Australian, and Japanese surveys in earlier seasons were covered in 1984 by the US Geological Survey's research vessel *S. P. Lee*. The

two probes produced additional data on continental spreading to support the possibility that the breaking away of Australia and New Zealand from Antarctica may have produced basins of which some could be rich in hydrocarbons.

Japan has concentrated on marine geophysical surveys in Antarctica since the 1980-81 summer. 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 Industry. A geological survey ship owned by the Japanese Metal Mining Agency has been used for the surveys, and the research staff has included scientists from other institutions such as the Tokyo University Ocean Research Institute.

Late in November 1980 the geological survey ship *Hakurei Maru* went south to begin the first survey in the Bellingshausen Sea (1980). The programme was continued in the Weddell Sea (1981) and the Ross Sea (1982). A second three-year programme began in 1982-83 in the Wilkes Basin area of the Dumont d'Urville Sea off Adelie Land and in part of the Ross Sea, and was completed in two stages.

Two-stage survey

A two-stage survey was completed by the *Hakurei Maru* during the 1984 summer in the Australian sector of Antarctica as far as Amundsen Bay, Enderby Land. The three-year programme was completed in 1985-86 by surveys in the Norwegian sector of East Antarctica off the Queen Maud Land coast.

Last season the *Hakurei Maru* left Japan early in November for the South Orkney Islands to continue the programme initiated in 1980-81. She returned at the end of March after the scientists aboard completed another marine geology and geomorphology programme for the technology research centre of the Japan National Oil Corporation.

Brazil, which became a consultative party to the Antarctic Treaty in 1983 and

established a summer research station, now permanent, on King George Island in the South Shetlands, is another country to carry out seismic surveys outside the official programme. A Brazilian oil company, Petrobras, is reported to have made a seismic survey of an area of 5000 square kilometres off King George.

Last season the company, which is said to be supported by the Brazilian Government, was reported to be planning a seismic survey in the Ross Sea. So far there has been no information about the survey, the ship to be used, and just where Petrobras intended to operate.

Sub-Antarctic

Seal studies at Australia's sub-Antarctic Islands

Recent scientific observations have revealed a decline in the elephant seal populations at most sub-Antarctic Islands, except South Georgia where numbers have remained relatively static. Populations at Heard and Macquarie Island have declined as much as 50 percent in the last 35 years.

This summer Australian scientists focussed on migration, diet and pupping of elephant seals in an effort to isolate the reasons for the decline. Part of the project was co-operative with South African scientists working on Marion Islands.

Work was also undertaken on the leopard seal and on the fur seals which are increasing in number.

Two parties were landed at Heard Island early in the summer to carry out the second full census of elephant seals at Heard Island. The first party of 13 worked from the ANARE base at Atlas Cove counting seals on the nearby beaches. The second party of four worked from Spit Bay counting seals along 46 km of coast from Compton Lagoon in the north of Cape Labuan in the south. By using amphibious craft scientists were able to survey distant coasts in one day on two occasions.

Seals on nearby Spit Island were counted from helicopter during the landing of the second summer party on Heard Island. Nella Dan was also able to sail close enough to the Island to enable the number of harems to be counted from the bridge.

In all approximately 13,000 breeding elephant cows were counted confirming 1985/86 data which indicated a 60 per cent decline of the Heard Island population since the 1950's. The Macquarie Island census showed a 50 per cent drop in the equivalent period.

Counts will be made regularly on Macquarie and at the Vestfold Hills during the winter months.

Other aspects of the elephant seal research programme included the collection of blood samples from seal pups to determine the genetic relationships between the seals in the populations of Heard and Macquarie Islands. In all, 120 samples were collected from pups in the Atlas Cove area while 230 samples were taken from pups between Compton Lagoon and Long Beach. A similar number of blood samples were collected from Macquarie Island.

For further information on their migration the hind flippers of all male seals were checked for tags to determine whether they were returning to the same or a different location. The programme was carried out at Macquarie, Heard, Vestfold Hills and by a two person team landed late in the season at Petersen Island. Four hundred and seventy eight male seals were tagged at Petersen Island this season.

In 1986 over 300 males were tagged at

the Vestfold Hills and 200 males at Heard Island. Animals tagged at Heard Island and at Casey and Davis, on the continent, were found in the Heard Island colonies. Among them were two cows and two bulls tagged at Davis 1740 km to the south only seven months earlier.

Comparative weighing

In the second part of a five year programme a large number of weaned pups were weighed at both sub-Antarctic island locations and at the colonies near the continental bases. Cows do not feed while lactating and data from the weighing can be used as a measure of maternal investment. Concurrent and comparative weighings were carried out by the South Africans at Marion Island. In all 825 weaners were weighed at Heard Island and more than 100 each at both Marion and Macquarie Islands.

Also working on Macquarie were two scientists from the University of Queensland who concentrated on the food and feeding strategies of pregnant and lactating seals, the growth of sucking pups and their diet in the early post weaning stages when they are thought to feed close to the Island unlike the adults which move further afield. This too, should help in understanding aspects of the energetics and maternal investment.

Additional work was undertaken on the measurement of blubber of the elephant seals at Macquarie and Heard Island using ultrasound and tritium techniques.

The stomach contents of 60 male seals at Heard and 25 at Macquarie were washed out through a soft rubber hose from anaesthetised animals. Such work is significant because elephant seals feed on squid and fish and may be valuable indicators of the status of the Southern Ocean ecosystem. Further elements of the overall programme from which survival, movement and diving patterns may be determined.

Leopard seals

Work was also undertaken on the leopard seals which are known to migrate northwards from the pack ice ecosystem in

numbers which vary in cycles of about nine years. From observations at Macquarie during the last 35 years the numbers of seals hauling out varies between 20 in sparse seasons to 200 in an abundant year.

Records at Heard Island are more sparse. From figures obtained over a limited time between 1949 and 1953 when it was manned continuously it is unclear whether a similar trend exists. As part of this information a census was also taken of the numbers of leopard seals at each island location and details such as body length and sex were recorded. Stomach lavation of 35 leopard seals for diet data was also undertaken.

Information on the condition and dispersal of such groups will assist in assessing the effects of their predation of crabeater seals, an important part of the diet of leopards and also of krill, and in providing an index of some natural background fluctuations in the pack-ice ecosystem.

Fur seals

While elephant seal population figures are declining, and data on the Leopard seal is being collected, the numbers of fur seals, hunted to extinction at Macquarie Island in the early part of the century are increasing. This is also true on Heard Island where more than 10,000 fur seals were seen in late February 1988.

Three species of fur seal are known to exist in the Australiasin segment of the southern oceans, the New Zealand Fur seal (*A. Fosteri*), the sub-Antarctic fur seal (*A. tropicalis*) and the Antarctic fur seal (*A. gazella*).

In 1948 small numbers of the New Zealand fur seal were observed by the first ANARE party on Macquarie Island and new born pups were seen in 1955. While the other species have been breeding on the North Head Peninsula the New Zealand fur seal has not.

Work began this season on a ten to 20 year programme to establish the conservation status of fur seals at Macquarie. It will focus on the growth rate of seals on the Island, the contribution of each species on

that growth and whether the population is likely to expand markedly from breeding there or to increase slowly from immigration only.

As part of the programme the total number of animals on North Head Peninsula were counted each week during the season and the numbers of bulls and cows in each territory were recorded.

Mating was observed to determine whether it occurred between the sub-Antarctic and Antarctic seals and whether the New Zealand fur seal was involved. Methods to determine the differences between the three species were sought as a

programme of body measurements, and weighing to estimate growth rates was undertaken. Juveniles, tagged as pups the previous season, and tagged cows were sought to determine whether they returned to breeding territories and which produced pups.

An unexpected discovery from Heard Island in the 1987/88 summer was the finding of the sub-Antarctic fur seal. A few dozen animals were seen among the thousands of Antarctic fur seals. One sub-Antarctic fur seal pup, that was born on the Island, was recognised as well.

Greenpeace ship on way to Antarctic Peninsula

Greenpeace, the international environmental organisation, sent its third expedition to the Antarctic Peninsula on March 9 to continue its programme of environmental monitoring of scientific bases. This will be the first voyage to the area for the purpose by the organisation's ship Greenpeace. In 1986-87 it sailed to the Ross Dependency and East Antarctica and a base was set up on Ross Island.

Delayed for two weeks at Lyttelton by engine trouble the Greenpeace finally sailed south on January 24 and was off Cape Evans, Ross Island, by February 3. The expedition resupplied its World Park Base, replaced last winter's team with four new volunteers, visited McMurdo Station and Scott Base, and departed on February 14 to inspect other bases in the Ross Dependency. Because of thick ice and heavy seas the expedition was unable to visit the Soviet Base Leningradskaya on the Oates Coast or the French Dumont d'Urville Station in the Pointe Geologie Archipelago, Adelie Land. The Greenpeace changed course for Lyttelton when past the Balleny Island, reaching port on March 3. After nearly a week in port to refuel, make crew changes, and dispose of 150 drums of rubbish, including 30 of human wastes, from World Park Base, the Greenpeace departed on the second leg of

this season's programme on March 9. When she arrives at the Argentinian Port of Ushuaia, Tierra del Fuego, additional crew and supplies will be taken on.

How long the ship will remain depends on ice and weather. Present plans are to spend 30 days visiting bases and carrying out the environmental programme. Because the region normally has a longer ice-free summer season and milder weather the ship could remain for most of April and even return to Ushuaia early in May.

Most of the Greenpeace programme will concentrate on King George Island in the South Shetlands, one of the most accessible areas in Antarctica. Argentina, Brazil, Chile, China, Poland, Soviet Union and Uruguay have stations on the island and South Korea, Peru and Ecuador established bases this summer.

Greenpeace proposes to examine each

base in terms of its impact on the surrounding environment. The cumulative effects of 10 bases on the island ecology will also be studied.

No major construction was done at World Park Base during the ship's stay but the expedition initiated an alternative energy project, using solar panels and a wind generator. A 600W solar panel system was fitted against the sides of the main building to prevent wind damage and a 2kw wind generator was placed on a 13m tower close to the base.

To provide additional workshop space the nearby dismantled hut used by the Footsteps of Scott Expedition was re-erected. The satellite radome on the roof of the base was moved away and placed on a 10m tower.

An important environmental change was the introduction of a "BIO-LOO" which will convert all human wastes into compost for easier removal when the base is resupplied.

When the Greenpeace departed from McMurdo Sound at 11 p.m. on February 14 she left behind the second winter team of three men and one woman. They are a 35-year-old American, Keith Swenson (leader-mechanic), a West German woman geologist, Dr Sabine Schmidt (3), a Polish oceanographer, Wojciech Moskal (37) and a 37-year-old Dutch-Australian radio engineer, Sjoerd Jongens. Dr Lynn Horton went south as the winter base doctor but she was replaced by Wojciech Moskal.

Team returns

Dr Horton returned with last winter's team of three New Zealanders, Kevin Conaglen (leader), Justin Farrelly (radio operator), Dr Cornelius van Dorp (doctor) and a West German woman biologist, Dr Gudrun Gaudean. They had been at Cape Evans since February 14, 1987.

Research projects to be carried out this year by Dr Schmidt will follow the pilot programme of biological and meteorological research initiated last year but will include some geological work.

Dr Schmidt will study the coastal fish of the western Ross Sea to obtain basic data for a whole year. Fish will be caught

through ice holes with lines and traps and their organs will be collected and examined later for traces of pollution. Little data was available last season because sea ice near Cape Evans was either absent or unsafe for walking. A related study will examine the composition and distribution of plankton in the Ross Sea near Cape Evans.

Other projects will include observation of penguins, skuas, and seals near the base and monitoring of meltwater lakes. The meteorological study will cover detailed observations of air and water temperatures, wind strength and direction, barometric pressure and humidity and ice formation and movements.

A monitoring programme of certain beach profiles in the geological project will include changes in geomorphology and grain size during the seasons. Seaborne litter on the shore will be monitored and encrusted animal and plant life on it will be examined.

Melatonin studies

Last year the goal of the medical research was to investigate the function of the pineal gland in the winter team. Dr van Dorp explored the hypothesis that mood is related to exposure to sunlight, the mediating organ being the pineal gland, and also the belief that increased secretion of melatonin in the winter months is related to the Antarctic wintering syndrome.

During the winter the team members answered a mood questionnaire every fortnight and recorded their sleeping patterns. Every month they filled in a series of forms to provide information on their physiological state, reactions to each other, and their methods of coping with their environment.

Methods developed by the second expedition for sampling soil, ice, and snow near bases were used again this year by Greenpeace scientists during the time their ship was in McMurdo Sound. They spent a day taking 31 samples of soil and water for analysis to test for contaminants from McMurdo Station and neighbouring Scott Base, and photographed both bases.

Waste dump sites were also examined to determine whether they contained any rubbish prohibited for disposal in Antarctica by the Antarctic Treaty code of conduct on waste disposal. The expedition brought back to Lyttelton a 4m length of effluent pipe found floating in McMurdo Sound, metal, fuel pipes, and a decomposing battery picked up on the foreshore.

Terra Nova Bay

When Greenpeace II visited the newly-built Italian station in Terra Nova Bay in the 1986-87 season the expedition had completed its programme, which included an environmental impact study, and sailed for Lyttelton. The Greenpeace III team arrived on February 16 and found that completion of construction of the station this season included the installation of a waste incinerator and a water treatment plant.

While the Greenpeace was in Terra Nova Bay a party flew by helicopter to Gondwana Station, small West German summer base established in Gerlache Inlet in January, 1983. It has not been used since the 1984-85 season. Greenpeace opposes any expansion of the base because no environmental impact assessment report was prepared. The party photographed the base which Greenpeace believes should stay closed until a full EIA has been prepared and other possible sites have been explored.

Continued north

Greenpeace continued north off the Victoria Land coast to visit the abandoned joint US/NZ Hallett Station in Edisto Inlet behind Cape Hallett. The station has been closed since 1973, and for several seasons New Zealand and American teams have worked to clear up the area and minimise the effects of human habitation and also provide the best conditions to rejuvenate the site as a penguin rookery.

Originally the Greenpeace expected to arrive off Cape Hallett early on February 18 and spend a whole day examining the deserted base but it had to stand out to sea until late on February 19. On February 20 it was in Willett Cove, a sheltered cove inside Edisto Inlet near Hallett Station. It had

almost completed the inspection of the base when the master, Captain James Cottier, was asked by Don Richards, master of the Allan and Vi Thistlethwayte if the ship's helicopter could pick up six Australians who had climbed Mt Minto in the Admiralty Range on February 18.

Because of the loss of a motor toboggan the climbers' return to the AVT which had brought them from Sydney to Cape Hallett was likely to be later than planned. Don Richards was concerned that the late return might lead to the AVT being caught by ice in the Ross Sea.

A reconnaissance flight towards the climbers' base camp at the junction of the Staircase and Tucker Glaciers was made on February 21 by the chief helicopter pilot Gary Dukes, and Kevin Conaglen but they were forced back by bad visibility and high winds. On February 23 however, the weather was better and Gary Dukes and the second pilot, Peter Malcolm, flew the Hughes 500D in turns to pick up the climbers and their gear. The operation, which took five trips, began at 6.10 a.m. and was completed by mid-day.

Landed on the helicopter pad of the Greenpeace the climbers were transferred to the AVT in inflatable boats. Later in the day both vessels headed out to the Ross Sea and turned north. They ran into bad weather, and with time running against them Greenpeace gave up plans to visit Leningradskaya or Dumont d'Urville.

Impassable ice

Leningradskaya, established in 1973, is difficult to reach because of an area of fast ice 10 km to 20 km wide. Last year the ship was blocked by impassable ice and any attempt in late February would have been most risky.

Ice reports were also unfavourable for a visit to Dumont d'Urville to examine the present status of the 1100m all-weather airstrip which France began to build in 1982-83. Direct work on the strip was suspended for three seasons, but construction began again this summer, and Greenpeace was concerned about the effect of the work on Adelie and Emperor penguin

colonies and the breeding sites of other seabirds.

Footnote: Greenpeace has already called for four volunteers who will winter at World Park

Base in 1988-89. A medical doctor, a radio technician, a diesel electric generator mechanic and a biologist will be required from September this year to March 1990.

Australians climb Mt Minto

Four Australian climbers and a two-man film crew completed the first ascent of Mt. Minto (4165m) in the Admiralty Mountains of Northern Victoria Land on February 18 and returned to their base camp at the foot of the peak on February 19. Leader of the party was a geologist, Greg Mortimer, who was in the Australian team which climbed Mt. Everest in 1984.

With Mortimer were three mountaineers, Jonathan Chester, Lincoln Hall and Lyall Closs, and the film crew, Chris Hilton and Dr Glen Singleman. The six men of the Australian Bicentennial Antarctic Expedition sailed from Sydney on December 31 in the Oceanic Research Foundation research vessel Dick Smith Explorer, now renamed Allan and Vi Thistlethwayte after a generous supporter of the venture. The AVT carried a crew of five, four men and one woman headed by Don Richards (master/radio operator), who has made two earlier Antarctic voyages.

After a 33-day voyage, mostly under sail, the AVT arrived off Cape Hallett at 2 a.m. local time on February 1. When she reached 69deg 42min S the ship was caught in thick pack ice and had to motor through it from January 28 until January 30. She was stuck for two days and broke free at noon on January 30. But there was open water off Cape Hallett, and the AVT was able to motor into Edisto Inlet, escorted by 40 to 50 fin whales, and tie up to a sheer ice shelf close to land and the now uninhabited US/NZ base.

All hands worked through the early hours to unload the climbing party's gear and stores. The sun was out all day, and by February 2 the sledges, two large and one small, had been put together, and the skidoo assembled.

On February 3 at 4 p.m. local time the

men departed, five on skis and one driving the skidoo which towed the sledges. They made good progress and camped at the head of Edisto Inlet for the night. The next day they started the crossing of Football Saddle, the broad pass on the ridge between Edisto Inlet and the Tucker Glacier, which offers an all-snow route to the lower end of the glacier. By the end of February 4 they were 32 km from the ship.

Greg Mortimer sent Chester and Hilton back to pick up more fuel for the skidoo and other items on February 6. They spent the night on the ship which motored them the next morning almost to the head of the Bay. The pair then started back to a base camp on the glacier some 30km further away. The next stage was the difficult ice climb rising more than 300m up the Tucker Glacier and then in by the Man-o-war glacier to reach the south side of Mt. Minto and put in a base camp for the final assault.

When ice to which the AVT was moored started to break up and move out on February 6 the ship motored out towards the Edisto Inlet entrance and into good sheltered water. The original plan was for the AVT to sail out of Edisto Inlet and remain in the Ross Sea area away from ice until the climbers returned to their shore base but, concerned about conditions, the Captain asked the master of Greenpeace if the ship's helicopters could recover the team which had lost its motor toboggan and was slowing its retreat. The operation which took five trips, began at 6.10 am on February 23 and was completed by mid-day, the climbers were transferred from the helicopter pad on Greenpeace to the AVT by inflatable boats. The AVT returned to Sydney via Christchurch.

Trans-Antarctic crossing planned for 1990

The first west-east axis traverse of Antarctica was announced in the United States late in 1987. It is planned for 1989/90. Six explorers from different countries will use dogs in the operation which will be the first unmechanised crossing of the continent, involves the building of a special support vessel and has a budget of \$US8 million.

The 5,000 mile, seven month traverse is due to begin in August of 1989 and end in March 1990. The team will sail south in their specially designed sailing vessel currently under construction at a small shipyard south of Paris. It is 120 feet long, 30 feet wide and has a 16mm thick walnut shaped aluminium hull designed to overide and crush the ice. She has two masts, a 365 hp motor, will have a crew of eight and is costing \$US2 million.

With the traverse team and 50 dogs the UAP, as she will be called, after her sponsor, a French insurance company, is due to leave Duluth, Minnesota in the spring of 1989 on a journey which will take them through the Great Lakes, down the coast

of North and South America to Hope Bay at the tip of the Antarctic Peninsula. From there, on August 15 of 1989, the dogsled traverse will begin, the team being due at the South Pole by December 15 before crossing the area of Inaccessibility, and heading via Vostock, to the Soviet coastal base of Mirnyy where it is due to arrive on March 1, 1990. It will be met by the vessel and returned to the States.

Minnesotan Will Steger (43) and French adventurer Jean-Louis Etienne (41) are the joint leaders of the expedition, first mooted at a chance meeting in the Arctic in 1986. Steger was leading a successful dog sled expedition to the North Pole to which Etienne was skiing alone.

They will be accompanied by Victor Boyarski, a Russian glaciologist with the Arctic and Antarctic Institute in Leningrad, who has had extensive Antarctic experience and will be in charge of the scientific experiments in glaciology, meteorology, ozone and radiation planned during the expedition.

Other members of the team are likely to



Prior to leading a successful expedition to the North Pole in 1986 Will Steger's achievements included first ascents in the Peruvian Andes of two peaks over 19,000ft and 10,000 miles of kayaking on the MacKenzie, Peace and Yukon Rivers. From 1973 to 1986, following three years of teaching at the Minnesota Outward Bound School, Steger operated a winter travel school out of Ely, Minnesota. He currently owns and operates a dog breeding and training camp in norther Minnesota from which the dogs to be used in the expedition will be drawn.



In 1986 Dr Jean-Louis Etienne became the first Frenchman to reach the North Pole at the end of a solo skiing adventure. A physician specialising in sports medicine and nutrition he has completed nine major expeditions since 1975. These include two in Patagonia, a sailing/climbing venture on the northwest coast of Greenland and two in the Himalaya's. Having sailed as a crew member in the 1976 Tall ships race and in the 1977-8 round the world race he has overseen the construction of the specially designed vessel for the Trans-Antarctic Expedition. He will also be the team's physician.

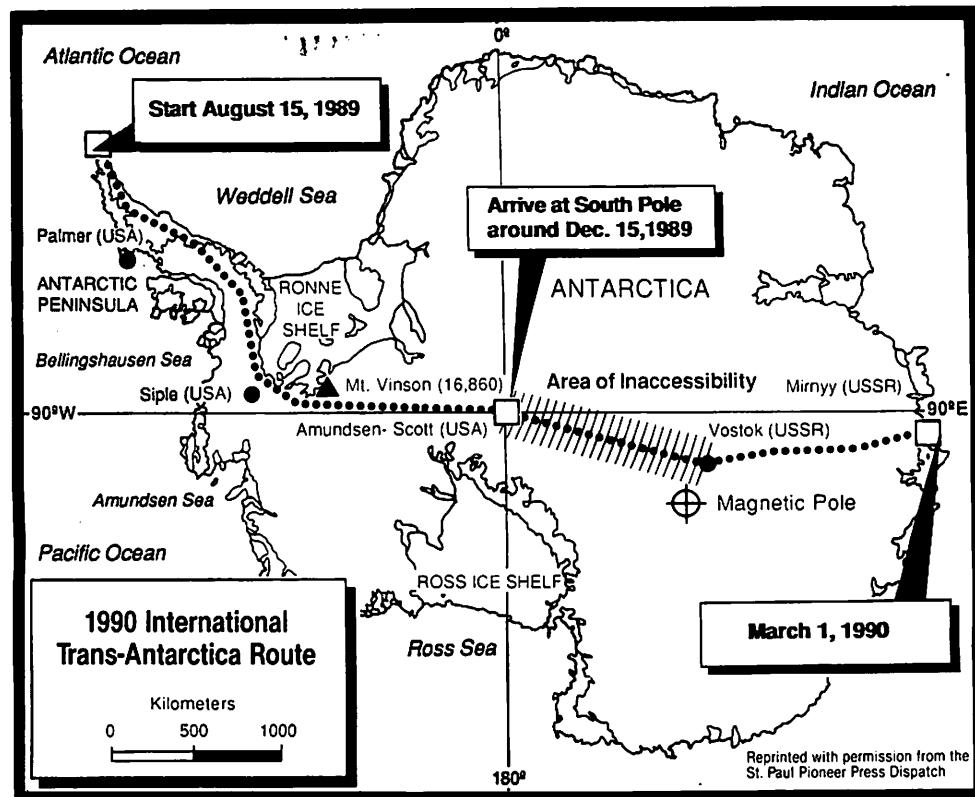
be Geoff Somers from Northern England, who has spent 36 consecutive months on the Antarctic Peninsula working with the British Antarctic Survey; Keizo Funatsu from Osaka, Japan, who has spent four years training with dog teams in the United States and Martyn Williams, a Canadian who runs Adventure Network International, an Antarctic tourist operation and guides in the Yukon for the rest of the year.

Dogs and expedition members have been training at Ely, Minnesota Base Camp under the direction of Steger who owns and operates a dog breeding and training camp. Some of the dogs used in the expedition may be descendants of the Scott Base huskies flown to Minnesota in February 1986 after a decision to withdraw them from active involvement in the New

Zealand Antarctic Research Programme.

The team was due to leave St Paul, Minnesota, on April 10 for Greenland where it is to train for three months. Using a chartered flight they will take 30 dogs to Narssarsuaq where they will be transferred to the ice cap 50 miles north by helicopter on April 16 to make a 2000 mile traverse across the ice arriving at the Humboldt Glacier area on June 20. After three weeks they will be resupplied by Twin Otter flying out of Nook on the eastern coast of Greenland.

A French film crew accompanying the team for the start of the training run will be collected at the same time; they are preparing a series of five separate documentaries, the first to be filmed of *The proposed route of the 1990 international Trans-Antarctica expedition.*



training in North Minnesota, a second of Will Steger, followed by Greenland, Antarctica and a combination of all after the expedition. ABC has bought the rights to

the expedition and will be preparing newsbriefs during the next two and a half years and hope to do the first live broadcast from Antarctica.

90 Degree South ship for sale

Aurora, the former Norwegian Arctic sealer and research vessel Polaris V which took the 90 Degrees South Expedition from Lyttelton to the Bay of Whales and brought Dr Monica Kristensen and her companions back after their unsuccessful attempt to reach the South Pole, is up for sale. The expedition has been unable to retain the ship and she is now in Oslo harbour.

Vangen, the expedition's logistic base near Kingsvinger in Norway, has been maintained. It serves as a home for the 16 huskies the expedition still owns. Most of the others have been returned to their previous owners. Vanen has also been a useful base for reorganising all the equipment brought back by the Aurora, and such activities as cataloguing and classifying the 10,000 slides taken on the expedition.

Since her return to Oslo, Dr Kristensen has included in her responsibilities the

writing of the story of the expedition. The Norwegian version of "Toward 90 Degrees South" (Mot 90 Grader Syld) is about 250 pages long and has 42 colour and 10 black and white photographs, and three maps.

Publication in Norway and Denmark was planned for October. The Norwegian price is expected to be 238 kroner (\$NZ55 plus). British and Swedish editions are planned for the northern spring of 1988.

An hour long documentary film of the expedition was made in conjunction with the National Geographic Society and BBC Channel 4. Three members of a British film unit were aboard the Aurora on her first voyage south and returned to Lyttelton with 25,000 ft of film.

Arrangements were made for the first screenings of the film in the United States on October 18 and in Britain the week before Christmas. It is also to be shown by Norwegian TV.

Profile:

U.S. artist visits McMurdo Sound

The U.S. National Science Foundation, which manages and oversees all American studies in Antarctica, has in the last ten years invited a number of artists, photographers and writers to visit various United States Antarctic bases and interpret the experience using their particular medium. Their choice for the 1987-88 season was Alan Campbell who was selected because of his level of experience and the emphasis of colour and light in his paintings.

Campbell received his Bachelor of Fine Arts with Honours from the University of Georgia in 1973, completed his M.F.A. there in 1976 and studied further at the University of California at Berkeley and in Cortona, Italy. In this special interview "Antarctic" asked Alan:

"What in your background equipped you for this last season's work?"

"Since I gave up teaching ten years ago I have undertaken a number of fulltime commissions for individuals and corporations and have completed several documentary series of paintings about a

number of special places. Five years ago I became involved in a project for the Sea Grant Programme from the University of Georgia. I spent two weeks on board a deep sea research vessel observing aspects of fisheries research and produced a series of works relating to the experience. It was a wonderful collaboration."

"What interested you in Antarctica?"

"About two years ago I saw a series of photographs of Antarctica and immediately realised that here was an opportunity to combine my interest in science with my documentary work and my longtime interest in colour and light."

"Of all aspects of art what created this emphasis for you?"

"The study of J. M. W. Turner and the French impressionists certainly come to mind. The American artists Winslow Homer and Edward Hopper also figure very strongly in this influence. For some time I have had an increasing interest in the abstract qualities in nature in both architectural and landscape forms, plus adopting a documentary interpretive approach to a given subject. I felt that all of these different aspects, plus the experience with another science group could be drawn together by working in Antarctica."

"What impact did the photographs have?"

"The first photographs I saw of Antarctica hit me like a brick. I remember being stunned by the sight of an iceberg like a huge piece of marble glowing deep red in a blue black ocean. The light, colour and the highly abstract qualities of the Antarctic landscape were a powerful motivation and a direct link to my experience as an artist. I also have quite a lot of science in my background from studies at university level even though I don't work professionally in science areas at all. However when I wrote

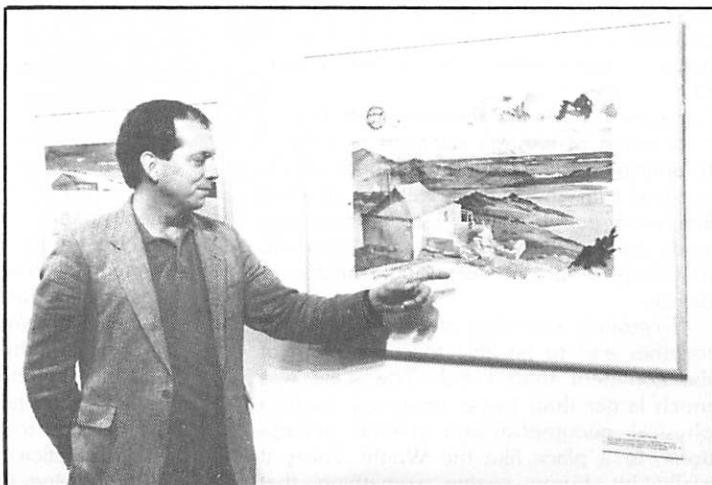
to the National Science Foundation, I was encouraged to apply and was subsequently accepted."

"Which Antarctic painters did you study?"

"From the historical perspective Edward Wilson and Herbert Ponting did some of the best work that has probably ever been done down there, with Wilson so noteworthy for his watercolours. Others did good on-site personal paintings of sledging through storms, ships and early expeditions. More recently I have met Austen Deans and seen Maurice Conly's works and I hope to be in touch with three contemporary Australian artists sent down the previous season through the Australian programme. They are planning an exhibition at the National Museum at Canberra next year. David Smith is an English painter who has been down with BAS; his work is also of interest."

"Why art and not photography?"

"They are two quite different mediums. Each serves its own purpose and neither one substitutes well for the other. For a lot of accurate information to be obtained quickly a camera is certainly better than a paintbrush but if you want interpretation, the manipulation, editing, selective use of colour, and are dealing in abstract ideas — painting is most often stronger in those areas. To some extent photography copes but the latitude is greater in painting. For



example there are limitations in the range of colours possible in photographic dyes; the sensitivity of the human eye is much greater. I am trained as a painter, I do a lot of photography but the options are much greater in painting as to what I can say and how well I can say it. I also feel I have a much greater range of choices and ways of responding to them. To me it is a much more successful way of conveying feelings about a place, to individual people so that they share some of the experience. It is very hard in photography to reach below the surface appearance of things. I prefer not to exhibit any of the photographs except for references as to where the site was."

"How did your Antarctic experience tie in with your general philosophy towards painting?"

"In being able to translate an experience; I was given enough time to get far enough into the subject and place, for it to become more than a superficial experience and for me to be able to translate that experience to people who may not have any direct contact with it at all. Being able to take these images back to the States, show them to people who have never been to Antarctica and watch their reaction will be, quite an important stage in the project.

"Antarctica is one of the few places I have worked where I had no previous experience and yet could be excited about going to paint without feeling like a tourist."

"Any preconceptions about Antarctica?"

"I talked to enough scientists to be able to anticipate the tremendous ranges of colour and light and knew it was not all white like most people think. I also knew blizzards did not blow every day non stop and that there would be surprisingly mild conditions.

"I certainly expected places to be closer together and to be able to cover more of the continent than I did. The scale was much larger than I ever imagined, both in physical geography and mental perceptions. In a place like the Wright Valley it really hit home seeing something that

looked 15 minutes walk and finding that it was a good three hours distant and then only eight feet high!

"Time and geological change was also more vast than I thought; what is a 75 to 100 year lifetime in the context of a place millions of years old?

"The influence of 24 hour sunlight was unexpected; the best time to work was about 12 until 3 in the morning. Back in New Zealand I am still having trouble sleeping on a regular schedule. I am still re-adjusting.

"I didn't anticipate the strange surreal qualities such as the dead silence where you can hear the blood moving through your ears, and where the senses of smell and hearing on which we normally rely are so suppressed. The mirage effects too were quite startling; I have a photograph of a C130 under a second floating upside down above it at Williams field!"

"What technical difficulties did the environment pose?"

"I was used to operating much faster; it took time to come to terms with the idea that everything took so much effort and energy. For example to operate in the area of McMurdo Sound you are very dependent on helicopter schedules and these in turn are dependent on the weather. This all created a sense of urgency.

"Once actually on location the weather still played a factor. In extreme conditions, I relied on the use of a nylon dome tent with a perspex window to combat freezing temperatures with the watercolours. It worked wonderfully.

"Planning was always essential. For example, we had two and a half hours on the Canada Glacier for the ice caves and had to be able to plan ahead to set up immediately and be prepared to do what was practical for that amount of time."

"Why watercolours?"

"Well it didn't seem that lifting wet oil paintings in and out of helicopters would be a great social success! Seriously though, the decision to use watercolour in a place like Antarctica, even with the possibilities of employing it in freezing temperatures,

was a strategic success. It is a very light weight, very portable medium. Also it dries very rapidly. Just the character of the medium itself which is ideally suited to the subject. Watercolour is 'THE' medium for very spontaneous work. In terms of capturing qualities of light it often exceeds oils, particularly when working quickly. Also it is probably the medium I am most at home with even though I have painted with oils for twice as long. The fact that it adjusted so well in conjunction with the dome tent relieved me from needing any other medium.

"I was happy to put the whole initial round of work in watercolour and will build up larger watercolours up to 10 feet long in addition to large oil paintings from the initial water colour studies."

"Were these works completed on site?"

"All but about three or four were finished on site and only one in the exhibit was done from photographs; that was the flight out of Adelie Land with 321. Everything else was done entirely on location."

"Why was that so important to you?"

"Because there is a greater range of subtleties of colour, texture and detail that the human eye can pick up. Even the best photographs can't really capture such colours as I saw there. Also there is something about the spirit of the place when you are there. It will be quite abstract to be back in a warm summertime studio in Athens, Georgia and doing paintings about icebergs without feeling the temperatures and the presence of all the landscape. Having been there personally and having taken all my own photographs will help immensely but it will be even more help to have worked as much as possible on location."

"How many different locations did you visit, how long were you there?"

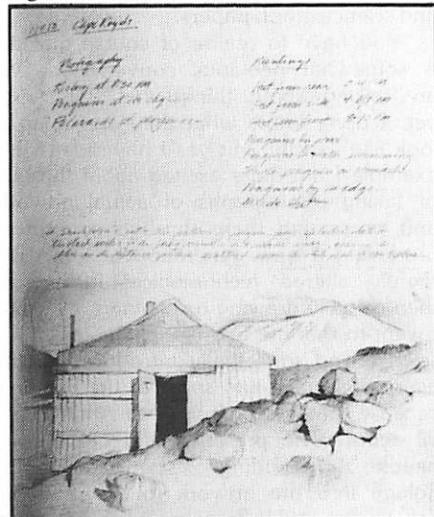
"I visited four sites in the dry valleys: Vanda Station, Linneaus Terrace near the ice falls in the Wright Valley, back around the Taylor Valley on a promontory at Lake Bonney adjacent to the upper Taylor Glacier and on the lower end of the Taylor Valley at Lake Fryxell and the Canada Glacier.

"As for other sites we were in and out of places like Marble Point, the Koettlitz Glacier, Miers Valley — some very brief stays of an hour or two but they still generated enough ideas for painting. Some more extended stays were at Vanda for ten days, Cape Royds for four, and three at Cape Evans, in and around Scott Base and McMurdo, up Castle Rock and Arrival Heights and then out at Cape Crozier for a short trip: I also forfeited a trip to the South Pole in order to travel up to Cape Hallett for three days with the icebreaker, including Terra Nova Bay briefly. And I was in Adelie Land — at the site of 321 — the day they flew it out after 17 years on the ice. There was one additional flight down to the Nicholson Peninsula to pick up an American science team."

"Who chose the locations?"

"They were recommended by NSF, American scientists, the Navy helicopter pilots and by some people at Scott Base. Scientists who I talked to and explained what I was doing gave very clear recommendations about places that had unique landscape features such as in the dry valleys. And the helicopter pilots who were constantly flying about and knew the most accessible locations became very eager and supportive.

Page of the artists notebook.



"I was covering and learning as much as possible and had to try and rely on other people's experiences and bring them into the project. Actually using other peoples' knowledge and eyes and ears rather than just looking at maps became quite important."

"What dominated your selection of subject material?"

"Light and colour. There is obviously a lot of landscape and yet some of the paintings to be produced back in the States will have quite a few figures in them; people in various situations and settings. There are not too many people or figures in this initial selection of work but there will be in the later exhibits. They are there in the sketch books and in the slides. There was such a breadth of material to cover in Antarctica that this (exhibition) is just the first round of preliminary work."

"Will subsequent work be impressions or will it follow the photographs very closely?"

"I will try to capture some of the multiple impressions of the place; I hope that some of the work does become more abstract. I want to take some of the images of science and put them into more of the work. The only example of this in the exhibit are the drawings and small water colour that were done on the meteorological and science graph papers.

"You have to realise of course that this is somewhat nebulous conversation. We are talking about things that don't exist yet. I don't know what they are going to look like exactly, but yes I have ideas. For example I am quite excited about the idea of taking photographs of actual artwork, and processing them through computers, producing a new generation of images in slightly altered technological forms and then actually drawing or painting over that. I want to mix the two disciplines of art and science and to actually introduce the imagery of science into some of the paintings because that is so much what Antarctica is all about. The presence and activities of people; the blending of science and technology into the artwork to where it will actually be visible in some of the types of

imagery used; these are important concerns. Landsat photographs, montage, the collage practices of juxtaposing photographic and handmade images, the use of charts and graphs of computer images, all of these methods offer possibilities."

"Aside from watercolours and 35mm did you utilise any other medium?"

"I took ten hours of video which have undergone some preliminary editing but it has no narrative type quality as yet. It is barely beyond a private subject listing at this stage. I may do something with it but in the meantime it is good reference material for some of the artwork and some of the presentations and talks that will be given."

"What happens next?"

"My exhibition schedule in the States starts in September of this year. Six exhibitions are planned at present and they run all the way through summer of 1989; three in the State of Georgia, followed by one in Washington DC, and in February/March of next year the first sites of a tour through museums starting at Tennessee and Los Angeles.

"We hope to put together two more on the west coast; one in San Francisco and one in Seattle. This is important because there is a lot of support for the icebreakers and the helicopter squadron in these areas.

"Also we hope to be able to exhibit in Australia and England and maybe have return exhibits in New Zealand. Incidentally one of the exhibitions in the States is going to be a combined show with former astronaut Alan Bean featuring his paintings of the moon. We have talked about the possibility of turning that into a larger schedule to take the idea of juxtaposing Antarctica and the moon into an extensive tour."

"And after that?"

"Maybe write a book and reproductions of the paintings. Although artists, writers and photographers do not normally go down for more than a season the subject certainly demands serious treatment and I am prepared to show a commitment for the next four or five years. Yes I would very much like to go again."

Obituaries: Death at 99

William Burton: last of Scott's men

Scott's last man, William Burton, who died in Christchurch on the morning of February 15 only a few weeks before his 100th birthday, made a modest but lasting contribution to the Heroic Age of Antarctic exploration in his three years with the 1910-13 expedition. He was only 22 when he joined the *Terra Nova* from H.M.S. *Indomitable* but his reliability, resourcefulness and capacity for hard work in the engine room or wherever he was needed were recognised by his commanding officers and his shipmates, most of whom were Royal Navy men.

William Burton lived in New Zealand for 67 years after he left the Royal Navy with the rank of chief petty officer. When the last member of Scott's shore party, Trygve Gran, died in 1980 Bill Burton was alone with his memories.

This quiet and independent 99 year old was a Londoner and proud of it. He was born in Limehouse on April 7, 1888, and lived in Camberwell. His mother died when he was four. When he was eight, he and his sister were sent to a school at Clifton in North Wales where they had to board while their father and uncle were in Venezuela engaged on a railway construction job. As Bill was ready to leave before his father returned, the school was responsible for finding him a job.

For two years he was a farmer's pupil or labourer. He wanted to be a farmer and to earn more money worked in a coalmine. Finally he decided to join the Royal Navy.

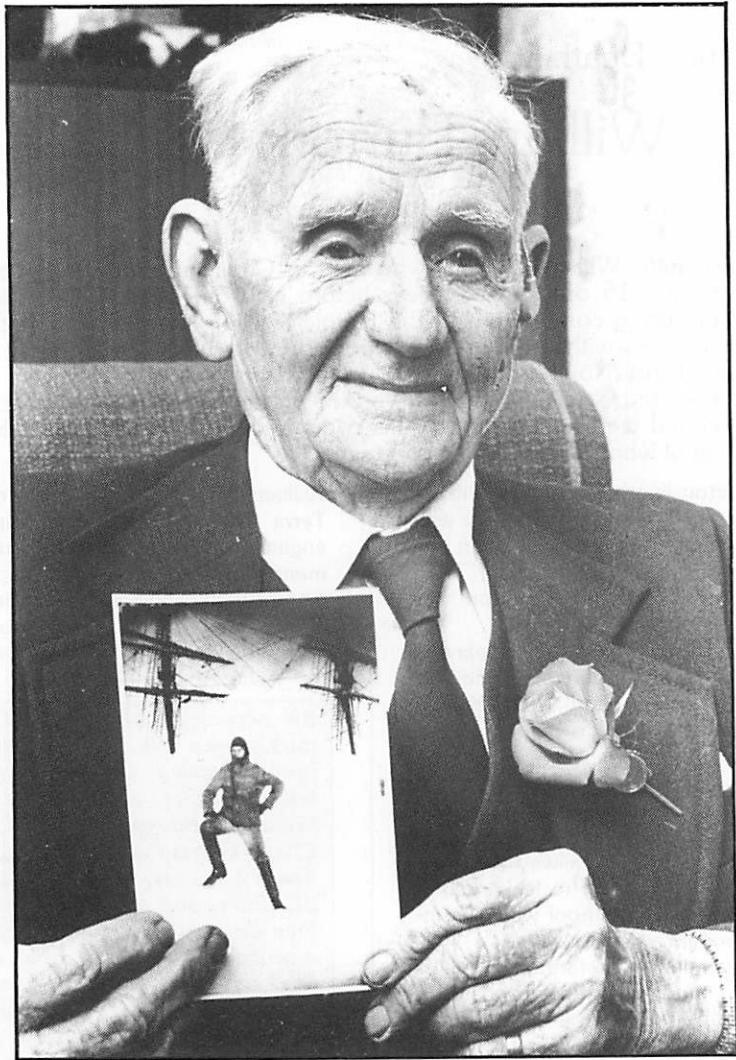
On January 13, 1908, Bill Burton signed on for 12 years. His first ship was H.M.S. *Acheron* and he was entered as a stoker second class. After five months he spent about two weeks at H.M.S. *Pembroke*, shore base of the Chatham Division and then joined the 17,250-tonne battle cruiser, H.M.S. *Indomitable*. She had been completed early in 1908, carried a crew of 750, and could steam at 26 knots.

It was while he was serving in *Indomitable* that Chief Engine-Room Artificer

William Williams, R.N., engineer of the *Terra Nova*, asked the *Indomitable*'s engineer-commander if he could recommend three leading hands prepared to discard their ratings and join the expedition as firemen. Bill Burton, who had been promoted to stoker first class before he left the *Acheron*, was one of the lucky ones

(Of necessity this account of Bill Burton's service with Scott's expedition has been compiled with the help of the books, diaries and letters of Scott, Wilson, Bowers, Teddy Evans, Cherry-Garrard and Scott biographies. These accounts do not mention all the 32 officers and men in the ship's party; they do help us to understand what it meant to serve below decks in a coal-fired ship more than 75 years ago. My greatest debt is to Bill Burton himself. He was always happy to talk of the old days on informal occasions. I am grateful also to Robin Burton, who recorded some of his grandfather's memories in more detail, and Dr David Wynn-Williams, of the British Antarctic Survey who also talked to Bill not so long ago. — J.Mc.)

chosen to join the crew of Scott's last expedition. On 3 May, 1910, he joined the *Terra Nova* one month before she sailed for New Zealand. He retained his navy pay and remained on the books of H.M.S.



Bill Burton (Photo - Christchurch Star)

President, shore base of the London Division, for the whole of his three years' Antarctic service.

After a rousing send-off from Cardiff on June 15 the expedition faced a long voyage through the tropics to the Cape by way of Madeira and the remote island of South Trinidad in the South Atlantic. Built in 1884 the former whaler was a slow ship with steam and not much better under sail as well. She was heavy on coal, and in Bill

Burton's own words "she would roll on grass". Another bad habit was her persistent leaking.

After South Trinidad the Terra Nova encountered rough weather on the way to the Cape of Good Hope and did not reach the Simonstown Naval Base until August 15. Scott had been waiting anxiously for her arrival, having been in Capetown since August 2 trying to persuade wealthy South Africans to contribute to the expedition's

funds. Although the response was disappointing South Africa was hospitable and members of the expedition were able to enjoy some time ashore after nearly nine weeks at sea.

Bill Burton spent part of his leave in Capetown and like others in the crew was regally entertained. He went ashore first with Lashly and Crean, and with the Bo's'un Alf Cheetham visited Groote Schurr, once the home of Cecil Rhodes at Rondebosch on the outskirts of the city.

When the two men returned to their ship Bill Burton was carrying a squirrel given to him as a pet by some children. It was still aboard when the expedition left Simon's Bay on September 2, and remained below decks with other pets until the Terra Nova reached Lyttelton on October 28.

Leak

To everyone in the expedition Lyttelton meant another four weeks of hard work and also enjoyment of New Zealand hospitality. The first task was to dry-dock the Terra Nova to find and stop the leak which had plagued her since Cardiff. Then all the stores had to be landed, sorted and restowed when the ship came out of dock. When the Terra Nova sailed for Port Chalmers on November 26 her upper deck, according to Lieutenant Teddy Evans, resembled a floating farmyard with ponies, dogs and rabbits. In 1922 when Apsley Cherry-Garrard wrote "The Worst Journey in the World", he remembered the rabbits and added squirrel and Persian kittens to the pets aboard the ship. Evans, who wrote "South with Scott" in 1921 also referred to these animals.

Both men no doubt remembered Bill Burton bringing his squirrel aboard the Terra Nova at Simonstown, but unlike Crean's rabbits it did not multiply on the voyage to Lyttelton. Some of the rabbits reached Cape Evans and although popular accounts of the expedition have often referred to squirrels it never sailed. Bill Burton entrusted it to the Johnson family who ran fishponds and gardens, a popular

place in Christchurch for picnics and entertainment. It escaped while being exercised.

Port Chalmers was the Terra Nova's last port of call. The over-burdened ship sailed on November 29. On the night of December 1 she ran into a furious storm which lasted until early on December 3 and almost brought her to the brink of disaster. Scott, Evans, Wilson, Bowers and Cherry-Garrard gave their versions in diaries, letters and books. All accounts praised the desperate efforts of scientists and crew to save the ship but few names were mentioned.

Below decks, at the height of the storm, Bill Burton, now an assistant engineer, and his shipmates toiled to keep the engines going at slow speed while the Terra Nova was swept by huge waves and rolled incessantly. More and more water poured into the ship and the pumps began to clog with a mixture of coal dust and oil in the bilges.

Desperate straits

Early on the morning of December 2 Williams reported that his pumps were choked and could not cope. He and Lashly, working up to their necks in water, cleared and re-cleared the pump suction boxes but the water beat them and started to put the fires out. When dawn broke the Terra Nova was in desperate straits with much of the lee bulwarks torn away, leaving the decks open for the sea to pour in.

In the next 24 hours men worked in two-hour shifts to bail the ship out with buckets, forming a chain up from the engine room, and one watch manned the hand pump which, although choked, discharged a small stream of water. While the bucket brigade and hand pumpers worked hour after hour the chief engineer and the ship's carpenter, Francis Davies began the task of cutting a hole in an iron bulkhead to reach the hand and pump suction boxes. The job had to be done with hand drills and chisels and took hours. Bill Burton was part of the team which finished its vital work by 10 p.m. There was room enough then for Evans, Bowers, Davies

and one of the biologists Teddy Nelson, to climb through into the hold and wriggle along to the pump-well.

Evans and his men spent two hours bringing up buckets of coal dust and oil balls which had choked the pump suction boxes. By 4 a.m. on December 3 the hand pump was gaining on the water, and five hours later fires were lit and the engineers and stokers were able to raise steam. The weather moderated, the sun came out and the Terra Nova was underway again.

After the storm and stress Bill Burton and his shipmates had three weeks of relief from raging seas in the comparative silence of the pack ice until they reached open water. The Terra Nova was off Cape Evans on January 4, 1911, and in eight days of intense activity day and night everything was ashore, and the shore party moved into the hut on January 17.

As Lieutenant Evans joined the shore party the navigator Lieutenant Harry Pennell assumed command of the Terra Nova and Bill Burton began a series of cruises which are part of polar history.

In the last week of January the Terra Nova headed eastward to land the Eastern Party, led by Lieutenant Victor Campbell, which was to explore King Edward VII Land. Heavy pack ice prevented a landing, and the ship turned back. On January 31 she steamed into a deep bay which proved to be the Bay of Whales and the next morning one of the scientists saw a ship anchored to the sea ice. It was the Fram.

Amundsen

Bill Burton saw Amundsen and two of his officers arrive for lunch on the Terra Nova. Later he was in a party of officers and men who met the Norwegians, inspected their ship, and said goodbye. The Terra Nova was back at Cape Evans on February 8 and Pennell left a note for Scott at Hut Point telling of Amundsen's plans. Then he headed north to land Campbell's men, now the Northern Party, at Cape Adare where Borchgrevink's expedition had wintered in 1899. Pack ice and a four day gale delayed the ship's ar-

rival until February 18. In spite of his engine room responsibilities Bill Burton was able to go ashore. Campbell's men sheltered in one of Borchgrevink's huts while their own was erected, and Bill Burton was called on to get the stove going. It was already operational when he arrived so he had an excuse to stretch his legs on shingly Ridley Beach.

Pennell left Cape Adare on February 20. Two days later some snow-capped mountains, and then more peaks and lower land were sighted west of North Cape. This new land was christened Oates Land. Pennell tried for several days to get closer to the new land but could not break through the barrier of pack ice. The ship was held up on March 2 and did not clear the pack until March 8. The next fortnight was spent coping with heavy weather and trying to gain a favourable wind which came at last and the Terra Nova reached Lyttelton on April 1.

Refit

For three months the ship underwent a thorough refit at Lyttelton. In the winter arrangements were made with the New Zealand Government for the Terra Nova to do surveying work around the Three Kings Islands and between the group and the extreme north of New Zealand. The ship was away from July 10 until October 10, and in the next months those on board were fully occupied with preparations for the second voyage.

This time the ship's cargo included seven mules given to Scott by the Indian Government to enable him to do further exploration in the second year, and 14 Siberian dogs of Vladivostock. Loaded with relief stores for Cape Evans the Terra Nova departed at daybreak on December 15.

Fine weather and a smooth sea made the first days more pleasant than those of the previous summer. The engine worked without a hitch, the mules were able to move in their stalls, and the dogs were given a daily run around the upper deck. By December 28 the ship was held up in heavy pack, but conditions improved, and the ice was left behind early on January 1.

On the morning of January 3 the Terra Nova met heavy pack near Cape Adare, and Robertson Bay was full of ice. By 7 p.m. the next day Campbell and his party, their specimens and all necessary stores were on board. The ship had to work through more pack to reach Terra Nova Bay, and could not land the Northern Party near Evans Cove until January 8.

Four days later the ship arrived off Beaufort Island to find heavy pack barring the entrance to McMurdo Sound. Nothing could be done until February 4 when the ship was off Cape Barne. In the next two days two miles of ice went out in a gale, and at last the Terra Nova was secured alongside fast ice and safe ice between her and Cape Evans. The dogs were put ashore, the mules were hoisted out the next morning and the crew began the arduous task of unloading tonnes of stores and the slow sledge journeys nearly three miles across the sea ice to Cape Evans began.

On February 14 ice started breaking up and did not go out so the Terra Nova crossed to Butter Point to pick up the geological party. In their report of the ship's three Antarctic voyages, Evans and Pennell described the 1911-12 season as a hard one in many ways for the engine room personnel, and said they never failed the ship in any of her difficulties which started soon after picking up the geological party. The four men could not be landed at Cape Evans so the ship turned north for the first attempt to pick up Campbell's party. For four days the Terra Nova tried to make her way through heavy pack, her progress not helped by heavy snow and a storm which lasted two days. On February 23 she was caught in the pack and had to struggle for four hours to turn, finally escaping 26 hours later.

Evans ill

Conditions were not much better when the ship headed for Cape Evans to embark those going home. A strong southerly wind made it difficult to approach and when a boat was sent ashore on the night of February 25 Pennell was told that Lieutenant

Evans was at Hut Point seriously ill and should be taken off at once. The gale came on again and Atkinson and his party could not bring Evans aboard until the early hours of February 28.

There were still 19 tons of stores to land at Cape Evans. Everyone on shore and aboard pitched in when the ship arrived, and the stores were landed in the boats between 2 a.m. and 7.30 a.m. on February 29. Pennell headed north again to reach Campbell's party but conditions of Terra Nova Bay were no better. The pack was impenetrable so on the morning of March 3 the ship returned to Cape Evans to put Atkinson ashore (Evans had needed medical care for a few days) and embark men going home. Shortly after 10 p.m. the ship turned north the third time for Terra Nova Bay. She had to force her way through thickening ice past Cape Bird and found conditions had grown even worse off Terra Nova Bay. On March 7 the extent of the pack forced Pennell to turn north as there was no chance of reaching the party that season.

Storm raged

For a fortnight the Terra Nova's voyage was relatively uneventful. It blew hard between March 21 and 25, and on the night of March 24 a severe storm raged — the most severe encountered by the ship during her whole commission. Two days' calm followed. At daybreak on April 1 the ship entered Akaroa Harbour to dispatch telegrams with the season's news. She berthed at Lyttelton on April 3.

Refitting of the ship was hurried as much as possible and arrangements were made for a ship's party of 13 including officers to survey Admiralty Bay in the Marlborough Sounds during the winter. Three men remained aboard the Terra Nova as ship-keepers. Bill Burton and his best friend Robert Brissenden, were in the party which boarded at an accommodation house near French Pass and worked from motor launches in the bay. This work lasted from June 10 to October 15 when the party had to return to Lyttelton to prepare for the last relief voyage. On August 17 Brissenden

was drowned. He was buried on the hillside overlooking the bay and a marble cross was erected to his memory.

Bill Burton's final voyage south in the Terra Nova began when the ship left Lyttelton at 5 a.m. on December 14, 1912. She ran into heavy weather on December 17 and on December 26 passed the first iceberg of the voyage.

Hopes of an almost ice-free voyage to the Ross Sea were not realised. The Terra Nova, now commanded by Lieutenant Evans, who had recovered from his bad attack of scurvy, had a tremendous struggle to get into the Ross Sea at all. She entered the pack on December 30, having fought her way for more than 400nm, and was not clear of the ice until January 16, 1913.

On the morning of January 18 the ship rounded Cape Barne and steamed towards Cape Evans, anchoring off the beach. The shore party gave three cheers and the ship's company replied. Then Campbell shouted back to Evans Scott and his party had died on the way back from the Pole.

For the next 30 hours the Terra Nova remained at anchor off Cape Evans. All hands worked through the night and in 24 hours had packed and transported specimens, collections and equipment to the ship. A list of food and equipment was made, and the hut cleared up and closed. On January 19 the expedition left Cape Evans for the last time. A call was made at Cape Royds to pick up specimens, and then the ship steamed up McMurdo Sound towards Hut Point until stopped by fast ice.

Sledge party

Early on January 20 Atkinson set out with a sledge party of seven men to erect the memorial cross on Observation Hill. Davies built the 9 ft cross of Australian jarrah timber and Bill Burton and other members of the ship and shore parties hauled it by sledge from Cape Evans across the sea ice to Hut Point.

When Atkinson and his party returned on the night of January 21 the Terra Nova headed for Granite Harbour to pick up a geological depot. Then early on January

23 the ship began to punch her way through heavy pack ice to reach Terra Nova Bay. By 3 a.m. on January 25 she had worked through the ice near Campbell's winter quarters. A depot of geological specimens left behind in 1912 was picked up, and the rest of the expedition inspected the ice cave where the Northern Party had spent the 1912 winter. Very early on January 26 the Terra Nova left the ice-guarded coast of Victoria Land and by evening was virtually in the open Ross Sea. She ran into heavy weather on February 2 and was beset by icebergs.

Oamaru

Eight days later at 3 a.m. the ship reached Oamaru. Pennell and Atkinson went ashore with Scott's dispatch for circulation to the world. The Terra Nova remained at sea until February 12 when she returned to Lyttelton with flags at half-mast. Seventy-five years later the ship's White Ensign covered Bill Burton's coffin at the funeral service.

One month after her sad homecoming the Terra Nova began the voyage back to England under Pennell's command. Crossing the Southern Ocean north-east winds drove her farther south than intended and in the last week of March progress towards Cape Horn was marred by fog and thick weather and the presence of several icebergs. But after passing Cape Horn on April 11 in a strong gale the ship faced a beautiful day on April 12 and then experienced fine weather all the way to England.

Bill Burton enjoyed the fine weather, the presence of 13 dogs going home as pets of various members of the expedition, and leave in Rio de Janeiro where the Terra Nova arrived on April 28 and stayed for four days to coal and take on fresh food. Coal trimming was slightly less arduous because a New Zealand volunteer, Mr Gibson Anderson, of Christchurch, had been taken on for the job.

After a call at Fayal in the Azores on June 2 so cable messages could be sent home the Terra Nova finally anchored in Crew Sound, Scilly Islands on June 11.

Two days were spent painting and cleaning up and on June 14 the ship arrived at Cardiff, exactly three years after leaving.

When the Terra Nova came back under two to a London dock Bill Burton did not return immediately to the Royal Navy. In July members of the expedition went to Buckingham Palace to be honoured for their Antarctic service by King George V. Bill Burton received the Polar Medal in silver. Nearly 58 years later he wore the medal in Christchurch when he was presented to Prince Charles, great-grandson of King George V.

Bill Burton remained on the books of H.M.S. President until September 29, 1913. From London he returned to H.M.S. Pembroke at Chatham and was promoted to stoker petty officer on December 18. In March the next year he married Florence Cott who had waved goodbye to him in 1910. They lived at Gillingham, Kent, which was close enough for Bill Burton to walk from the base when his ship was in port.

Three months before Britain declared war on Germany Bill Burton was at sea aboard H.M.S. Lowestoft, a brand-new 5400-tonne light cruiser built at Chatham. He served in her at the Dogger Bank and Heligoland Bight actions early in the war.

War service

Bill Burton's next two ships were destroyers. H.M.S. Midge was in a reserve flotilla when the Battle of Jutland was fought in May, 1916, but took no part in the action. Bill Burton did not join her until the third week of June, and served in her for less than a month.

His next posting was to his second destroyer, H.M.S. Pellew, in which he served from June 22, 1916 to December 3, 1917. He was promoted to chief petty officer in 1917 and recommended for the Distinguished Service Medal but the lieutenant-commander who was to sign the necessary papers when he returned from sea duty was killed in action.

Towards the end of the war Bill Burton was sent to a hospital ship to have his ears checked. They were so bad that he was

sent to a shore hospital. After his discharge he was posted first to H.M.S. Pembroke, then to H.M.S. Wallington, and finally back to Chatham on shore duty.

By 1919 Bill Burton's hearing was no better. He was concered he would not hear orders properly and did not want to blemish a good service record. So, having spent some time in H.M.S. Gibraltar, the naval shore hospital at Portland, he was invalided out on October 5, 1920.

When he left the Royal Navy Bill Burton and his wife decided to emigrate to New Zealand where he had arranged a job in Christchurch. In 1921 the Burtons and their three children, Lewin, Blanche and Albert, sailed from Southampton aboard the Waimana, bound for Wellington and then Lyttelton.

There was no job in Christchurch; the firm had gone into liquidation. Bill Burton worked as a painter until he found a job with the Christchurch Tramway Board. He was with the board as a welder for 27 years.

Antarctic Society

As the 67 New Zealand years passed Bill Burton became an honoured and well-loved member of a community with Antarctic interests which was more aware than the general public of his part in Scott's expedition. And his interest in the Antarctic never waned. He joined the New Zealand Antarctic Society's Canterbury branch when it was formed in 1955, served on its committee, and in 1964 was made a life member of the society.

In 1963 the United States Navy took three shipmates, Bill Burton, Mortimer McCarthy and William McDonald, back to Antarctica. As the guests of the Naval Support Force Commander, Rear-Admiral James R. Reedy, they sailed south as they had done 53 years earlier. The support ship Arneb took them to Hallett Station and McMurdo Station. They visited Scott Base, the historic huts at Cape Evans, Cape Royds, and Hut Point, and though unable to make the steep climb to the memorial cross were flown over Observation Hill by helicopter.

A New Zealand Federated Mountain Clubs expedition worked in Northern Victoria Land during the 1962-63 season and honoured the Terra Nova veterans by giving their names to three peaks in the Victory Mountains. Mt Burton (2740m) appropriately, like the other peaks, is near the Trafalgar Glacier.

After his wife died in 1968 Bill Burton

lived by himself. He continued to drive his car until he was 94 and wanted to stay on the road but admitted that the car gave up first. With the loving support of a devoted family he maintained his independent way of life until he was 97. He went to live in a rest home early in 1986 and attended his last Antarctic church service when he was 99.

Second Colbeck a navigator with Mawson

Two Colbecks, father and son, are remembered on maps of Antarctica for their service to expeditions led by Borchgrevink, Scott and Mawson. The son, christened William Robinson like his father, died in Liverpool last year aged 80.

Colbeck the younger, one of four sons, joined Scott's old ship Discovery as second officer and navigator with the British, Australian and New Zealand Antarctic Research Expedition led by Sir Douglas Mawson which discovered Mac. Robertson Land, the BANZARE Coast, and Princess Elizabeth Land, and carried out the preliminary charting of a vast arc of East Antarctica's coastline in the 1929-30 and 1930-31 summers.

When he joined Discovery at the age of 23 in 1929 Colbeck had served in H.M.S. Sussex as a Royal Naval Reserve sub-lieutenant. He played a prominent part in navigating and surveying the coastline of what is now known as Australian Antarctic Territory. His name was given to the Colbeck Archipelago which consists of numerous small rocky islets near Byrd Head, Mac.Robertson Land at 67deg 26min S/60deg 58min E.

After the BANZARE expedition ended Colbeck was promoted to first officer for the homeward voyage from Melbourne to England. Later he served in the Merchant Navy, was engaged in salvage work in Liverpool during the Second World War, and held the rank of captain RNR when appointed marine surveyor to the Mersey Docks and Harbour Board. He held a master's degree in engineering and was a

Fellow of the Royal Institute of Chartered Surveyors and the Institute of Navigation.

Colbeck's father, who died in 1930, was a ship's officer when he first went south in 1898 as magnetic observer with Borchgrevink's expedition which wintered at Cape Adare in 1899. He returned to the Wilson Line and in 1902 was commissioned as a lieutenant RNR and appointed to command the Morning which made two relief voyages to McMurdo Sound during Scott's 1901-04 National Antarctic Expedition.

When the Morning returned to England Colbeck resumed service with the Wilson Line and eventually became its commodore. He was engaged on "secret" work in the First World War and also attained the rank of captain RNR. Later he became marine superintendent of a shipping company in London.

Colbeck Bay (71deg 38min S/170deg 05min E) in the southern part of Robertson Bay, Victoria Land, is a reminder of Captain Colbeck's service with Borchgrevink. Better known is Cape Colbeck (77deg 07min S/157deg 54min W) at the northwest end of Edward VII Peninsula, Marie Byrd Land, discovered by Scott's expedition in January, 1902.

Both father and son were awarded the Polar Medal for their Antarctic service. But the son was first gazetted in error to receive a bar to the medal, the authorities having mistaken him for his father. The error was quickly rectified, and he received the medal in his own right.

Books

In the footsteps of Scott

by Roger Mear and Robert Swan

Johnathan Cape, London 306 pages, route maps, 108 photographs. Size 255 mm d. x 175: ISBN 0-224-01418-3. N.Z. \$49.99.

Englishmen Robert Scott and Robert Swan both set their minds on walking from Ross Island to the South Geographic Pole. Like Scott some 70 years before, Swan didn't just talk about such an escapade. He went to Antarctica and did it. At the Pole, Scott found a black flag; for Swan there was an ignominious flight home that tarnished a personal triumph.

In a glorious death for Empire, Scott created a legend. In Swan's wake, during the decade since 1977 when he first dreamed up this scheme, remains a tangled path of vivid experiences embroidered by friendships formed amid collisions with bureaucracy, a sunken vessel and a vast debt.

In the "Footsteps of Scott", largely written by team-member Roger Mear, retraces that adventure, focusing on the 1984-86 period in Antarctica. The book takes the readers from expedition origins with the British Antarctic Survey where Swan and Mear met, through the first winter at Cape Evans, to the main sledging journey itself, the dramatic sinking of the Southern Quest off Beaufort Island and on to the evacuation to New Zealand by the U.S. Antarctic Programme of almost the whole Footsteps' expedition.

The narrative ends with the final pick-up that Swan and Giles Kershaw pulled off in December, 1986. They flew a Twin Otter across the continent from South America to collect Gareth Wood's team that had remained for a second winter in the Cape Evans Base. Wood ensured the expedition equipment, including a Cessna Kershaw originally planned to fly to the Pole, was not souvenired or scattered to the four winds. Greenpeace finally returned the Footsteps' equipment to New Zealand in March, 1987 leaving behind the hut which has been incorporated into its World Park base.

Mear handles the task of recording a complicated set of events extremely well. The writing is tight, yet still captures the serenity and beauty of the Ross Island area, the Beardmore and the Polar Plateau. Importantly, Mear has been honest and open in his descriptions of how team members related to each other during the winter, while re-enacting the "Worst Journey" to Cape Crozier and particularly on the Pole journey. The first winter ascent of Erebus by Mear on his own, helps the reader to interpret Mear's dominant role throughout the whole expedition.

The appendices on nutrition, physiology, psychology and equipment are valuable comment for future polar work by small groups. Swan, Mear and Wood even surprise themselves with the efficiency of manhauling using ultra-modern gear including fibreglass pulks for long range unsupported traverses. Mear is the first to decry the use of extra supplies when they meet a U.S. geological team on the Beardmore Glacier. Such an event shreds the precious feeling of isolation. It also affects interpretation of logistic data and performance in reaching the Pole with considerable food and fuel reserves.

The colour photographs are graphic. They capture the immensity and seriousness of the undertaking by contrasting the insignificance of an individual in an awesome landscape with the punishing ease that the Southern Quest slipped beneath the pack ice. Pictured in such an environment it is a matter for wonder that such a frail-looking aircraft as a Cessna could be able to make the round trip to the Pole and return the trio to Ross Island.

The authors are not at odds with government policy towards private expeditions, merely the way rules were interpreted and applied. New Zealand and in

particular U.S. administrators do not come out of the book well at all. Mear is careful with every word, yet comes across more strongly and directly in his criticism of the Government approach to the Footsteps' repatriation.

Private expeditions in Antarctica can only increase. Despite attractive coastal

objectives quite distant from government operations, the Geographic Pole and its principal gateway Ross Island, will continue to be a magnet for adventurers. Inevitably this must lead to interaction with government operations and seemingly conflict of interest. — Colin Monteath

Living Dangerously

Ranulph Fiennes

Macmillan, London, 1987. 263 pages, 67 colour and 15 black and white plates, maps, diagrams. Size: 250mm d. x 190 w. ISBN 0-333-44417-5. N.Z. \$39.95.

You would expect a name like Sir Ranulph Twisleton-Wykeham-Fiennes to attract an unusual string of experiences. His autobiography 'Living Dangerously' is as complex and exciting as the name. Yes, Ran Fiennes is British, with family traditions stretching back to the ninth century. (One of his relatives is immortalised in the nursery rhyme 'Ride a Cockhorse to Banbury Cross').

Despite four adventure books prior to 1979, most New Zealanders had never heard of this rather zany Englishman until January 1981 when Fiennes, with two companions drove skidoos toward Scott Base. They had just completed the second crossing of Antarctica in a mere 67 days. Twenty-two thousand New Zealanders who flooded through the trade exhibition in Auckland will never forget the British Transglobe Expedition.

Crossing Antarctica is impressive enough, yet I suspect this book would never have been written if Fiennes and Charlie Burton had not reached the North Pole on their second attempt. During Easter 1982, both men became the first in history to have reached both poles by surface travel.

By circling the globe on the Greenwich meridian in the course of a single journey, Transglobe encompassed the greatest journeys of Shackleton, Amundsen, Nansen, Franklin, Peary and others. What began as the whimsical idea of Ginny Fiennes', took fully ten years to complete. In achieving such a multi-million dollar ambitious goal, essentially without a bank account (so they couldn't get into debt!), it

now seems amusing that this determined and ingenious group were written off as amateurs.

'Living Dangerously' is not a book about Transglobe — in fact, only the last two chapters are dedicated to the expedition. Polar buffs should already have read Fiennes' excellent Transglobe volumes 'Hell on Ice' (Hodder and Stoughton 1979) and 'To the Ends of the Earth' (Hodder and Stoughton 1983).

Ran Fiennes was born and bred a soldier with deeply rooted family traditions. The madcap expeditions described throughout the bulk of the book, such as parachuting into remote Norwegian mountains and travelling up the Nile by hovercraft, are from much-needed breaks in his active service with the Sultan of Oman's forces against Communist guerillas.

Ruthless desert warfare has a profound effect on Fiennes and is largely responsible for his eventual full-time occupation as an adventurer. I thoroughly enjoyed reading of his early life in South Africa, hair-brained schemes during school days at Eton and in the army.

In many ways the book is a tribute to Virginia Pepper, childhood sweetheart, who became the skilled logistics manager and communications expert throughout the Transglobe operation. Prince Charles writes "My admiration for Ran is unbounded and thank God he exists. The world would be a far duller place without him".

Fiennes is different, refreshingly so. Having already stood the polar world on its ear, I look forward to his next move. C. M.

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.

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