

ANTARCTIC

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STEVEN CHAMBERS, DOG HANDLER AT SCOTT BASE, WEIGHS A HUSKY PUP, NOOGIS (NUGIS) WHILE HIS PROUD MOTHER, BETTY, LOOKS ON. NOOGIS WAS BORN ON OCTOBER 24 LAST YEAR.

Antarctic Division photo by Mike Bradstock.

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CONTENTS

ARTICLES

ENVIRONMENT STUDY 152

POLAR ACTIVITIES

NEW ZEALAND 138-146

UNITED STATES 147-155

AUSTRALIA 156-161

UNITED KINGDOM 162-164, 168

SOVIET UNION 165-167

ARGENTINE 169-170

NORWAY 170

SOUTH AFRICA 172

SUB-ANTARCTIC

SCUBA DIVERS 146

GENERAL

“MAGNETIC LADIES” 171-172

THE READER WRITES 173

BRITISH CLIMBERS 174

TOURISM 174-175

OBITUARIES 175

ANTARCTIC BOOKSHELF 176

NEW ZEALAND SEASON

MARIE BYRD LAND TO VOSTOK

New Zealand's Antarctic research programme for the 1977-78 season, which ended last month, called on the services of more than 150 men and women during the four summer months. Fourteen field parties worked out of Scott Base and Vanda Station in the Wright Valley, and participation in international or United States programmes enabled New Zealand scientists to range as far as Marie Byrd Land, the Ross Ice Shelf, and Vostok, the most remote Soviet station on the Polar Plateau.

Now 13 men — 11 at Scott Base and two at the Amundsen-Scott South Pole Station — remain in Antarctica to await the spring flights of the new season. The Scott Base party began its seven months of isolation officially on February 6 when the summer leader, Mr Bob Straight, of Motueka, relinquished his responsibilities to the winter leader, Mr John Lythgoe, of Wellington, who had been his deputy during the summer.

Mr Lythgoe, who was an assistant maintenance officer at Scott Base in the summer of 1967-68, and his 10 companions will not see new faces again until September when the first pre-season flights by United States Navy Hercules aircraft will bring mail and fresh food. New Zealand's men at the Pole Station, Messrs John Waller and Kevin Bisset, will have to wait until November before their isolation ends.

MEN AT POLE

Deputy-leader at Scott Base this winter is 25-year-old John Thomson, of Temuka, who is the base engineer. He wintered at the base in 1975. His companions are: Barry Hiscock (fitter-mechanic, Temuka), Mike Lord (fitter-electrician, Howick), Warwick Williams, (senior science technician, Revesby, New South Wales), Will Kimber (science technician, Rotorua), Dean

Drake (science technician, Hawera), Russell Arnott (cook, Queenstown), Paul Dennison (Post Office radio technician, Wellington), Randolph Waller (postmaster, Clyde), and Steve Chambers (assistant maintenance officer and dog handler, Waiouru).

For the third year New Zealand is co-operating with the United States in the meteorological programme at the Pole Station. Thirty-five year-old John Waller, of Wellington, is no stranger to isolation. He was chief meteorological officer at Raoul Island in the Kermadecs during the 1968-69 season, and spent three months at Vanda Station as a meteorological observer in the 1970-71 season. Kevin Bisset, of Cambridge, who is 23, is a telecommunications officer on a year's leave from the New Zealand Army.

MAPPING PROJECT

One of the main field events of last season's programme was a geological mapping project in the region between the Foster and Blue Glaciers. These are between the Royal Society Range to the west and McMurdo Sound to the east. A Geological Survey team led by Dr D.N.B. Skinner spent 79 days in the field from October 29 to January 15 with U.S. Navy helicopter support, and using motor toboggans and sledges to cover an area of some 1000



Ice-filled depressions called "kettles" and a frozen lake in the mouth of the Garwood Valley, South Victoria Land where a New Zealand Geological Survey party worked last season.

Antarctic Division photo.

square kilometres.

Heavy snow storms and katabatic winds gusting up to 90 knots from the Polar Plateau hampered the geological work, and in December the party was tent-bound for eight days. No movement was possible on three days, and on one day the weather was too bad for flying. To complete its detailed geological investigations the party had to work its motor toboggans down crevassed glaciers, and climb vast rock screens and jagged ridges to examine rock outcrops.

One aim of the project was to establish lithostratigraphic and metamorphic correlations with the region of study, and to extrapolate this work into the region of the Taylor Valley to the north and the Skleton Glacier to

the south where Dr Skinner's Geological Survey team worked in the 1975-76 season. Mr R.H. Findlay's task was to make a detailed structural analysis of the region between the Renegar and Blue Glaciers.

For the geological mapping section of the project the object was to complete in the region of the Foster and Renegar Glaciers the work done in 1975-76, and to do more regional reconnaissance mapping between the Renegar and Blue Glaciers. Regional mapping was done in the region of the Foster and Renegar Glaciers, and detailed studies were made between Heald Island and the Hobbs Glacier.

An Auckland University geologist, Miss Anne Wright, did reconnaissance sampling of some of the Mc-

Murdo volcanics between Heald Island and Lake Miers. Mrs Margaret Clark, a geomorphologist and well-known mountaineer, was the field leader for the project.

Results of the field party's work will enable the rocks of the Skelton and Koettlitz Glaciers area to be correlated with those between the Renegar Glacier and the Victoria Valley area. Also the geologists will be able to produce a detailed structural and metamorphic history of the rocks in the Skelton and Renegar Glaciers region, and in the region of the Koettlitz and Blue Glaciers.

Storms delayed the departure of the party from Scott Base until October 29, and it made its first camp on the northern side of the Foster Glacier in a 25-knot wind. During the next two days the wind speed rose, gusting to an estimated maximum of 80 knots. Work began on November 1, and on November 8 a route to the Renegar Glacier was reconnoitred.

SLEDGES DAMAGED

On November 10 the party travelled by motor toboggan to the southern side of the Renegar Glacier. The route involved a descent of 400 to 500m over a distance of four to five metres, but travel was easy despite white-out conditions. But the double-ended dog sledge and the manhaul sledge were damaged a few minutes before the party made camp on moraine at the confluence of the Renegar and Koettlitz Glaciers.

After the party moved to the north-eastern side of the Renegar Glacier on November 14 its move to Heald Island was delayed for three days by bad weather. The damaged sledges, the rough ice of the Renegar, and even rougher ice on the Koettlitz, prevented the party from travelling to Heald Island by motor-toboggan, and it was lifted there by helicopter on November 20. Mapping was completed on November 22, and the party moved to Dismal Ridge by helicopter on November 25, camping on moraine at the

mouth of Roaring Valley.

Geological studies of Dismal Ridge and the eastern end of Rucker Ridge ended on November 30 when the party moved to Pipecleaner Ridge. Stormy weather kept the party confined to its tents on December 4,5,6 and 8. Heavy snow from the storm of December 4-6 considerably hampered geological work on Rucker Ridge after they moved there on December 9.

BAD WEATHER

Work on Rucker and Pipecleaner Ridges led to an investigation of the geological structure at the west end of Dismal Ridge where the helicopter lift was completed on December 14 just before low cloud closed in. The weather stopped work on December 15. It was completed the next day, and then the party had to remain in its tents on December 17 and 18.

On December 19 there was another lift to the Chancellor Lakes. Geological work was completed by December 21, the party had an enforced rest on December 22, and on December 23 moved to Lake Miers where it camped at the eastern end. After Christmas celebrations mapping began on December 26 and was completed on December 29. The weather was unsuitable for flying on December 30, but the next day the party moved to Hobbs Peak where geological mapping was carried out along the east and west ridges on the first two days of the New Year.

Results of this and previous work necessitated a move to the mouth of the Garwood Valley on January 3 to investigate type sections described in the Marshall and Garwood Valleys in 1963. The results of this work and that at Lake Miers led to a visit to Lake Vanda to compare the gneisses and granites of Lake Miers and those in the Garwood Valley with those in the Wright Valley described in 1962.

From the Garwood Valley the party was lifted to Lake Pewe on January 6. Dr Skinner and Miss Wright returned to Scott Base to pack rocks for ship-

ment to New Zealand, and flew back to Lake Pewe on January 7. Mapping there was completed on January 8, but the weather delayed the move to Vanda Station until January 13.

Granites at the east end of the Dais were investigated on January 13, and those on the floor of the Wright Valley between Vanda and Bull Pass the next day. The results necessitated resampling granite at the type locality by Lake Vida. This was done on January 15 during the flight to Scott Base when the helicopter put down for 15 minutes at Lake Vida. The party reached Scott Base late in the afternoon, and returned to New Zealand on January 19.

ROSS ICE SHELF

Three scientists from the New Zealand Oceanographic Institute took part in a major international event — the Ross Ice Shelf Project — last season. In the 1976-77 season they were unable to work with the project because technical drilling problems prevented completion of the hole drilled through the ice shelf in an attempt to discover whether life existed in the water and the seabed below.

But in the second week of December the drilling team penetrated 377m of ice, and scientists were able to examine the water 182m from the bottom of the ice shelf, and the seabed. Later in the month the New Zealanders, Dr Janet Bradford, Bill Whitley, and Paul Anderson flew to the drilling site 664km south-east of Scott Base, and worked there for a week.

Before they left Bill Whitley was able to lower a sampling dredge of his own design down the hole to the sea floor. The dredge brought up sand and gravel containing mollusc shells, bryozoa (aquatic organisms) and a small snail.

Dr Bradford, a specialist in tiny planktonic animals called copepods, was not so lucky. Although she filtered about 1000 litres of sea water pumped up from the murky depths,

she found no plankton, only fine organic debris.

Before Dr Bradford went to the R.I.S.P. drilling site she did additional marine biological work from Scott Base. She studied plankton samples taken last winter from beneath the ice of McMurdo Sound by Mr J. S. Oliver, of the Scripps Institution of Oceanography, to work out the development stages of copepods.

VOLCANO ACTIVE

A series of eruptions from the inner crater of Mount Erebus prevented a French-New Zealand team from achieving one object of its scientific study of the volcano — a descent into the crater to obtain hot gas samples from the active lava lake. Because of the volcanic activity two French chemists worked from the rim of the main crater during their two weeks on the mountain, and could collect only cold gas samples from the inner crater.

Violent eruptions in 1974 forced a New Zealand-French-United States expedition to abandon a proposed descent into the inner crater after the scientists had spent more than three weeks near the summit of Erebus. This time the plan for a descent was shelved before the French party was flown to the mountain.

In December Mr Peter Farrell, field leader of the team, and Dr Philip Kyle, a New Zealand geologist working with the United States research programme, spent five hours near the summit, and reported intense volcanic activity. They saw between 20 and 40 fresh lava "bombs" on the floor of the main crater, and one nearly 2m across on the rim of the crater. During their reconnaissance they saw two relatively large "bombs" hurled 120m to 150m from the inner crater to the edge of the main crater.

Because of the intense activity from the inner crater two New Zealanders, Dr Werner Giggenschach, of the Chemistry Division, D.S.I.R., and Dr Graeme Lyon, of the Institute of Nuclear Sciences, both of whom have

worked on Erebus before — Dr Giggenbach was with the 1974 expedition — did not join the team. The New Zealanders who worked on the mountain in January were Peter Farrell, a leading mountaineer, of Christchurch, Brad Scott (technician, Rotorua), and Russell Brice (field assistant, Christchurch).

FRENCH PARTY

One of the world's leading volcanologists, Dr Haroun Tazieff, who has been studying volcanoes all over the world for 30 years, led the French party. He was disappointed that no descent could be made into the inner crater because this was the second time his plans were foiled — he was the leader of the French party in the 1974 expedition. With him this year were two chemists, Drs Rene Faivre-Pierret and Georges Polian.

Because of the risk of altitude sickness parties on Erebus (3779m) usually spend some time in the Fang Glacier camp at 3048m on the north-east slope to acclimatise. This time, however, only Dr Kyle, who was on Erebus for the sixth time, and his field assistant, Mr William McPherson, of the University of Colorado, Boulder, acclimatised before they worked at the summit.

On January 3 Dr Tazieff and the rest of the party were lifted to the Fang Glacier by a United States Navy helicopter, but they spent only two hours there, and then were flown direct to the summit camp 100m below the main crater rim. As a result all suffered from altitude sickness, and Mr Farrell had to use oxygen for seven hours.

Four helicopter flights were needed to establish the team at its camp, and a fifth was made to move gear to the crater rim. From January 4 to 17 the team worked on the eastern and northern rims of the main crater in low temperatures and chilling winds of up to 19 knots. During the day temperatures ranged from minus 26 deg to 27deg Celsius, and at night they dropped to minus 30deg, and one

occasion to minus 32deg.

SIX ERUPTIONS

During their fortnight on Erebus the team observed as many as six brief eruptions daily from the active inner crater. These threw up ash and "bombs" — semi-solid blocks of lava — from the lava lake which is twice as wide as it was in 1974. On the night of January 12-13 one eruption showered lava "bombs" all around Dr Tazieff and Mr Farrell, and they were spattered with small pieces of rapidly cooling lava.

Although Dr Tazieff was unable to descend into the inner crater, he observed something in the lava lake which he had never seen before in 30 years of volcanology. He and Mr Farrell saw a huge bubble 100m across form in the lake. In five or six seconds the bubble burst into long, viscous threads 2m to 3m wide which rose to a height of 120m.

Gas volcanology is a relatively unknown field in the study of volcanoes, and the two chemists in the French party spent their time on Erebus measuring the composition of the gases rising from the inner crater, and their radioactivity. They collected gas samples with a pump on the rim of the main crater.

EVIDENCE OF LIFE

Evidence of life near the summit of Erebus was found by three other scientists from the University of Waikato. They discovered a small, dark-coloured moss growing on geothermally warmed ground in an air temperature of minus 27deg C. Dr Keith Thomson (botanist), Dr Benno Meyer-Rochow (zoologist), and Mr Don Cowan (post-graduate student), made a special helicopter trip from Scott Base to search for the moss.

Dr Thomson says that the volcano's heat held in by a thin covering of earth over the moss seems to enable it to survive. The scientists also believe that among the moss there may be tiny animals — mites and tardi-

grades. These are among the very few organisms which can survive under fluctuations of temperature in an extraordinarily harsh environment.

Dr Meyer-Rochow, who has studied the eyes of the giant Antarctic slater (*Glyptonotus antarcticus*) for several years ("Antarctic", December, 1977, Page 112) was able to obtain fresh specimens of this bottom-feeding scavenger which lives in depths of up to 3000m in the chilly waters under the sea ice of McMurdo Sound. One specimen was found to have another pair of eyes under its head. They are smaller and simpler in form, and are probably a special adaptation used when the animal swims on its back. The discovery throws new light on Dr Meyer-Rochow's continuing studies of vision in cold water specialist crustaceans.

MITE SPECIMENS

Dr Meyer-Rochow made another discovery in the waters of McMurdo Sound — a tiny, unusual deep-water mite, one of few ever found in Antarctic waters. From a depth of 140m near Scott Base he collected several specimens of the mite on sponge fragments in a fish trap. The mite is a quarter of a millimetre long, and has four pairs of hairy legs and two red stripes on its abdomen.

This mite appears to be of a species new to science, according to Dr Meyer-Rochow. Most mites live on land, in fresh water or between tides. One 10 species have been discovered in deep Antarctic waters.

Early in January Dr Meyer-Rochow crowned his research by catching a 17kg Antarctic cod (*Dissostichus mawsoni*), something he and his colleagues had been trying to do for nearly two months. The catch was made first by a Weddell seal which surfaced at an ice hole with the cod in its mouth.

Dr Meyer-Rochow took advantage of the seal's poor vision and waited until the fish's head was clear of the water. He dropped a hook into its

mouth, set it firmly and hung on tight. After a brief tussle he was able to walk back to Scott Base with his "catch"

After it had been examined the cod served another useful purpose. Cut



Antarctic fisherman Dr Benno Meyer-Rochow with his 17kg cod.

Antarctic Division photo.

into steaks and baked in butter by the base cook, Russell Arnott, it provided a meal for 36 people. However, it was only a "tiddler". *Dissostichus mawsoni* grows up to 70kg in weight.

SNOW CHEMISTRY

For the first time New Zealand scientists worked at Vostok, known as the coldest place on earth, which is 1250km from Scott base. Professor A.T Wilson and Dr C.H. Hendy, flew there on December 18 to continue the University of Waikato Antarctic research unit's studies of the geochemistry of Antarctic snow.

Originally the scientists planned only to study the snow surface at Vostok and complete a programme carried out at Byrd and Plateau Stations in 1967-68 and Pole Station in 1964-65. But because of transportation difficulties they had to remain at Vostok longer than expected. When the snow surface studies were completed they carried out similar studies on ice cores taken from the 950m hole drilled by Soviet scientists through the polar ice-cap.

Vostok sits on ice more than 3500m deep, and drilling has been done there for several seasons. With Soviet co-operation the New Zealanders, who spent a month at the station, were able to measure the accumulation rate down the whole length of the ice core. This enabled the various sections of the core to be dated. The 950m level of the Vostok core was found to be 51,000 years old.

FIELD PARTIES

Vanda Station in the Wright Valley 130km west of Scott Base was almost as busy as the main base during the season. The normal summer population is four, but it began to grow early in November, and for periods of one to three months during the summer there were seven field parties living and working near the station.

Activities of those field parties covered a wide range of the earth sciences, including soil studies, geo-

logy, glaciology, and geophysics. Also at Vanda for the annual summer task of monitoring selected dry valley glaciers, the flow of the Onyx River, and the levels of Lake Vanda and other major dry valley lakes were two Ministry of Works and Development hydrologists, Messrs Trevor Chinn and Tim Omundsen, and two surveyors, Messrs John Palmer and Nigel Nalder.

Vanda Station was manned last season by Messrs Eric Saxby (leader, Queenstown), Chris Longson (technician, Auckland), Brad Scott (technician, Rotorua), and Russell Brice (field assistant, Christchurch). They made climatological observations, recorded solar radiation, and made regular measurements of the Onyx River's flow and the ice thickness and temperature of Lake Vanda.

St Paul's Mountain climbed

Two New Zealand soil scientists, who combined mountaineering with their studies of old weathered soils in South Victoria Land, climbed what is believed to be a virgin 2700m peak on the north side of the Taylor Glacier last season. Drs Graeme Claridge, of Wellington, and Ian Campbell, of Nelson, made a six-hour ascent of St Paul's Mountain from their camp in the Taylor Valley.

To reach the summit of the jagged, steeply-cliffed peak, the two climbers had to work their way along a steep and sheer-faced ridge. They examined rocks and debris around the summit, and were rewarded for their strenuous climb by a magnificent view of Mt Erebus 150km across McMurdo Sound.

St Paul's Mountain (77deg 53min S/ 160deg 20min E) is two miles north-east of Round Mountain on the north side of the Taylor Glacier, and is joined to Round Mountain by a high ridge. It was named by the National Antarctic Expedition (1901-04).

Colder summer stops river flow

Summer in Antarctica was unusually cold last season. Meteorologists at Scott Base reported that the summer there had been one of the coldest since operations first began in 1957, and the average temperature for December at Vanda Station in the Wright Valley was minus 1.6deg Celsius — a drop of minus 1.7deg since the station was established in 1968.

Between 1957 and 1975 a gradual warming trend has been recorded at Scott Base. But there has been a change since then, and last season was the first in which the December and January temperatures did not reach a plus figure.

In December last year the average daily temperature at Scott Base was a record — minus 7.5deg C. The January figure dropped to minus 8.4deg. This was the lowest average for January since 1960 when the temperature dropped to minus 8.8deg.

One result of the unusually cold summer was that the Onyx River, the only river on the Antarctic Continent worthy of the name, failed to flow for the first time in 20 years. Fed by melt water from the Lower Wright Glacier the Onyx rises at the coast end of the Wright Valley, and is one of the few rivers in the world that flows inland.

About 240 men and women, mainly Americans, took part in snowcraft and survival courses conducted by New Zealand mountaineers from Scott Base last season. Three men, Peter Farrell and Bryan Carter, of Christchurch, and John Horsley, of Wellington, ran 36 courses in three months for the Antarctic Division, D.S.I.R.

These courses are held every season for Americans and New Zealanders on Ross Island. New Zealand field parties, the Scott Base summer support staff, and the winter team, all took part last season.

Usually the waters of the Onyx begin their inland flow down the 30km course to Lake Vanda about mid-December, and by January should be flowing freely. For several seasons New Zealanders at Vanda have held a sweepstake based on the date water from the Onyx will top the weir at the station. Last season they waited in vain.



Record cargo load carried

A record cargo load was carried south for McMurdo Station and Scott Base last season by Hercules aircraft of the Royal New Zealand Air Force. Although the nine flights from Christchurch were interrupted by heavy snowfalls, they took more than 113 tonnes of freight and 203 passengers south before the runway on the sea ice in McMurdo Sound became unusable for wheeled aircraft.

Because of the load distribution requirements of the United States Navy's ski-equipped Hercules aircraft, the R.N.Z.A.F. was called on to fly in the largest item of cargo — a 13-tonne tracked vehicle. This was needed at McMurdo Station to replace equipment taken to a field camp.

Six Royal Australian Air Force air crew were observers on the flights. Next season the R.A.A.F. will use its new C-130H Hercules aircraft for four flights between Christchurch and McMurdo Station. In return the United States Navy will make two flights for the Australians between McMurdo Station and Casey, a distance of more than 200km.

Caretakers for historic huts

Two members of the New Zealand Antarctic Society will have the opportunity to spend three weeks in the Antarctic next season working on the repair and maintenance of the historic huts at Cape Royds, Cape Evans, and Hut Point. Applications to the Canterbury and Wellington branches of the society close on May 30. The selected caretakers will be required to attend the training camp at Tekapo for the Antarctic research team, and will go south in December.

There have been caretakers working on Ross Island every season except one since the 1969-70 summer, and the project is part of the New Zealand Antarctic research programme. The two caretakers will be selected by the superintendent of the Antarctic Division from nominations made by the two branches of the society. South Island members can obtain application forms from the Canterbury branch secretary, P.O. Box 404, Christchurch. North Island members can apply to the Wellington branch secretary, P.O. Box 2110.

Special clothing, transport, food and accommodation, are provided by the Antarctic Division, which has suggested certain qualifications of value to anyone applying. These include interest in one or more of the Antarctic research projects, particularly biology or meteorology, and



"Antarctic Record", a new publication produced by the Antarctic Division of New Zealand's Department of Scientific and Industrial Research, will make its first appearance next month. It is designed to give up-to-date scientific and technical information on New Zealand's Antarctic research programme, and will be distributed in New Zealand and overseas.

knowledge of or interest in the historic huts, and the conservation of fauna and flora. Other suggestions are that applicants should have practical experience in some trade or profession, and mountaineering and/or tramping experience.

Macquarie scuba divers

Three Americans and a New Zealander spent last summer on Macquarie Island collecting, studying, and photographing fishes and marine invertebrates around the coastline down to a depth of 20m. They also studied the fauna of the fresh-water lakes on the island plateau.

Collections were made chiefly by scuba diving and a variety of methods. Mesh bags were used to sample sediments, "slurp guns" to catch scavengers, and an anaesthetic (rotenone) to collect fish. Some tiny marine invertebrates were collected by placing household plastic pot scourers on the ocean floor. These made ideal homes for the small animals, and were easily collected at the end of the survey period.

Of the party three had worked previously in the zoology department of the University of Canterbury in Christchurch. They were Dr Jim Lowry, curator of crustacea at the Australian Museum, Sydney, who spent three seasons with the university's Antarctic biological research unit on Ross Island; Dr Don Horning, who led the 1975-76 expedition at Cape Bird, and has made four expeditions to the sub-Antarctic Snares Islands; and the New Zealander, Dr Gary Poore, now with the National Museum, Victoria, who did his thesis at the university. The third American was Mr Rob Ricker, of the University of California.

Signs of life beneath Ross Ice Shelf

After four years of research and financial and technical setbacks, one of the major projects in the United States Antarctic research programme was successful last season. Scientists drilled through 377m of the Ross Ice Shelf to open up an undersea world never before seen by man, and found evidence of life in the frigid, sunless waters beneath the shelf, which have been hidden by ice for at least 120,000 years.

More than 330 scientists worked on 90 projects in the programme during the 1977-78 summer. In Marie Byrd Land they found a new link in the volcanic "ring of fire" which encircles the Pacific Ocean, and in South Victoria Land they discovered 310 meteorites, two of which may be carbonaceous chondrites, the first carbon-bearing meteorites ever found under conditions of minimum terrestrial contamination. Algae, bacteria, and fungi were discovered living just below the surface of rocks strewn over more than 100 locations in the dry valleys, and in the Cumulus Hills of the central Trans-Antarctic Mountains scientists collected 116 fossil remains of amphibians and reptiles which lived in Antarctica 230 million years ago.

In the 1975-76 season field activities of the Ross Ice Shelf Project, which began in 1973, had to be deferred because of restriction on spending and the temporary loss of two aircraft. Drilling through the ice shelf in December, 1976, was terminated when ice flowing under the pressure of its own weight blocked the drill assembly when the hole had reached a depth of 330.3m.

FLAME DRILL

All attempts to free the drill last season by means of hot water circulation failed. On December 2, however, a new flame-jet drill normally used in cutting granite, burned through 420m of ice to the waters of the Ross Sea

under the shelf. But there was another initial setback — sea water gushed up, flooded the hole, and then froze before closed-circuit television cameras could be lowered into the hole to study the water and the seabed far beneath.

Success came on December 13, a year after the first unsuccessful attempt to drill through the ice shelf at J9, the drill camp 644km south-east of McMurdo Station, and 482km from the edge of the ice. In slightly more than nine hours the drill cut through 377m of ice, and two days later a television camera was lowered down the hole which had an average diameter of 457mm with a minimum diameter of 279mm at one depth.

Then the scientists had their first sight of life in the "lost world". Twice swimming organisms which appeared to be tiny fish swam slowly across the field of vision near the seabed. Other signs of life were seen in the form of tracks, trails, and burrows. The seabed appeared paved with small angular rocks, most of them less than 152mm across, and apparently covered with a thin veneer of sediment.

SEABED SAMPLES

Later analysis of the video tape suggested that the tiny fish might be crustaceans. Various arthropods were seen as they approached the bait attached to the TV assembly, and one crustacean was captured. Foraminifera, arthropods, and possible worm trails were also observed on the camera screen.

Samples recovered from the surface of the seabed contained abundant various fragmented diatoms of mixed ranges, including some Late Miocene. A gravity core 29cm long contained an abundance of well-preserved planktonic diatom flora which appeared to be in place and not reworked.

Thirty-six scientists from six nations — Australia, Norway, the Soviet Union, New Zealand, Denmark, and the United States — hoped to spend the rest of the summer studying the biological, chemical, and physical characteristics of the environment beneath the shelf. Crustaceans (isopods, arthropods, and euphausids) were trapped or photographed, and water tests and measurements were made. But efforts to keep the hole open by means of a dangling heated cable failed, and it froze solid.

Closure of the access hole to the waters under the ice shelf did not prevent scientists from collecting ice cores from another hole drilled mechanically at another site. To prevent ice closure the hole was kept open by filling the lower half with Arctic diesel fuel.

VOLCANIC ACTIVITY

Early last season United States Navy Hercules aircraft flew from McMurdo Station to establish a field camp on the Hobbs Coast of Marie Byrd Land at 76deg 45min S/135deg W. A geological and geophysical survey of the coastal area was made by United States scientists, who travelled to study areas in three helicopters flown in by the Hercules aircraft.

This survey, which will contribute towards a reconstruction of the geological history of West Antarctic, included a study of volcanoes and volcanic rocks between 140deg and 110deg W. In the Hal Flood Range, whose mountains are at least partially of volcanic origin, scientists discovered fumaroles on Mount Berlin (3169m). This was the first hint of current volcanic activity along 5632km of coastline flanking the southernmost

part of the Pacific.

Discovery of 310 meteorites, especially those believed to be carbonaceous chondrites, is regarded by United States authorities on meteorites as significant as the recovery of moon rocks. Of the world's supply of about 2000 meteorites only 25 are known to be carbonaceous chondrites, so named because of their high abundance of carbon.

If analysis of the two samples at the National Aeronautics and Space Administration's Lunar Receiving Laboratory at Houston confirms that they are carbon-bearing, the meteorites could give scientists new clues about the origin and evolution of the solar system, and possibly of the origin of life on earth. Carbonaceous chondrites come closest to representing the unaltered, very old material from which planets are formed.

EARLY FINDS

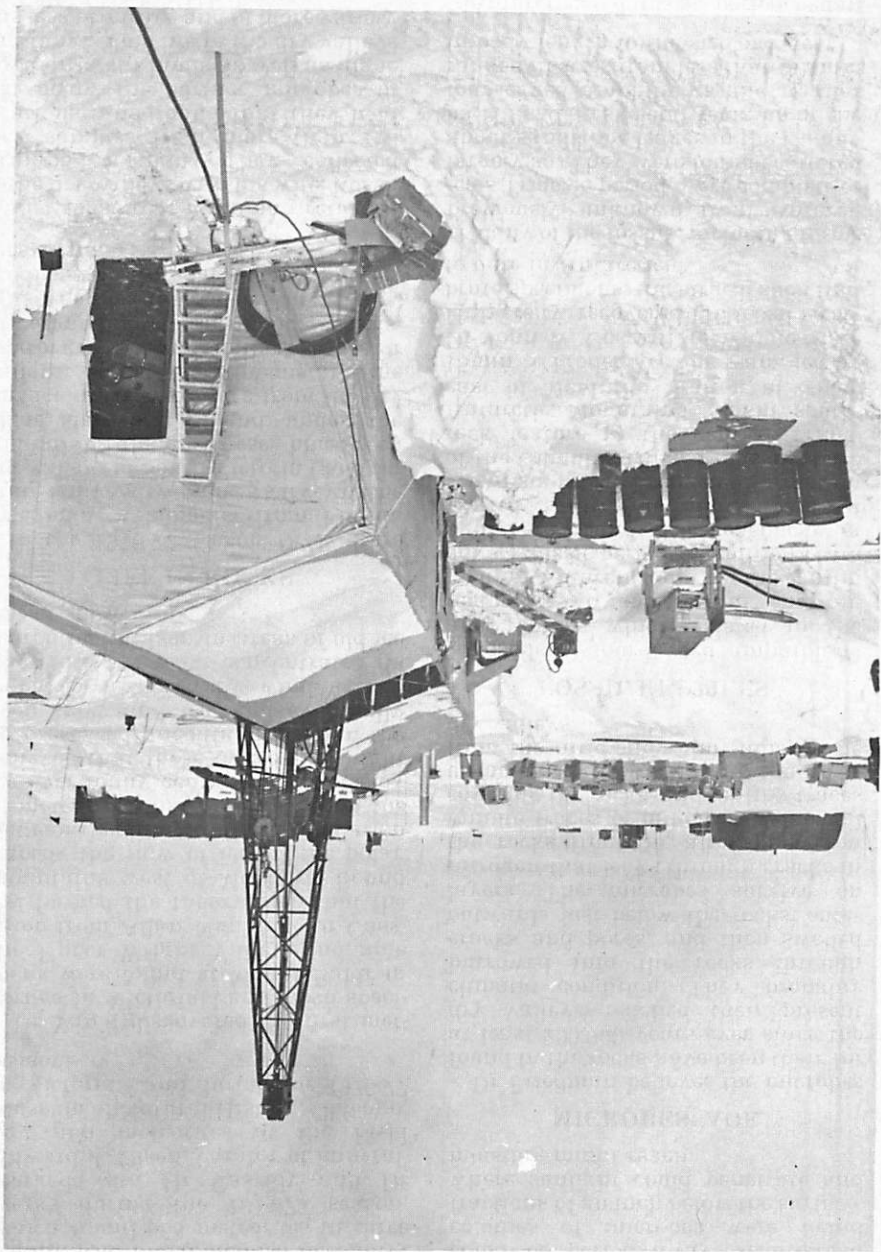
Because the Antarctic ice and cold protected the meteorites from chemical reactions, contamination, and erosion, the specimens found last season could give scientists clues which were denied them before. Meteorites found elsewhere lost much of their pristine qualities because they become contaminated and weathered by exposure to the elements.

All the meteorites were found in December and January by a United States — Japanese team of four scientists. When they first camped near the Allan Nunatak about 200km north-west of McMurdo Station they found 21 meteorites in one day. The Americans were Dr William A. Cassidy, of the University of Pittsburgh, and Dr Billy P. Glass, of the University of Delaware, Dr Keizo Yanai and Mr M. Funaki, of the National Institute of Polar Research in Tokyo, were the Japanese representatives.

Since 1969 Japanese geologists have discovered more than 1000 meteorites on the surface of bare ice areas in the Yamato Mountains about 300km south of Syowa Station. Dr

Ross Ice Shelf Project drill camp site, J9, which is 644km South-East of McMurdo Station. In the foreground is the Langdon shelter over the wireline drill rig used for obtaining ice cores.

U.S. Navy photo.



Yanai, who was a member of a party which found 663 meteorites in three weeks during the 1974-75 season, worked with Dr Cassidy and Dr Edward J. Olsen, curator of mineralogy and meteorites at the Field Museum of Natural History, Chicago, in Victoria Land during the 1976-77 season.

Dr Yanai discovered the first meteorites in Victoria Land. Two specimens were found at Mount Baldr in the Upper Wright Valley, and nine came from Allan Nunatak. Dr Cassidy formed the theory then that the mountains west of McMurdo Sound impede the flow of ice off the polar plateau, leading to an accumulation of meteorites that have fallen on the ice over many centuries. Dr Cassidy believed that these meteorites might be preserved uncontaminated in the deep snow and ice, and eventually would be exposed by wind action. Therefore the team concentrated its search last season in areas of old ice free of snow.

LIFE IN ROCKS

In the 1976-77 season Dr E. Imre Friedman, a biologist from Florida State University, made a survey in the dry valleys of South Victoria Land for endolithic algae. These blue-green algae had been found under the surface of rock samples from the dry valleys. Both the organisms and the type of growth were similar to those Dr Friedman had found in hot deserts. This was the first evidence of primary producers in the cold Antarctic desert ecosystem.

Last season Dr Friedman returned to the dry valleys with his wife, Roseli Ocampo-Friedman. They collected rock samples from more than 100 locations, and found that they held just below the surface microbes of three different kinds as well as algae and fungi. This life in the dry valleys was less primitive and of more variety than life found in hot deserts.

On their field trips Dr Friedman and his wife heated rock samples until they broke apart and their outer layers

could be peeled away. Widespread colonies of microbes were found fractions of an inch below the surface, where sunlight could penetrate and moisture might reach.

MICROBES' AGE

Dr Friedman believes the microbes found in the rocks have been there for at least 200,000 years ever since the dry valleys reached their present climatic condition. They probably burrowed into the rocks through cracks and pores, and then swelled outwards just below the rocks' outer layers. The microbes survive on nitrogen that leaks through cracks in the rocks from the atmosphere, on minute traces of minerals in the soil covering the rocks, and on tiny traces of moisture that melts into the rocks from the little snow that falls in the dry valleys.

FOSSIL REPTILES

Fossils of four-legged amphibians and reptiles which existed in the temperate to sub-tropical environment of Antarctica during the continent's Triassic period 230 million years ago were found last season by a United States-Australian team of scientists in the Fremouw Formation of the Cumulus Hills, a massive bare rock feature in the central Trans-Antarctic Mountains 725km southeast of McMurdo Station at 85deg 15min S/175deg W. The team, led by Dr John W. Cosgriff, of Wayne State University, recovered 116 fossil vertebrate specimens, the largest such find to date in Antarctica.

Many of the fossils, including forms previously unknown from Antarctica's Triassic period, were complete or largely so. They were found scattered about sandstone ledges in the Cumulus Hills. The skeletal remains of the four-legged amphibians and reptiles ranged in sizes from less than 304mm in body length to the size of a deer.

Antarctica's Triassic period began 230 million years ago, and lasted 50 million years. The scientists' objective was to collect fossils of amphibians, reptiles, and fish of the early Triassic

period. They went to the Fremouw Formation, Cumulus Hills, because it contained proven fossil fields which were sampled in the 1970-71 season, and their rich find was the outcome of previous work there.

FORMER CLIMATE

Thirty of the fossils found last season are of particular importance to scientists because of their completeness and quality of preservation. Many of the species found entombed in the barren rocks are also known in contemporary rock deposits in Africa, Australia, and India. This adds to existing geological and geophysical evidence which suggests that Antarctic, Australia, Africa, South American, and India, formed one land mass during the Triassic period.

Dr Cosgriff says that the nature of

the Antarctic fauna of the Triassic period demonstrates that the continent existed then in a temperate to subtropical environment. This is in sharp contrast to the Cumulus Hills of today where a few small and widely scattered lichens constitute the only noticeable life form.

Another party from Ohio State University also worked in the Cumulus Hills last season. Drs James W. Collinson and Kenneth O. Stanley, and Mr Charles L. Vavra studied the stratigraphy and sedimentary petrology of the Lower Triassic vertebrate-bearing beds in the area. Their purpose was to reconstruct the depositional environment and provenance of the Fremouw Formation, to determine the occurrence patterns of fossiliferous beds, and to locate additional fossil beds.

One woman remains for winter

Women working in the Antarctic during the summer are no longer a novelty. There were three at the South Pole last season — a communications operator, a cook, and her helper — and United States and New Zealand women scientists were in the field at many places — the Trans-Antarctic Mountains, the Ross Ice Shelf, the dry valleys, the South Pole, and Wilkes Land.

But few women remain to work during the winter. Only three American women scientists have wintered at McMurdo Station. The fourth is there now, sharing isolation with 73 men. She is Miss Sue Williams, of the University of Texas, who works in the geodetic satellite observatory.

Last year Mrs Donna Oliver spent a winter at McMurdo Station with her husband, and in 1974 Dr Mary McWhinnie was station scientific leader during the winter. Another scientists, Sister Mary Odile Cahoon, shared the isolation.

Two women and a married couple

wanted to stay at the Amundsen-Scott South Pole Station this winter, but it has been a strictly masculine preserve since 1957. This year there are 22 men at the Pole, 19 Americans, two New Zealanders, and one Soviet scientist, Dr R.M. Galkin. His field is geomagnetics, and he is carrying on work started by his compatriot, Dr Alexander Zaitsev, who spent last winter at the Pole.

One American is spending his winter with the Soviet team at Vostok, the coldest place on earth, deep in the heart of the continent. He is the United States exchange scientist, Mr Robert Gregory, an electronics technician from Stanford University.

Including Mr Gregory, there are 105 Americans wintering in Antarctica this year. There are 74 at McMurdo Station, 19 at the Pole Station, five at Siple Station in Ellsworth Land, and six at Palmer Station on Anvers Island off the Antarctic Peninsula. New Zealand has a winter population of 13 — two at the Pole and 11 at Scott Base.

ENVIRONMENTAL STUDY OF RESEARCH PROGRAMMES

Studies of the environmental impacts of the United States Antarctic research programme, and the development of American bases in the next 30 years, have been commissioned by the United States National Science Foundation. A long-range planning team headed by a Californian architect, Mr Dennis McBreen, and Californian engineering and environmental consultants, were engaged in these studies last season.

Basically the function of the planning team is to suggest how development should proceed over the next 30 years, and the goal is to make McMurdo Station more cost effective in supporting scientific operations. At present the National Science Foundation spends nearly \$50 million in Antarctic research, and of this about \$7.5 million is for scientific grants. The rest goes towards support, and the planning team says that six people are needed to support each scientist.

Another goal of the planners is how to make McMurdo Station more attractive. Mr McBreen says: "Its not a pretty place. In the long run we have to try to consolidate and rebuild it."

To produce a draft environmental impact statement on the United States Antarctic research programme the engineering and environmental consultants, Davis and Moore, will have to analyse the environmental impacts of the activities at McMurdo, Amundsen-Scott South Pole, Siple, and Palmer Stations, and temporary field stations. Their study will consider also the long-range environmental effect of all forms of transport — aircraft, helicopters, cargo ships, tankers, icebreakers, and land vehicles.

Improved methods of monitoring and controlling air and land travel to

and in Antarctica will be assessed in the D.E.I.S. The consultants will also try to assess the possible effects of oil spills, and the impact, if any, of air traffic on wildlife, particularly penguin rookeries and seal colonies.

Waste disposal has also been covered in the study. This is a problem at field camps if they are in environmentally sensitive areas. The D.E.I.S. will evaluate the long-term effects of the present methods for dealing with solid wastes — burning, burial in the ice or disposal at sea. Other disposal methods will also be considered.

U.S. support force command

After five seasons in Antarctica Captain C.H. Nordhill will relinquish command of the United States Navy's Antarctic support force officially in June. His successor is Captain D. Westbrook, who has had 23 years' service in naval aviation. Captain Nordhill was once his flying instructor.

Captain Nordhill, who first went south in 1970, commanded the Navy's VXE-6 Squadron in 1971 and 1972, and has been the support force commander since 1976. Captain Westbrook, now the National Science Foundation's division of polar programmes, has flown a wide variety of aircraft. He has served aboard aircraft carriers, and commanded a training squadron in Texas.

Captain Westbrook has degrees in electrical and aeronautical engineering from the Navy's graduate school for senior officers in Monterey, California. He has also studied at the United States Naval War College.

Critical flights made to Siple Station

One of the busiest places in Antarctica last season was Siple Station, 2250km from McMurdo Station at the base of the Sentinel Mountains in Ellsworth Land. For weeks United States Navy Hercules aircraft maintained almost a shuttle service to the remote station, performing a most vital task in support of the research programme — an airlift of men and nearly 350 tonnes of materials to build a new Siple Station.

Time and the unstable weather in Ellsworth Land made the operation critical. Usually there are only 54 days each summer when aircraft can fly in to Siple, and bad weather at McMurdo Station early in the season, which lasts slightly more than 12 weeks, delayed the first flight until the last week of October. But VXE-6 Squadron's crews and their Antarctic work-horses kept on flying day after day — 30 flights were made in November — and enabled the construction crew, also working against the calendar, to complete the first stage of a two-year project.

Siple Station (75deg 56min S/84deg 15min W), which was first occupied all the year round in 1973, has to be replaced because it is slowly being crushed by the weight of ice and snow on its buildings. The new station will consist of 24 prefabricated modular buildings under a metal arch 75m long and 13m wide. Expected to last 10 years or more, the station will accommodate eight persons, and should be ready for occupation in January next year.

Everything needed for Siple Station was carried there by air, each flight taking 10 hours. A temporary summer camp was built to accommodate the 32 men of the construction crew, who had to work under pressure to assemble the modular buildings and erect the metal arch before the season ended. VXE-6 Squadron aircraft carried all the men and materials needed to build the new

station; they also had to fly in the summer and winter research teams, and the supplies and fuel needed to support them.

BUSY MONTHS

As in past seasons the Hercules aircraft flew to other remote parts of Antarctica to support the scientific projects. In their two busiest months — October and November — they flew 1600km from McMurdo Station to establish a field camp on the Hobbs Coast of Marie Byrd Land, relieved the Amundsen-Scott South Pole Station, carried a United States Geological Survey party 2278km to the Orville Coast of the Weddell Sea in three flights, and later in the season made two flights to the Soviet station, Vostok, 1110km from McMurdo Station on the Polar Plateau.

Other inland flights in support of the research programme were to the Leverett Glacier and the Cumulus Hills in the central Trans-Antarctic Mountains. VXE-6 Squadron helicopters were transported to Marie Byrd Land for field operations, and others shuttled back and forth across McMurdo Sound to Vanda Station, New Harbour, the Foster and Blue Glaciers, and to various areas in the dry valleys. Local flights included lifting French scientists to the summit of Mount Erebus, and visits to Cape Evans.

FRENCH HELP

For the first time a United States

Navy Hercules flew to the French base, Dumont d'Urville, on the coast of Adelie land. The flight of 1500km from McMurdo Station was made to enable Navy and civilian experts to visit a disabled Hercules abandoned about 1060km from McMurdo Station in December 1971, and decided whether it could be retrieved and put back into service.

After the successful recovery of three damaged Hercules aircraft from Dome C in Wilkes Land during the 1975-76 and 1976-77 seasons, the National Science Foundation and the Navy considered the recovery of the fourth aircraft. This, No. 148321, was downed on December 4, 1971, because of a malfunctioning JATO system, at 68deg 20min S/137deg 31min E, about 225km inland from Dumont d'Urville after it had resupplied a French traverse party.

Expeditions Polaires Francaises assisted the experts and a support team to reach the aircraft which is at a point, D59, on the traverse route. The operation had to be carried out in stages because Dumont d'Urville has no facilities for Hercules aircraft, and no landings could be made on the ice unless a skiway could be prepared first.

SKIWAYS BUILT

A skiway was constructed about 19km inland by the winter team at Dumont d'Urville. Then a French support team was flown from McMurdo Station. It made a traverse from the small inland base, Carrefour, to D59 and built a skiway there. Next a team of experts from the Navy and the aircraft manufacturers flew in from McMurdo Station, and a temporary camp was established.

United States aerial and French surface observations over the last six years, knowledge of the actual damage to No. 148321, and the experience gained in the recovery of the other aircraft at Dome C, indicated that the abandoned Hercules could be repaired and returned to service. Inspection by

the experts confirmed this opinion, and a recovery attempt will be made next season.

VXE-6 Squadron aircraft also operated in Wilkes Land last season in support of the French research programme. They made several flights to Dome C to enable a team of glaciologists to carry out a deep drilling project on the ice-cap.

Last season United States Navy and Air Force aircraft carried twice as much cargo to Antarctica as they did in the 1976-77 season to support the research programme and maintain the inland stations.

The tonnage carried by sea was nearly twice that shipped to McMurdo Station in the previous season.

THREE ICEBREAKERS

Support for supply operations by sea was provided by three icebreakers instead of the usual two. The United States Coast Guard's most powerful icebreaker, the new 13,000-tonne Polar Star made her debut in Antarctic waters. She worked with two veterans, the Glacier, which has operated in southern waters since 1955, and the Burton Island, which was to have been decommissioned at the end of the 1975-76 season, but was called back to service again in the 1976-77 season.

Later in December the three icebreakers cut a channel through 25km of sea ice in McMurdo Sound to enable the supply ship Schuyler Otis Bland and the tanker Maumee to reach the ice wharf in Winter Quarters Bay. The task took only 32 hours; in the 1976-77 season the older and less powerful icebreakers Burton Island and the Northwind took 13 days to cut a 35km channel.

But the Polar Star's maiden voyage produced problems. Her variable pitch propeller system, which had to be redesigned and strengthened after trials in Bering Strait ice, again caused her trouble in the Antarctic. She returned to Wellington with a fault in a propeller bearing, and then went back to Seattle for repairs.

When the Polar Star has been repaired she will work in the Arctic during the northern summer, but she is not expected to return to the Antarctic until the 1979-80 season. Her sister ship, the Polar Sea, will come south for Antarctic ice trials in December this year.

CRACK IN HULL

After the supply ship Schuyler Otis Bland reached Winter Quarters Bay on her first trip early in January a hairline crack near the waterline was discovered on the starboard side of her hull. The crack, about 2m long, allowed some salt water to enter one hold, but no cargo was damaged, and the ship was able to return to Wellington for repairs.

On her second trip south the Bland was delayed at Lyttelton for several days while repairs were made to her boiler feed pump. Her cargo for McMurdo Station included a number of prefabricated buildings for use in the construction of Williams Field II, a new airfield complex on the McMurdo Ice Shelf.

Before she sailed from Winter Quarters Bay direct to Port Hueneme, California, on February 21, the Bland loaded about 4200 tonnes of marginally contaminated soil from the site of the nuclear power plant on Observation Hill. In the previous season she took 7908 tonnes of contaminated soil back to the United States.

Last, but the most vital, supplies for the winter and next summer, arrived in the tanker Maume. On her ninth visit to McMurdo Sound she discharged 4.7 million gallons of aviation and Antarctic diesel fuel.

Antarctic to Arctic

One of the last of the polar explorers, Wally Herbert, who led the British Trans-Arctic Expedition in 1968-69, is attempting to circumnavigate Greenland, the world's largest island. One of his two companions is a New Zealander, John Bitters who, like Herbert, has served with the New Zealand Antarctic research programme.

Using dog teams and umiaks (large kayaks) Herbert, Allan Gill, another Englishman, and Bitters, left Thule on January 26. Three Eskimos travelled with them on the first 643km of their 11,265km journey, which they expect to complete in 15 months. The British North Polar Expedition, 1977-79, has the patronage of Prince Charles, and is supported by the London "Sunday Times".

Before he led his 1968-69 expedition across the Arctic from Point Barrow to Spitzbergen Wally Herbert worked with the British Antarctic Survey. Then he went to Greenland to buy dogs for Scott Base, which he brought to New Zealand in 1960. He wintered at Scott Base in 1961, and in the 1961-62 season led a field party which followed part of Amundsen's route back from the South Pole down the Axel Heiberg Glacier.

John Bitters, of Napier, was formerly a sergeant in the New Zealand Special Air Service. He was an assistance maintenance officer at Scott Base in the 1972-73 season, and was the dog handler with the winter party in 1973. He was the first New Zealander to make a parachute descent in the Antarctic. In 1972 he made two jumps from a helicopter with a United States Navy airborne rescue team on to the Ross Ice Shelf in a temperature of minus 15deg C, and from a height of 1097m.



A.N.A.R.E. REPORTS

Marine Research to be Expanded

Australian plans to expand marine research in Antarctic waters, and to co-operate with New Zealand and the United States in air transport to the continent, were initiated during the 31st summer programme of Australian National Antarctic Research Expeditions. Studies of the Southern Ocean were made during the relief voyages of the Nella Dan and Thala Dan, a fisheries scientist took part in a West German krill research expedition, and Royal Australian Air Force crews flew with the Royal New Zealand Air Force between Christchurch and McMurdo Station to prepare for their support role next season.

Co-operative flights with New Zealand and the United States will begin in November and December when the R.A.A.F. will make four flights with its C130H Hercules aircraft from Christchurch. In exchange the United States Navy will make two flights to Casey more than 2000km from McMurdo Station in January next year.

These flights will enable Australian scientists to make more short-term visits to Antarctica during the summer. The American ski-equipped Hercules aircraft will use a snow airstrip about 13km inland from Casey, which was inspected last season by Mr Tom Petry, assistant director (engineering and operations), Antarctic Division, the aviation officer, Mr Alf Argent, and the officers-in-charge at Casey in 1977 and 1978.

CASEY TRAVERSE

Four years ago ANARE began a programme of geology, geophysics, glaciology, and aerial mapping in Enderby Land. This programme was continued last season for six weeks by scientists who worked from a base camp at Mount King, and covered an area of some 200,000 square kilometres. In addition glaciologists continued their involvement in the International Antarctic Glaciological Project. An Antarctic Division glaciologist, Mr Neal Young, took part in a

major Soviet traverse from Mirny into Wilkes Land, and during this autumn and spring the winter party at Casey will make a traverse 900km inland from the station as part of the I.A.G.P. studies of the East Antarctic ice sheet.

Collection of rock samples for age determination was the main geological priority in the Enderby Land project last season. This was done by two Bureau of Mineral Resources geologists, Messrs Lance Black (geochronologist) and Lyall Offe. Also in the programme were Dr Edward S. Grew, a specialist in metamorphic rocks from the University of California, Los Angeles, Dr Pat James, a structural geologist, of the University of Adelaide, and a post-graduate student, Mr Adrian Griffin, of the University of Melbourne, who did detailed mapping of rock outcrops in the Beaver Glacier area.

Remeasurement of the positions of ice marker poles set up on the traverse route between Mawson and Mount King in 1976, and the establishment of more such markers in the region, were the main features of the glaciology programme. Two glaciologists, Messrs Peter Keage and Joe Jacka, of the Antarctic Division, were flown from the Nella Dan to a tractor train waiting at an ice movement marker 40km south of Knuckey Peaks.



Macquarie Island station of the Australian National Antarctic Research Expeditions seen from Wireless Hill. This month marks 30 years' continuous occupation of the station by members of Australian expeditions. The main station area is in the foreground, with Hasselborough House, the women's quarters at left and the new stores building at right.

Antarctic Division photo by Jutta Hosei

This tractor train, which set up the Mount King camp, travelled back to Mawson, stopping at each marker for several days to determine positions by the use of signals from United States Navy satellites. When the tractor traverse ended Mr Jacka and a surveyor were flown by helicopter to various points in Enderby Land to establish more ice movement markers in the high flow rate areas of a number of glaciers.

After its support in the establishment of the Mount King base camp, the fixed-wing Pilatus Porter aircraft, flown by Captain Chris Galvin, of the Australian Army, was used to do vertical colour photography from a height of 6000m between 45deg and 48deg

East. This completed the task commenced in 1976 when all but the extreme western sector of Australian Antarctic Territory was photographed in this manner.

When the major portions of the aerial photography programme were finished, Mr Keage transferred to the aircraft to begin ice-thickness measurements along the line of the markers with the Antarctic Division's ice radar. The programme completed measurements made in the 1976-77 summer.

Preliminary studies of the Southern Ocean as part of the new marine research programme were carried out during the first voyage of the Nella

elephant seal pups.

Professor J.F. Lovering and Mr G.A. Travis, of the University of Melbourne, collected geological samples for geochronological and palaeomagnetic studies of the area around Casey. They also made a general survey of the Windmill Islands, being flown to various points by helicopter.

Botanists from the University of New England and the University of Casey area. Their basic aim was to find out what species of mosses and lichens were present and their distribution in the region. This work tied in with similar studies near Mawson, and by other nations in various parts of Antarctica.

A documentary film on the work of Australian expeditions in Antarctica was prepared for television by a team of three from the Australian Broadcasting Commission's "Four Corners" programme, who travelled in the Thala Dan to Casey. This programme will be screened this year.

FIRST VOYAGE

ANAR's summer programme began when the Nella Dan sailed from Melbourne for Macquarie Island on the first of the four annual expeditions. She carried 19 members of the 1978 winter party, which includes a woman cook, Ms Endi Borschmann. She is on leave of absence from her post as principal of a large country high school in Victoria.

After her return from Macquarie Island the Nella Dan sailed again on December 2 on her first continental voyage to relieve Mawson and Davis. The expedition was led by Mr Graeme McKinnon, of the Antarctic Division, and the ship carried 54 men, including the Mawson and Davis winter parties, and stores and equipment for both stations.

On December 15 the Nella Dan reached the pack ice 30km north of the Soviet station, Mirny. An Antarctic Division glaciologist, Mr Neal Young,

Dan to Mawson and Davis. Antarctic Division scientists measured the abundance of phytoplankton, the basic food of marine living resources, in the various oceanic zones through which the ship passed. Measurements were made of the chemistry and temperature of the sea water for later analysis by the Commonwealth Scientific and Industrial Research Organisation's Division of Fisheries and Oceanography.

Samples of krill were collected by towing a plankton net behind the ship some 15 to 80km outside the pack ice zone. Also two gill nets with 200mm mesh were set on the sea floor from the Nella Dan's boat on several occasions to collect specimen of large Antarctic fish, and particularly the largest — the Antarctic cod (*Dissostichus mawsoni*).

On the Thala Dan's voyage to Casey and Macquarie Island Mr Bob Edwards, an oceanographer from the CSIRO Division of Fisheries and Oceanography, continued the study of the physical oceanography of the Southern Ocean started in the 1976-77 summer. Water samples from the surface layers of the ocean were taken at regular intervals, stored, and then returned to Australia for analysis. On-the-spot measurements of various surface and sub-surface parameters were also made with various instruments, including one which measured the temperature profile of the top 400m of the ocean about every 50km.

FIELD STUDIES

Scientists who travelled south in the Thala Dan carried out several programmes during the six days the ship was at Casey. Helicopters were used to transport them to various places for field studies in biology, botany, geology, and glaciology.

An Antarctic Division biologist, Dr Gavin Johnstone, reviewed the 1977 ornithological programme to prepare recommendations for biological work this year. Some of the more remote offshore islands were reached by helicopter to band bird chicks and tag

was flown to the station by helicopter to take part later in a major Soviet traverse into Wilkes Land towards Dome C, which is part of the International Antarctic Glaciological Project. Mr Young took part in a similar traverse during the 1976-77 season.

PACK ICE

After the call off Mirny the Nella Dan proceeded westward to Mawson. Pack ice prevented her approaching closer than 40km so helicopters were used to transfer men and equipment. Bad weather and ice conditions caused some delays to the operation. Among the men transferred to Mawson were some of the winter party, and the officer-in-charge, Mr Ken Chester, of Brisbane.

After this operation the helicopters flew some 370km south-west to Mount King, forward base of operations for the Enderby Land summer project. From this camp, established by a traverse party from Mawson early in December, scientists from Government departments, and Australian and overseas universities, began their investigations of the glaciology, geology, geophysics, and cartography of some 200,000 square kilometres in the area about Mount King.

Because of ice conditions along the coast of MacRobertson, Kemp, and Enderby Lands, the Nella Dan experienced delays on her voyage. It took several days to find an ice floe large enough for the fixed wing Pilatus Porter aircraft to take off from. Finally a suitable floe was found, and the aircraft was assembled and flown off to take its part in the Enderby Land operations.

During this time the refrigerators on board the ship failed. This meant the replacement of frozen meat destined for Davis and Mawson. The refrigerators were repaired when the ship reached Fremantle, and a second shipment of meat was taken south on the second continental voyage in January.

WINTER PARTIES

From Mawson the Nella Dan sailed 650km east to Davis, arriving on January 6. The 1977 winter party was relieved, and 13 men under the officer-in-charge, Mr Philip Barnaart, of Quenbeyan, New South Wales, took over the station. Stores and equipment for the next 12 months were unloaded with the assistance of a four-man Army detachment which used amphibious vehicles to ferry cargo from ship to shore. A start was made on a major rebuilding programme which will continue for the next few years.

On January 13 the Nella Dan left Davis for Fremantle where she arrived on January 23 with 16 men who had spent 15 months at Davis and Mawson. She left behind the new party at Davis to continue studies in upper atmosphere physics, biology and microbiology, and the collection of meteorological data. This is the 18th year men have wintered at Davis.

Three more members of the Davis winter party, and 14 of the Mawson winter party were aboard the Nella Dan when she left Fremantle on January 23 to relieve and resupply Mawson, and bring back the men engaged in the Enderby Land summer operations. The expedition leader was Mr Bill Young, of the Antarctic Division, who was assisted by Mr Andrew Fleming, also of the Antarctic Division, as deputy-leader.

HISTORIC HUT

After a call at Davis to land the three members of the winter party, and a large building which will be erected later this year, the Nella Dan sailed for Mawson. After just over a week there for completion of the changeover of the 1977 and 1978 winter parties, and the unloading of supplies and equipment the ship sailed towards the end of the month for Melbourne where she arrived early last month.

When the Thala Dan left Hobart on

December 6 on her first voyage south to relieve the 33 men who wintered last year at the French base, Dumont d'Urville, she also had four Australian passengers — the Antarctic Division party which was to assess the feasibility of restoring the historic hut built at Commonwealth Bay by Sir Douglas Mawson for his 1911-14 expedition. The ship had to be diverted to Macquarie Island to land the leader and medical officer, Dr Trevor Tierney, who developed a rupture which needed medical treatment.

ANARE's second expedition to the Antarctic Continent began on January 10 when the Thala Dan sailed from Melbourne to resupply Casey, and carry out the changeover of the 1977 and 1978 winter parties. Fifty-one members of ANARE were aboard under the leadership of Mr Tom Petry, assistant director (engineering and operations), Antarctic Division.

For the first time an Australian Parliamentarian accompanied an Australian expedition to the Antarctic Continent. Senator Don Devitt, of Tasmania, who visited Macquarie Island in March last year, travelled in the Thala Dan.

CAPE DENISON

From Melbourne the Thala Dan proceeded to Commonwealth Bay where she landed a new Mawson hut party. Because of Dr Tierney's illness one member of the original party, Mr Tony Everett, a carpenter, joined the winter party on Macquarie Island. Messrs Guy Macklan (engineer) and Ray Brookes (carpenter), returned to Australia after the Thala Dan visited Dumont d'Urville, and then joined the new party led by Mr Rod Ledingham, officer-in-charge at Macquarie Island last year. His wife, Dr Jean Ledingham, who was the medical officer, completed the party.

Two days were spent at Commonwealth Bay while the hut party was established for its six weeks' stay at Cape Denison. Helicopters from the ship flew the party and its equipment

ashore, and a small, prefabricated hut was erected. On January 22 the ship sailed for Casey, and the party began its work which ended late in February when the last French expedition to Adelie Land called on its way back to Melbourne in the Thala Dan.

Six days were spent at Casey while the station was resupplied, and the winter parties changed over. The 1978 party consists of 23 men, and the officer-in-charge is Mr Doug Twigg, of Glenroy, Victoria. He has wintered at Macquarie Island in 1956, and at Mawson in 1958, and has taken part in and led numerous summer expeditions south since then.

During the ship's stay at Casey where a four-man Army detachment assisted in the unloading with amphibious vehicles, helicopters were used to transport scientists around the area of the station to carry out various investigations. The ship sailed for Macquarie Island at the beginning of February, and spent two days there unloading equipment. Scientific staff who had been conducting research since November last year were re-embarked, and the Thala Dan returned to Melbourne about the middle of the month.



A detailed study of the dynamics and thermodynamics of the Martian ice-caps, using techniques developed and tested on the Antarctic ice-sheet, and data gathered by the Viking space craft which landed on Mars in 1976 will be undertaken by an Australian group of scientists for the United States National Aeronautics and Space Administration. The group is led by Dr U. Radok, of the meteorology department, University of Melbourne. Other members are Dr R. Jensen of the University of Melbourne, and Dr W.F. Budd, of the Antarctic Division, Department of Science.

Medical emergency flight from Davis to New Zealand

Four nations — Australia, New Zealand, the Soviet Union, and the United States — shared in the medical evacuation of an Australian radio technician who collapsed at Davis on January 10 and became seriously ill with a bleeding duodenal ulcer. Soviet helicopters and a United States Navy Hercules aircraft flew Mr Colin Perger, aged 36, of Launceston, Tasmania, 7000km from Davis to hospital in Christchurch. He was constantly attended by doctors at Davis, Mirny, and McMurdo Station, and on the helicopters and aircraft which took part in the airlift.

Mr Perger, who arrived at Davis in the relief ship *Nella Dan* on January 6 was to have spent 14 months at the station. But he collapsed while unloading cargo from the *Nella Dan* on January 10, and became seriously ill within 48 hours. Because of the presence of the *Nella Dan* there were additional doctors to treat Mr Perger. He was given blood transfusions, and the doctors consulted by radio with specialists in Melbourne.

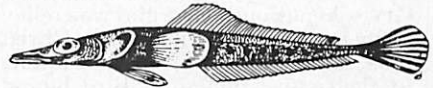
Davis has extensive medical facilities, but on January 12 the doctors decided that Mr Perger's condition warranted his evacuation. A message for aid was sent to McMurdo Station. Because Davis, 3150km from McMurdo Station, had no landing facilities for ski-equipped Hercules aircraft, arrangements were made for Mr Perger to be picked up by a Soviet helicopter from Mirny 700km from Davis, and for the United States Navy VXE-6 Squadron Hercules to fly 2500km across Antarctic to Mirny.

On the morning of January 13 the Soviet helicopter picked up Mr Perger, who was cared for by two Soviet doctors on the flight to Mirny. There he was transferred to the Hercules for the flight to McMurdo Station. Lieutenant-Commander M. Boyer, the United States naval support force medical officer, and a medical orderly, Hospital Corpsman T. Boxberger, flew with their patient from Mirny to Christchurch. Commander J.W. Jaeger, commanding officer of VXE-6

Squadron, was the pilot on the evacuation flight which took nearly 14 hours altogether. Also aboard the Hercules was Captain C.H. Nordhill, the support force commander.

When Mr Perger arrived at McMurdo Station the doctors decided to carry him to Christchurch on a scheduled flight which was delayed for the purpose. The Hercules left at 1.30 a.m. on January 14 and reach Christchurch at 9.20 a.m. Thirty-seven hours after the first request for assistance was received Mr Perger was in hospital. After an operation his condition improved rapidly, and he returned to Australia on January 23.

New Zealand's contribution to the evacuation came from the Antarctic Division, which maintained liaison with the Australian Antarctic Division. It also made the arrangements for Mr Perger's care and treatment in hospital.



Few signs of life were noted by a New Zealand Geological Survey party which worked in the region of the Foster and Blue Glaciers of South Victoria Land last season. Bleached bones of mummified crabeater seals were found occasionally on the valley floors, and once the party was puzzled to find penguin footprints 14km from the sea at an altitude of 700m.

B.A.S. NEWS

Operations restricted by ice and weather

After a series of comparatively ice-free years, conditions in the Antarctic Peninsula area for British Antarctic Survey operations last season were very bad — comparable to those in the late 1950s and early 1960s — and the two relief ships, R.R.S. John Biscoe and Bransfield, were unable to reach Rothera Station on Adelaide Island. Exceptionally bad weather over the peninsula, particularly in January, also severely restricted air operations by the two B.A.S. Twin-Otter aircraft.

Although the failure of the relief ships to reach Rothera prevented the completion of building projects there, field programmes were not affected. Men and supplies were flown south from Damoy Point, Wiencke Island, and nearby Anvers Island. Three stations were relieved on schedule before Christmas. They were Signy in the South Orkney Islands, and two stations off the west coast of the Antarctic Peninsula, Faraday (Argentine Islands), and the United States Palmer Station on Anvers Island.

Some of the summer field workers who had joined the ships in South America were landed at Damoy Point, and flown south at the beginning of the season. Others were airlifted from a landing strip near Palmer Station. Grytviken (South Georgia) was relieved by the Bransfield just before Christmas, and summer parties were landed at field sites, including Bird Island. The ship then sailed for Halley.

HEAVY ICE

Heavy pack ice was encountered in the Weddell Sea, but the ship was delayed only a few days and arrived on January 3. As usual, it was difficult to find a suitable site at which to unload on to the ice shelf from which there was also easy access to the station.

Eventually, after a few days reconnoitring, an area of fast ice in one of the creeks was chosen. This was only four miles from the station, but the actual route inland was circuitous and difficult, and the vehicles plying between the ship and the station with heavy loads required constant manoeuvring and frequent repairs. One large tractor broke through the fast ice, but the driver was pulled to safety before it sank.

Work at Halley was completed by mid-January and the Bransfield then undertook geophysical traverses in the northern part of the Weddell Sea and in the Scotia Sea as far east as the South Sandwich Islands. Calls were made at Signy Island and South Georgia en route. In mid-February, the ships' co-master and Dr. Raymond Adie, were picked up from Mar del Plata, Argentina, and the ship then returned to the Antarctic Peninsula to revisit the Argentine Islands and then make another attempt to reach Adelaide Island.

MARINE SURVEY

The John Biscoe shared in the relief activities at the beginning of the summer and also made a mid-season visit to Mar del Plata, Argentina, to collect her co-master and several summer visitors. She then proceeded to South Georgia, and in mid-January

began work on her main task of the season — an offshore biological survey south of the island ("Antarctic", September, 1977). This was expected to continue for six weeks.

Because of the exceptionally bad weather the air parties had a very frustrating season. In January, only six days' flights were possible, and only three of these were complete days. Ferry flights to Rothera from Damoy summer air facility and Palmer Station, began at the end of October when the first party was landed there by the John Biscoe.

When the weather permitted, field parties were transported to several localities in Palmer Land and on Alexander Island, and depots were stocked. Supplies were also taken to Fossil Bluff field station and the Spartan Glacier glaciological hut. This season's aeromagnetic flights were held up by faults in the equipment as well as by the weather, but east-west traverses over the peninsula were completed between 64 deg and 66 deg S., thus extending the previous coverage.

LONG FLIGHTS

One of the two aircraft also continued work on the joint U.S. Geological Survey — B.A.S. doppler satellite (geoceiver) programme, and gravity readings were taken at all established doppler stations in the area of the Ronne Ice Shelf and Coats Land. These involved flights as far south as Siple Station in Ellsworth Land and as far east as Halley.

Flights to Halley were co-ordinated with the logistic requirements of another major project — the completion of geological reconnaissance mapping of the Shackleton Range, which was begun as a joint British-United States project in the 1968-69 season. This season's work was concentrated at the eastern end of the range.

The party, consisting of one man from Halley and three from Rothera (including a senior staff member from

Cambridge, Dr. Peter Clarkson), were flown to the Shackleton Range by way of the Argentine General Belgrano Station in mid-November and remained there until mid-January. The aircraft then ferried the men and large quantities of rocks to Halley and Rothera by way of Belgrano, and continued the geoceiver programme at the same time.

One one flight to Belgrano from Rothera on February 3, the Twin-Otter's two engines failed and the pilot had to make an emergency landing 32 km from his destination. He and the mechanic discovered the cause of the problem — water in the fuel which had formed ice over the filters.

SOVIET HELP

A Russian aircraft which flew over to offer help took three of the men to Druzhnaya and returned with clean fuel. It then escorted the B.A.S. aircraft to Druzhnaya where the engines were re-checked before flights were resumed.

A week later the B.A.S. aircraft was reported to be at Belgrano, awaiting good weather in which to transport specimens and equipment from the Shackleton Range. The Shackleton project party was also still at Belgrano, and the second B.A.S. aircraft which was to help with the airlift was waiting at Fossil Bluff until the weather cleared at Belgrano.

Work was also carried out on the Orville Coast by the senior B.A.S. palaeontologist, Dr. M. Thomson, who accompanied a United States geological party which flew there from McMurdo Station. His specimens were picked up from the Sweeney Mountains by a B.A.S. aircraft in mid-January.

An American Survaair aircraft which had participated in the United States Ross Ice Shelf Project and was on its way back from McMurdo Station, was grounded at Rothera by the bad weather in mid-February. Unfortunately, while it was parked there, it was badly damaged by high winds.

H.M.S. Endurance visited South Georgia at Christmas and later visited Signy Island. The Governor of the Falkland Islands, Mr J.W. Parker, and Mrs Parker, were on board. The Endurance also assisted field parties at South Georgia, and her helicopters carried out aerial photography for B.A.S. biologists.

Other summer visitors were Professor R.J. Berry, of the Royal Free Hospital, London, who spent some time working on South Georgia with Mr Nigel Bonner, head of the B.A.S. Life Sciences Division. A geomorphologist, Professor Y. Yoshida, of the National Institute for Polar Research, Tokyo, visited the Antarctic Peninsula.

Helicopters from the Argentine ice-breaker General San Martin arrived at the Argentine Islands in mid-December, and late in January the ship called at Halley after relieving Belgrano Station. The German tourist ship World Discoverer intended to visit the station on Boxing Day but the approaches were blocked by ice. On a second visit on January 10, ice and weather were still bad, but about 70 tourists were ferried ashore.

MAMMAL RESEARCH

In December 1977, the Seals Research Division of the Institute for Marine Environmental Research, and the Whale Research Unit of the Institute of Oceanographic Sciences (formerly Discovery Investigations) were combined to form the Sea Mammal Research Unit. Like B.A.S., this unit is part of the Natural Environment Research Council, and is under the direction of Dr. R.M. Laws. It is housed in the B.A.S. Cambridge building.

The International Whaling Commission Secretariat is also now in Cambridge, but is completely separate from the S.M.R.U. and B.A.S.

As part of the general streamlining of the B.A.S. administration the Stanley office staff has been reduced

to one secretary. Clothing stocks formerly kept in Stanley are now stored and issued in the headquarters logistics block, which is also used for assembling and packing much of the cargo for the bases. The teleprinter link between the Antarctic bases and headquarters, formerly managed by the Stanley office, is now maintained by Cable and Wireless Ltd.



Husky pup goes flying

Huskies in Antarctica usually travel on their own feet to distant places, although teams from Scott Base used to be flown with field parties to various parts of the Ross Dependency. After the 1963-64 season, however, motor toboggans replaced dogs as pullers of sledges.

A return to the good old days in one respect was made by Steve Chambers, the Scott Base dog handler, in December last year when he took a new husky pup on a 90km helicopter flight to Mt Rucker in the Royal Society Range. Noogis (Nugis) named after one of the dogs in Scott's last expedition, was only six weeks old when he made his first flight.

For most of the outward journey to a New Zealand Geological Survey party working on the slopes of Mt Rucker (3816m) the fluffy, black and tan pup kept howling in his cardboard box. On the way home he slept quite placidly.

Noogis received more attention from the geologists than his handler. Dr Dave Skinner, Miss Anne Wright, Mrs Margaret Clark, and Mr Bob Findlay had been in the field for seven weeks, and Noogis was their first animal visitor.

SOVIET REPORTS

Molodezhnaya will have heavy aircraft

Construction of an airfield for heavy aircraft at Molodezhnaya, the main Soviet station on the Prince Olav Coast of Enderby Land, was one of the main projects of the 23rd Soviet Antarctic Expedition last season. Soviet scientists also made a second traverse from Mirny to Pioneerskaya and then towards Dome C in Wilkes Land. Drilling in the Shackleton Ice Shelf west of Mirny, and observations in the Scotia Sea and the Davis Sea as part of the international global atmospheric research programme, Poles-South, were also carried out.

Six ships and 500 men and women took part in last season's expedition, which was led by Valery Veniditov, and included scientists from Australia and East Germany. The first contingent sailed from Leningrad towards the end of October aboard the diesel-electric passenger ship *Capitan Kondratyev*. It was followed later by the flagship of the Soviet Antarctic fleet, *Mikhail Somov*, and the research vessel *Professor Zubov*.

Because of delays in the relief of Mirny last season's traverse towards Dome C planned to finish at a point 75deg S/ 129deg E made a late start, and did not reach its objective. The traverse, which included two Australian scientists, was part of the Soviet Union's contribution to the International Antarctic Geological Project and the International Magnetic Study. Once again the party used two of the improved *Kharkovchanka* tracked vehicles, three of which covered 2200km and reached a point 300km from Dome C in the 1976-77 season.

FIRST FLIGHTS

First flights to the new airfield from the Soviet Union will begin next season. These will be made by Ilyushin-76 aircraft. The IL-76, which can operate from unprepared airstrips, is used by Aeroflot in Siberia

and the north of the Soviet Union. It has a maximum payload of 40,000kg, which is reduced to 32,500kg when operating from unprepared surfaces.

There are other advantages in the choice of the IL-76 for Antarctic operations. Its airframe and four turbo-fan jet engines have been designed for operation away from ground maintenance for up to 90 days. Also the aircraft has its own mechanised handling system for cargo — four overhead cranes, each of which can lift 2250kg.

Establishment of an airfield for heavy aircraft and the use of the IL-76 cargo transport are expected to reduce the number of ships engaged in Soviet Antarctic operations. Since 1956 all supplies and equipment have been transported by sea, and expeditions in recent years have relied on several cargo ships in addition to the research ships each season.

For operations on the continent Soviet expeditions use Ilyushin-14 light twin-engined transport aircraft, and Antonov AN-2 single-engined biplanes. The Soviet workhorse is the Mi-8 twin-engined turbine transport helicopter, which is operated by Aeroflot. It can carry 24 passengers and a substantial payload, and is used to transport supplies and equipment from ship to shore, for ice reconnaissance, and for rescue operations.

Nine main projects were included in the programme of the 23rd expedition last season. Scientists investigated the following subjects: (1) Climate and circulation of the Antarctic atmosphere; (2) physical and dynamic state of the waters of the Southern Ocean; (3) morphology, dynamics, and regime of the continental ice-cap; (4) ice cover of Antarctic seas; (5) geological structure and mineral resources; (6) ionosphere physics and radio wave propagation; (7) morphology of geomagnetic field variations and its secular changes; (8) quick variations in earth's electro-magnetic field as an indicator of processes in cosmic space; (9) acclimatisation of man in Antarctic conditions.

A meteorological service was provided by the six Soviet stations — Molodezhnaya, Mirny, Vostok, Novolazarevskaya, Bellingshausen, and Leningradskaya — for ships of the Ministry of marine fleet and the Ministry of Fisheries cruising in the Southern Ocean, and systematic data was provided for the Soviet Union's hydro-meteorological and geophysical services. A full programme of scientific observations in the fields of geophysics, glaciology, meteorology, and medicine was carried out at all the stations.

SUMMER BASE

Druzhnaya, the summer station on the Filchner Ice Shelf, was the base for geological and geophysical investigations, and topographic and geodetic work on the coast of the Weddell Sea, and in the Shackleton Range and the Pensacola Mountains. Scientists used aircraft and helicopters for their studies.

As part of the International Antarctic Glaciological Project glaciological observations were made during traverses from Mirny to Komsomolskaya, and from Mirny to Pioneerskaya and to the point 75deg S/129deg E. These observations were made simultaneously with work on the snow measuring project "geo-

physical polygon in Antarctica" Meteorological observations and a survey of snow measurements were carried out during the regular supply traverse to Vostok.

Complex aerometeorological and hydrological investigations were made in the Scotia Sea from the Professor Zubov, and in the Davis Sea from the Mikhail Somov. These were part of the international programme. Poley-South. Simultaneous hydrological, ice and aerometeorological observations were also made along the routes of the two ships during their operations in Antarctic waters.

AIR SURVEYS

Seven ships were used by the 22nd Soviet Expedition in the previous season. They were the Mikhail Somov, Penzhina, Kapitan Gotskiy, Bashkiriya, and Estoniya, the Professor Zubov, and the tanker Gelendzhik. The Gelendzhik carried 10,000 tonnes of oil products to resupply Bellingshausen, Molodezhnaya, and Mirny.

Druzhnaya operated for the first two months of last year, and the programme included aeromagnetic surveys, photographic reconnaissance, and radio echo sounding surveys by two Il-14 aircraft from Molodezhnaya, and based at Druzhnaya for the summer season. Air operations included radio echo soundings along the 40deg W meridian from Druzhnaya to the South Pole and back, surveys in Coats Land to the east of the station as far as Cape Norvegia, and geological work in the Pensacola Mountains and the Shackleton Range.

In the Shackleton Range a field camp was set up at Mount Provender (80deg 23min S/ 29deg 55min W) at the western end of the mountains, and another 100km to the south-east. Observations were made at 40 stations, followed by detailed mapping of the selected sites, collection of leaf-by-leaf sections. About 1000 samples of rocks were collected. Two

American scientists, Dr Edward S. Grew and Dr Arthur B. Ford, and Dr Hans Paesch, of East Germany, participated in the Druzhnaya programme in the first half of February.

ICE DRILLING

An aeromagnetic survey at a scale of 1:2000,000 was made over an area of 300,000 square km in the southern part of the Weddell Sea. On the Filchner Ice Shelf an airborne landing geophysical survey was made over an area of 123,000 square km in 143 coordinate points (157 physical points of observation).

Work at Novolazarevskaya included drilling of two 100mm holes through the Lazarev Ice Shelf. One hole penetrated 357m of ice at a point 35km from the ice front, and sediment was recovered from the seabed under the shelf. The second hole, 50km from the ice front, reached a depth of 447m. The water layer was found to be 200m at the first drilling site, and 40m at the second.

Deep drilling was continued at Vostok, and the hole reached a depth of about 1000m. This programme began in the 1974-75 season, and in the first two seasons 500 specimens were collected. The oldest of these, recovered at a depth of 197m was estimated to be 8500 years old.

A microbiological research was started in the 1975-76 season, and a hole was drilled near the station to a depth of 207m. In the 1976-77 season drilling was continued to a depth of 304m with ice core recovery. Measurements of temperature, the inclination of the borehole, and wall deformation, were made to a depth of 180m.

Geodesic and hydrographic observ-

ations were made from November to March in the 1976-77 season by two ships of the 22nd expedition. Route measurements were made by the Mikhail Somov in the region of Molodezhnaya and Mirny, and the Balleny Islands. The Professor Zubov made similar measurements in the Southern Ocean and in the southern part of the Atlantic Ocean.

65-year-old camp site

A pick-axe stuck into a rocky mound on the lower slopes of Mount Erebus near the Barne Glacier led to the discovery of the remains of a camp site dating back to Scott's last expedition more than 65 years ago. The pick-axe was discovered by a New Zealand surveyor, Nigel Nalder, of Nelson, in the course of a survey for the production of a large-scale map of the western shore of Ross Island.

Mr Nalder was looking through his theodolite when he saw the pick-axe. The survey party, which included Messrs Russell Brice (Christchurch) and Roger Dunkley (Lower Hutt) made a one-hour walk to examine the find. Strewn about not far from the rusted blade and wind-blasted handle of the pick-axe were bottles, rope ends, and tins, some still containing paraffin.

Later the pick-axe was found to match one at Scott's hut at Cape Evans. It had the same brand name. The camp, between Cape Barne and Cape Royds, may have been established by Commander Victor Campbell, leader of the Northern Party. In December, 1912, he made a survey of Cape Royds after the party returned to Cape Evans.



LARGE LAKE UNDER ICE

A large lake — the first discovered in West Antarctica — was located under the ice close to the flank of the Ellsworth Mountains by a Scott Polar Research Institute team which made a glaciological and geophysical exploration of the Antarctic ice-sheet last season by airborne radio-echo sounding. Dr David J. Drewry, co-leader of the field team, reported that there was a definite body of water in the area under 2½km of ice.

This was the Scott Polar Research Institute's fifth season of radio-echo sounding of the ice-sheet. The work was part of the International Antarctic Glaciological Project, and is done in co-operation with the United States National Science Foundation and the Technical University of Denmark. Most of the sounding equipment has been designed and built by the Technical University of Denmark, and installed in a Hercules aircraft provided by the National Science Foundation, and flown by the United States Navy's VXE-6 Squadron.

In earlier seasons most of the sounding flights have covered wide areas in East Antarctica. But in the 1974-75 season the team also worked in Marie Byrd Land because of interest in the stability of the West Antarctic ice-sheet, and in interpretation of ice cores from Byrd Station. Flights were made then in the area between the Trans-Antarctic Mountains, the Ross Ice Shelf, Rockefeller Plateau, and Byrd Station.

Last season the team worked in West Antarctica east of Byrd Station, and towards the Ellsworth Mountains, and the Filchner Ice Shelf. The Hercules was based at McMurdo Station, and used the Pole Station and the Byrd Station field camp for refuelling. To investigate the complicated geological junction between West and East Antarctica the team did 12,000-km of on station flying.

Another 5000km of on station flying was done in East Antarctica, covering the coastal area in the direction of Dumont d'Urville and Casey. This was to fill in part of the grid previously flown in the International Antarctic Glaciological Project. The team also filled in the grid east of the geographic South Pole.

Although the S.P.R.I. team was unable to assess the West Antarctic material immediately, it did locate the first large lake under the ice sheet. Also it was able to establish the position of the Filchner Ice Shelf grounding line, and discovered differences of up to 60km.

As an international project the echo-sounding programme was a combined effort by British, United States, and Danish investigators. Dr Drewry and Mr D.T. Meldrum were co-leaders of the field team, which included Mr M. Pallisgaard, of the Technical University of Denmark, a New Zealander, Mr C. Brown, of Victoria University of Wellington, and Mr L. Irons, of the University of Nebraska-Lincoln, one of the co-ordinating team for the Ross Ice Shelf Project and the Ross Ice Shelf Geophysical and Glaciological Survey. The Hercules made detailed soundings on a flight over the Ross Ice Shelf, some of them for R.I.S.P.

Field trials of an airborne magnetometer system in the Hercules were conducted on the radio-echo sounding flights by a team from Johns Hopkins University with which the S.P.R.I. team worked. Both teams were able to use the airborne research data system installed in the aircraft. The A.R.D.S. receives, records, displays, and prints out atmospheric research data, aircraft altitude information, and other data as needed by the investigators.



Mrs Silvia Morello de Palma holds her two-week-old son, Emilio Marcos, the first child born in Antarctica, while her husband, Captain Jorge Palma, examines gifts sent to the infant by Argentina's President Jorge Videla. Captain Palma is the commander at Esperanza, the Argentine Army base on the Antarctic Peninsula.

Associated Press photo.

ANTARCTICA'S FIRST BABY WARMLY WELCOMED

Population and politics attracted world-wide attention to Esperanza, the Argentine Army base on the Antarctic Peninsula early this year. Mrs Silvia Morello de Palma, wife of the base commander, Captain Jorge Palma, gave birth on January 7 to the first child ever born in Antarctica, and President Jorge Videla welcomed the arrival of Emilio Marcos Palma as a reaffirmation of "the inalienable role of Argentines in those far lands".

Esperanza, which is in Hope Bay on the Trinity Peninsula at 63deg 24min S/ 56deg 59min W, has been an Argentine Army base since 1952. Until Captain Palma and his wife arrived late last year with three young

children women had been seen at the base only during the summer when they came ashore from tourist cruise ships. The arrival of the Palmas marked the first stage of the Argentine Government's plans to establish a

colony at Esperanza.

When President Videla sent his congratulations to Captain Palma, he said that the birth reaffirmed the role of the family in Argentine society. Two weeks later he sent a special emissary, General Ramon Camps to Esperanza with official gifts for the infant Emilio Marcos. These included gold medals, silver plate, and two volumes of Argentine history.

Reports from Buenos Aires suggest that the Argentine Government decided to colonise Esperanza to determine whether Antarctica is suitable for family life, and to reinforce its territorial claims. The project began when the Palmas and another Argentine Army couple arrived at Esperanza in November.

Five other soldiers arrived with their wives and 15 children last month. The party also included an engaged couple, two teachers and a Roman Catholic chaplain. There was work for the chaplain soon after his arrival. He baptised Emilio Marcos

Second Norwegian expedition

Norway sent another expedition to Antarctica last season to continue the work done in the 1976-77 summer by the expedition which spent two months in western Queen Maud Land and the Weddell Sea. It was Norway's first independent scientific expedition to go south since 1960.

Organised and led by the Norwegian Polar Institute, last season's expedition also used the chartered 500-ton icebreaker Polarsirkel. The Polarsirkel was chiefly engaged in oceanographic work, and two parties from the ship also worked ashore. One was on the ice shelf, and the other in the Kraul Mountains of the Princess Martha Coast — both about 400km north-east of Halley, where the expedition called on January 22.

Palma, and officiated at what is believed to be the first wedding on the Antarctic Continent.

Esperanza's normal winter population of 18 men now includes eight wives and 19 children. There will be an increase in the population before spring comes to Hope Bay again. Two of the wives, like Silvia Morello de Palma, were pregnant when they left Argentina.

Emilio Marcos Palma weighted 3.6kg at birth. He is regarded as an Argentine citizen.

New Argentine Icebreaker

Environmental considerations have influenced the design of the Argentine Navy's new icebreaker, Almirante Irizar, which is expected to come into Antarctic service in the summer of this year. Equipment on the vessel, which replaces the ice-strengthened General San Martin, includes a sewage treatment plant for liquid waste, and an incinerator for oil sludge and combustible waste.

Now under construction in a Finnish shipyard, the Almirante Irizar is expected to cost \$65 million. Designed to carry 100 passengers and a substantial amount of cargo, she will be able to winter in the Antarctic for six months with 210 aboard. Her tonnage is 12,000 tonnes, and she is 119.3m long and 25m wide. Fitted with diesel-electric engines, she is expected to do 16.5 knots in ice-free water. Equipment includes a 60-tonne towing winch, and two 16-tonne hydraulic cranes to handle helicopters, landing craft, and cargo.

Built in West Germany in 1954, the General San Martin has participated in Argentine Antarctic operations since 1955. In that year she sailed into the Weddell Sea with the expedition which established Argentina's southernmost base, General Belgrano, on the Filchner Ice Shelf at 77deg 46min S/38deg 11min W.

Mawson veteran meets last of "magnetic ladies"

When Mawson's Australasian Antarctic Expedition (1911-14) returned from Adelie Land its chief magnetician, Eric Webb, spent a year preparing for analysis many of the thousands of observations made at Cape Denison, and on his journey with Bage and Hurley to locate the South Magnetic Pole. Mr Webb, a New Zealander, and now one of the last two survivors of the expedition, was unable to complete his work at Canterbury University College, where he had been a civil engineering associate, because he went off to serve in the First World War.

While he was away 12 young women students in the physics department worked in their spare time on his magnetic observations. They became known as "the magnetic ladies of Canterbury College", and "the Mawson Club". That was in 1915. Sixty-two years later — December 20, 1977 — when Mr Webb returned to Christchurch to visit his brother and sister, the five survivors of the original "magnetic ladies" met him for the first time.

Mr Webb, now 88, was the guest of honour at a reception arranged by the University of Canterbury to pay tribute to one of its distinguished graduates. There he chatted to the five "Mawson Club" members — Miss Beatrice Smith, Mrs Bertha Jones (nee Rhodes), Miss Kate Leonard, Miss Joyce Robinson, and Miss Chrystobel Robinson.

NO COMPUTERS

Sixty-two years ago the "magnetic ladies" had no computers to help them. Mr Webb says that their work was mechanical, arithmetical, and clerical — needing some dexterity, much concentration, and conscientious care in recording and handling figures. "Altogether, it was an admirable exercise in compilation and tabulation", he says of the results.

One of four New Zealanders with Mawson, Mr Webb was a member of the main party of the expedition based

at Cape Denison. In 1912 he and two Australians, Bob Bage and Frank Hurley attempted to locate the South Magnetic Pole. They manhailed sledges through blizzards and sub-zero temperatures a distance of 960km, and made their last camp at 89deg 53min S within 80km of the Pole.

Three years earlier on the Shackleton expedition Mawson, Edgeworth David, and Mackay, manhailed their sledges from McMurdo Sound a distance of 200km and established the South Magnetic Pole at 72deg 25min S. Since 1912 the Pole has kept moving towards the coast, and is now at sea near the French Antarctic base, Dumont d'Urville.

After the First World War in which he served in Egypt and France with the Royal Australian Engineers, and was awarded the Distinguished Service Order and the Military Cross, Mr Webb worked on engineering projects in many parts of the world for a Swedish engineering company. In the Second World War he joined the English Electric Company. When he retired he assisted in the preliminary planning of the Churchill Falls hydroelectric power project in Labrador, the largest power project in the Western world.

WESTERN PARTY

Mr Webb flew over the area of the South Magnetic Pole on December 1 last year when he was a special guest

British climbing expedition believed lost at sea

Eight members of a privately financed British expedition which planned to climb peaks in the Antarctic Peninsula area and on South Georgia have not been heard of since they sailed from Rio de Janeiro for the Falkland Islands (Islas Malvinas) on November 1 last year. Their ship, a 35-year-old ice-strengthened Dutch tug, *En Avant*, was reported overdue late last month by two New Zealand climbers, Messrs David Kilcullen and Gary Ball, who were to have joined the expedition at Port Stanley.

Led by Simon Richardson, a 28-year-old British climber, who bought the *En Avant* for \$1440, the expedition sailed from Southampton at the end of July, 1977. Among those aboard were the noted British mountaineer, navigator, and author, Major H.W. Tilman, leader of the 1938 Everest expedition, who planned to celebrate his 80th birthday in the Antarctic, and an American climber, Joe Dittamore.

Three ice-capped peaks on Smith Island in the South Shetlands, Mts. Foster, Pisgah, and Cristi, were the expedition's main objective ("Antar-

tic," December, 1977. Page 127). The expedition also hoped to survey the island, visit King George Island and Deception Island, and work its way up the west coast of Graham Land. Its last call was to have been at Palmer Station on Anvers Island before sailing on to South Georgia.

Originally the expedition was expected to last 12 months, four of which would be spent in the Antarctic. Some minor repairs were made to the *En Avant* when she reached Rio, but apparently there were no problems on the voyage out.

When Mr Kilcullen returned to New Zealand after waiting several weeks for the *En Avant* to arrive, he said there seemed to be little hope for the ship's crew. There had been a force 9 gale over the tug's route in early November.

A thorough search of the coastline was made by the Argentine Coast Guard, and after the *En Avant* was reported overdue inquiries were made by the British Foreign Office through all Lloyd's agencies in the Argentine, Brazil, and Uruguay.

TOURISM

More Australian day trips to Antarctic

Another 1500 Australians saw Antarctica from the air last month as passengers on day trips by chartered Qantas aircraft. Between November 17 and December 1 last year Qantas operated four charter flights south. This year there were six on February 4, 6, 11, 12, 13, and 20.

Of the four flights by chartered Boeing 747 aircraft three were made from Sydney and one from Melbourne.

Each aircraft carried about 300 passengers. The charterers were a service club near Sydney, a Melbourne travel firm, and Dick Smith Electronics Pty. Ltd, which organised the first tourist flight in February last year.

On the flight from Melbourne the Boeing 747 flew to the location of the South Magnetic Pole off the coast of Adelie Land, and then across the

continent to McMurdo Sound, returning by way of Hobart. Two Sydney flights were to the South Magnetic Pole area, and the third was by way of Macquarie Island, Cape Washington and Cape Hallett, in the Ross Dependency, then back by way of Hobart.

One Boeing 707 flight on February 11 for an Adelaide travel firm began

and ended at Adelaide. The route was by way of Hobart to the South Magnetic Pole area. On the Melbourne travel firm's charter flight, made on February 12 the 707 flew by way of Hobart to Cape Washington, then across the continent to the South Magnetic Pole area, and back to Melbourne.

William MacDonald was polar mapping expert

An expert in mapping the polar regions, William R. MacDonald, who developed a vast and intimate knowledge of Antarctica, died in Annapolis, Virginia, on November 9. MacDonald, who was 52, had been head of the United States Geological Survey's branch of international activities since 1972. His contributions to the mapping of Antarctica began in 1954, and he is believed to have seen more of the continent than any other man.

MacDonald, who was born in Laurel, Maryland, joined the Geological Survey in 1942, and was assigned to work in Alaska. After war service with the Marine Corps, he returned to Alaska to work for the Geological Survey on the photogrammetric mapping of the Brooks Range. In 1954 he began compiling maps of Antarctica

from aerial photographs taken by the United States Navy during expeditions in the late 1940s. These maps were widely used by scientists in the 1957-58 International Geophysical Year.

Between 1960 and 1967 MacDonald spent about six months each year in Antarctica taking part in aerial photographic missions to obtain material for further mapping. During this period he was responsible for the planning and supervision of all the aerial photographic missions flown by U.S. Navy aircraft for topographic purposes. About one million square miles were photographed during the seven years MacDonald was in charge of the programme. His name appears on the maps to which he contributed so much; a mountain was named after him in 1961.

Another veteran of Rear-Admiral Byrd's first expedition to Antarctica has died. Arnold H. Clark, one of the 42 men who wintered at Little America in 1929, died in March, 1976, at his home in Pleasantville, New York. Advice of his passing was received belatedly in Washington by the Antarctic Society, of which he was a member.

Arnold Clark, who was a 24-year-old engineer from Greenfield, Massachusetts, when he went south, was described by Byrd as one of the quietest men in the winter party. He

assisted the expedition's physicist, Frank T. Davies, with the geomagnetic research, but most of his time was spent as a jack-of-all-trades because of his versatility and willingness to help.

Byrd praised Clark for his work with the Ford snowmobile during the difficult unloading operations in February, 1929. In addition to his geomagnetic work Clark helped Davies and Dr L.M. Gould in an investigation of the crevasses near Little America, and volunteered to serve as assistant cook. In his spare time he did secretarial work for Byrd.

on a Qantas charter tourist flight to the Antarctic. Before he left Sydney he was able to meet again the other survivor of Mawson's expedition, Captain Morton Moyes, now 91. They were 2200km apart during the expedition because Captain Moyes was one of the eight men of the western party led by Frank Wild who lived for a year and a day at the western base on the Shackleton Ice Shelf off Queen Mary Land.

Captain Moyes, who retired from the Royal Australian Navy after 32 years' service, was a graduate of the University of Adelaide when he was selected by his geology professor, Mawson, as the expedition's meteorologist. In 1916 he went south again in the Aurora with the relief expedition to rescue Shackleton's marooned Ross Sea Party of the Imperial Trans-Antarctic Expedition.

SOUTH AGAIN

As it was not known whether a search party would be required, Captain John King Davis, commander of the expedition, asked the Royal Australian Navy to second Captain Moyes as navigator for any sledge journeys that might have to be made. Captain Moyes was in Port Chalmers selecting material that might be needed when Shackleton arrived, and shared a cabin with him during the voyage.

In 1929 Captain Moyes went south a second time with Mawson in the Discovery. He was seconded to the British, Australian, and New Zealand Antarctic Research Expedition as survey officer for the first cruise in the 1929-30 season. Now he looks back on a notable career in the early days of Antarctic exploration — one of only nine men who served in three or more expeditions, and among the few who have been ashore in Victoria Land, Adelie Land, Queen Mary Land, and Enderby Land.

New South African ship

South Africa's new Antarctic research and supply ship, which replaces the RSA, has been named Agulhas, not RSA II. She is expected to sail from Cape Town on her maiden voyage to sub-Antarctic Marion Island late this month or early next month.

Built for the South African Department of Transport, the Agulhas was launched on September 30 last year from the yards of her builders, Mitsubishi Heavy Industries Ltd, at Shimonoseki. She arrived at Cape Town late in January this year.

Before the new ship arrived the RSA, which made her first voyage south in 1962, made her last relief voyages. Between September and January she called at Gough and Marion Islands, Tristan da Cunha, and Sanae.

South Africa began continental Antarctic research in January, 1960, when the first S.A.N.A.E. party took over the existing Norway Station from the Norwegians. The first two expeditions were transported in the Polarjorn and the Polarhav.

RSA, which was launched towards the end of 1961, took the third expedition south to construct an entirely new station about 19km north-north-east of Norway Station, which was at 70deg 30min S/2deg 32min W. Its first Antarctic voyage was eventful. It left Cape Town on January 6 and reached the unloading berth at Polarsirkelbukta on January 25.

On February 12 the RSA sailed for home, but she took 24 days to cover the first 152km of the voyage, and on March 6 she was caught with rudder trouble in pack ice north of Sanae on the Princess Martha Coast. But she broke free on March 22 and reached Cape Town on April 3.

THE READER WRITES

Sidelights of Antarctic Research

Sir, — Of all the relics of Scott's last expedition none seems more durable than the bicycle which Griffith Taylor rode over the sea ice on a fine Sunday morning 66 years ago from Cape Evans to the Erebus Ice Tongue. When the hut was first restored in 1960-61 the frame of the bicycle was found in the porch of the hut.

Seven years later a wheel, a spoke, and a pedal were found. Then in 1971 two New Zealand Antarctic Society caretakers, Messrs Richard McElrea and Harry Burson, found another wheel with the tyre and inner tube still intact.

Last December when two other caretakers, messrs David Harrowfield and Chris Buckley, removed more than 100 cubic metres of ice from the annex of the hut, the bicycle frame was found again. On the seat, cut into the leather, were the initials G.T.

Although the bicycle was part of the expedition's equipment Griffith Taylor probably earned the right to carve his initials on the seat. He was the first man to ride a bicycle in Antarctica, and his experience made him vow that his first ride would be his last.

Taylor and Bernard Day, the motor engineer, were really responsible for the presence of the bicycle at Cape Evans. Scott agreed to bring it there on their representations. Having ridden many miles over snow in France, Taylor thought a bicycle would be useful for short trips around headquarters on the sea ice.

Christchurch has a close link with the bicycle because it was made and given to the expedition by a local cycle dealer, M. Pitcher. In 1910 Christchurch was even more of a city of cyclists than it is today, and Pitcher Bros, cycle and motor engineers, had two shops, one in Colombo Street, and

the other in Cashel Street.

Since 1960 four bicycle wheels have been in or near the hut at Cape Evans, and Shackleton's hut at Cape Royds. One wheel was hanging on the wall in the annex, the hub and spokes of another were found in the open, and the third with the tyre and tube was buried in the ice.

Discovery of the remains of a fourth wheel — reduced to hub and spokes — at Cape Royds might suggest that the bicycle was provided with two spare wheels or there were actually two bicycles. But the explanation can be found in two entries in Scott's diary.

On May 7, 1911, he records that Bowers and Cherry-Garrard set up a thermometer screen on the sea ice north-west of the hut. They took the screen out on one of Day's bicycle-wheel carriages, and found it ran very easily on the salty ice.

In the May 22 entry Scott refers to a trip he, Wilson, Bowers, Atkinson, Petty Officer Evans, and Clissold, made to Cape Royds with a "go-cart" carrying their sleeping bags, a cooker, and a small quantity of provisions.

Scott's reference to one of Day's bicycle-wheel carriages suggests that the ingenious motor engineer built at least two four-wheeled "go-carts". And probably the wheels came from Pitcher Bros.

So there must have been 10 bicycle wheels at Cape Evans. The remains of one from a "go-cart" is at Cape Royds; one of the three at Cape Evans might have been used for the same purpose. But what has happened over the years to the other six wheels? And where is the bicycle pump Taylor says he took on his eight-mile ride — he had to walk half the distance — past Turk's Head to the glacier tongue?

Yours, etc.,
"JAMES PIGG"

ANTARCTIC BOOKSHELF



SECOND IN COMMAND

by
May Fluhmann

Department of Information, Canada. Government of the North-West Territories.
 162pp. Illustrations.

When Sir John Franklin died in the Arctic in 1847 while searching for a North-West Passage the command of his two ships and their crews devolved upon Francis Crozier, who made a vain attempt to lead the survivors to safety down the Great Fish River. Not a man regained civilisation. Crozier has waited a long time for a biographer, but in May Fluhmann he has found one who has brought to her task unbounded zeal and a deep knowledge of her subject.

For the last quarter of a century she has painstakingly researched the people who were in the shadows of such eminent explorers as Sir James Clark Ross, Sir Edward Parry and Sir John Franklin. She began writing "Second in Command" in 1969, but has had an interest in Franklin since she was a young child. She has made eight voyages in old wooden sailing vessels and has always been interested in the sea. While writing her book on Crozier she visited Beechey Island where the Franklin expedition spent 10 months.

May Fluhmann begins her biography of Francis Rawdon Moira Crozier by telling of his birth in Ireland and his joining the Royal Navy at the age of 14. It is interesting to read that he served as a midshipman under Sir Thomas Staines aboard H.M.S. Briton, and while in her visited Pitcairn's Island. The Briton was the second vessel to discover the hide-out of the mutineers of the Bounty. He later served in three voyages under Sir Edward Parry in his several attempts to find a North-West passage and to reach the North Pole, and while under Parry he was

promoted to lieutenant.

But it was not in the Arctic regions that Crozier attained fame as an explorer. Rather it was in the Antarctic that his greatest work was done as second-in-command of Sir James Clark Ross's expedition in the Erebus and Terror.

It is rather strange that while Ross has several geographical features named after him, Crozier's name adorns a solitary cape on Ross Island in the Antarctic.

We may here note Ross's association with this country in that between his first and second voyages into the South, he spent some three months at the Bay of Islands.

When the British Government decided to send another expedition in an all-out search for a North-West passage two ships were selected, the Erebus and Terror, Ross's old Antarctic vessels. Sir John Franklin was appointed to command the expedition, and he selected Crozier to take charge of his old ship, the Terror, thereby setting the seal on his destiny.

Miss Fluhmann does not seek to portray Crozier as a hero. Rather she shows him as a typical Victorian naval officer, dedicated to the service, doing his work competently in any part of the world he happened to be.

One minor criticism of a fine biography is its lack of maps. A map of the Antarctic and another of the Arctic regions would have enabled readers to pinpoint the areas referred to in the text.

H.F.G.

“ANTARCTIC”

is published quarterly in March, June, September, and December. It is the only periodical in the world which gives regular up-to-date news of the Antarctic activities of all the nations at work in the far south. It has a world-wide circulation.

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New Zealand Antarctic Society (Inc.)

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

The society has taken an active part in restoring and maintaining the historic huts in the Ross Dependency and has been involved in the establishment of a national Antarctic centre at the Canterbury Museum, Christchurch.

There are two branches of the society and functions are arranged throughout the year.

You are invited to become a member, South Island residents should write to the Canterbury secretary, North Islanders should write to the Wellington secretary, and overseas residents to the secretary of the New Zealand Society. For addresses, see below. The yearly membership fee is NZ\$4.00 (or equivalent local currency). Membership fee, overseas and local, including “Antarctic”, NZ\$10.00.

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