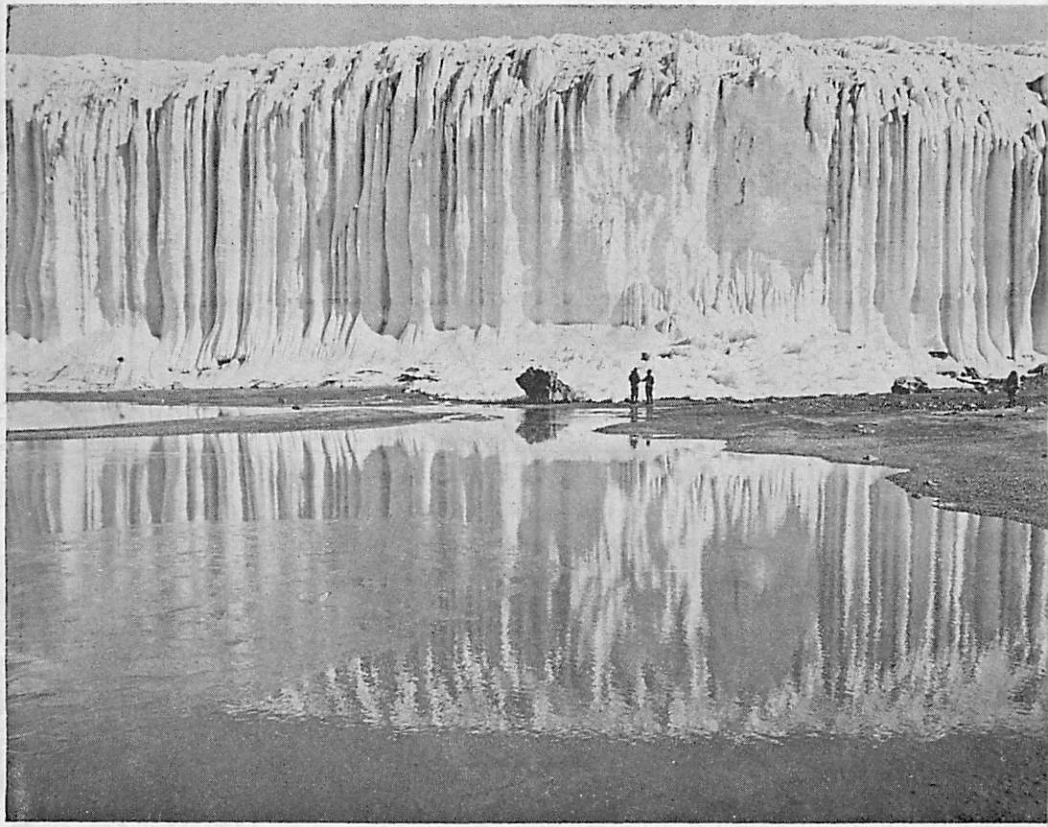
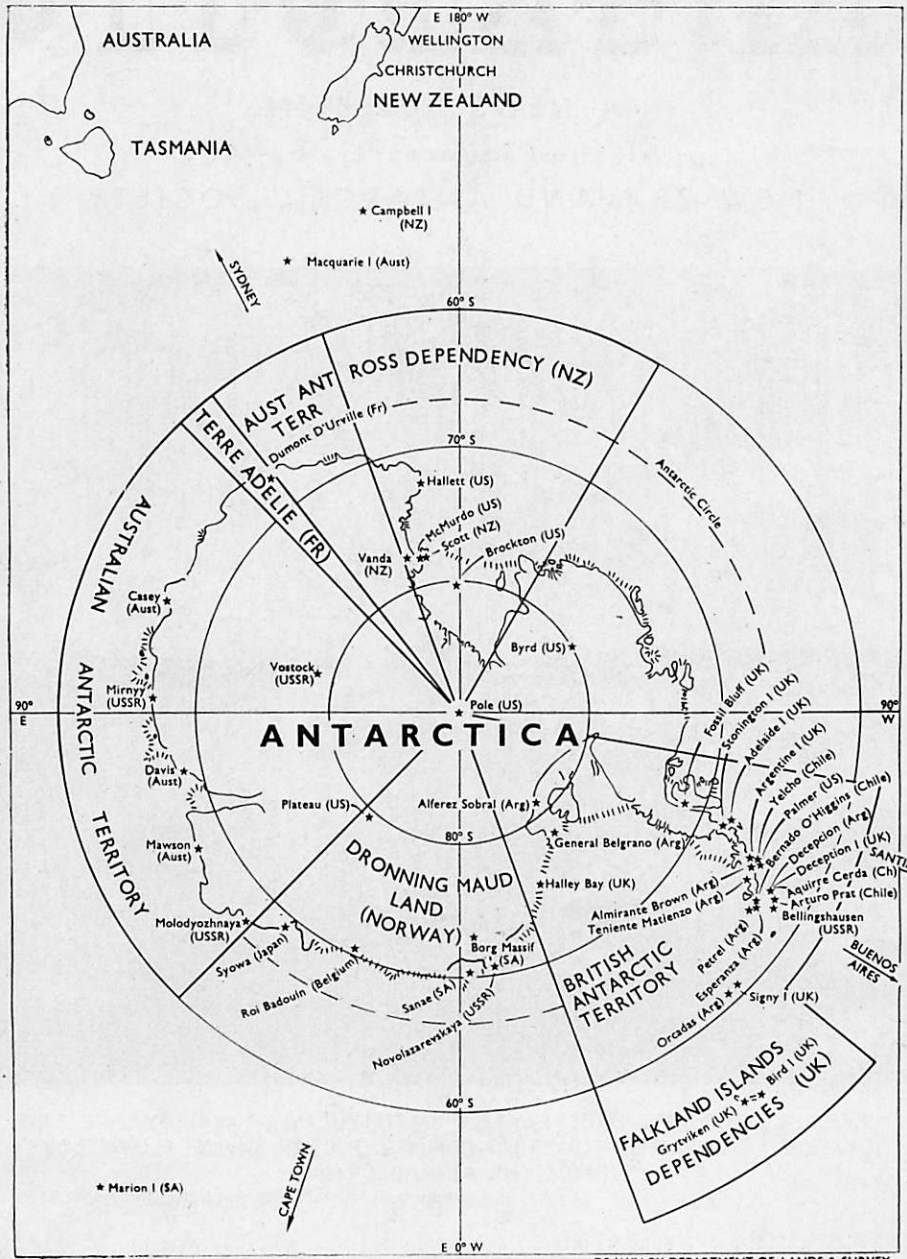
ANTARCTIC

A NEWS BULLETIN
published quarterly by the
NEW ZEALAND ANTARCTIC SOCIETY



THESE VISITORS TO LAKE FRYXELL IN THE TAYLOR VALLEY ARE LIKE DWARFS AGAINST THE TOWERING CANADA GLACIER WHICH FLOWS DOWN FROM THE ASGAARD RANGE.
—Photo by R. K. McBride. Antarctic Division, D.S.I.R.

Vol. 6, No. 7 **September 1972**



N.Z.M.S. 161

DRAWN BY DEPARTMENT OF LANDS & SURVEY
WELLINGTON, NEW ZEALAND, AUG 1969
3rd EDITION

"ANTARCTIC"

(Successor to "Antarctic News Bulletin")

Vol. 6, No. 7 **67th ISSUE** **September 1972**

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Fifteen years have passed since the International Geophysical Year of 1957-58 and it might be thought that the Antarctic Continent, through the continuing research carried out by the participating nations, would by now have yielded up all its secrets.

But this is a false premise; new discoveries in the various branches of science have either highlighted gaps in our knowledge or have pointed the way to investigation in new fields.

Antarctica will remain the Continent for Science into the foreseeable future, and "Antarctic" will continue its task of recording the activities of each country as it slowly but surely probes towards a better understanding of our world.

More New Zealanders in Antarctic This Season

Because of the increased scale of New Zealand's Antarctic research programme for 1972-73 more New Zealanders will be on the continent this summer than ever before. About 70 men and one woman will be involved in various aspects of scientific research, and Royal New Zealand Air Force Hercules aircraft will make ten support flights between November and December, twice the number made last season.

There are two Canadians in the New Zealand Antarctic Research Programme team; they flew to New Zealand specially to be considered for Antarctic positions. Four Japanese will continue their research in the dry valleys, working from Vanda Station, and Americans and Japanese will be associated with New Zealanders in an international drilling project near McMurdo Station.

Apart from the scientists and field staff there will be a number of short-term visitors to the Antarctic this season. These will include some of the delegates to the consultative meeting of the Antarctic Treaty nations, which will be held in Wellington in November. Other visitors will be representatives of scientific organisations.

WINTER TEAM AT SCOTT BASE

Ten men have been selected to winter at Scott Base through 1973. The leader is Major P. G. Frazer, who has been seconded from the Army to the Department of Scientific and Industrial Research. He is a signals expert.

Most of the new team come from the North Island, and all are New Zealand-born. There is one 21-year-old in the team, and the oldest are 42.

Members of the winter party are:

Peter Frazer (30), Auckland. Leader (see "Antarctic", June, 1972, Page 218).

Dennis A. Rapier (42), Napier. Scientific Officer. He is with the Ministry of Works at Napier, and has been engaged on hydrological surveys.

John R. Williams (25), Napier. Technician. He is an electronics technician with the Applied Biochemistry Division, D.S.I.R.

Philip S. Scothern (22), Waihi. Technician. He comes from a radio and television servicing firm in Tauranga.

John P. Housiaux (33), Otaki. Base Engineer. He is a mechanical-welding foreman in Otaki.

Stuart J. Simmers (22), Fairlie. Fitter mechanic. He has been employed as an A grade mechanic in his home town.

Russell W. Reeves (26), Hamilton. Fitter Electrician. A foreman electrician with a Hamilton electrical firm.

John Halewood (38), Blenheim. Cook. He served as a cook in the Royal Navy for six years, including three years aboard the Ark Royal, and has been in the Royal New Zealand Air Force since 1965.

John E. Brown (42), Wellington. Postmaster. H eis a radio inspector from Wellington, and in the last 25 years has served at the Awarua radio station, as superintendent on Niue Island, and in Tonga and the Cook Islands.

Allan J. Dawrant (21), Foxton. Radio technician. He was born and educated in Christchurch, and is a Post Office radio technician from the Himatangi radio station.

Summer Support Staff

Scientists from four universities, the Geological Survey, the Soil Bureau, and the Institute of Nuclear Sciences, will work at or from Scott Base, at Cape Bird, in Northern Victoria Land, and in the Wright Valley during some part of 1972-73. There will be 57 men and one woman in the summer support staff.

The only woman is Mrs Janet Crump, of Wellington. She will work in the Wright Valley with another member of the Victoria University team, and will study the physical limnology of Lake Vanda.

Two Canadians will take part in this year's programme. They flew to New Zealand specially to be considered for Antarctic positions. Four Japanese scientists will work again in the dry valleys.

Mr H. P. Lowe, one of three New Zealanders awarded the Polar Medal.

SCOTT BASE

Shaun M. Norman (29). Deputy Leader. An Englishman with previous experience as a British Antarctic Survey base commander, meteorologist, and general assistant.

Bruce W. Doncaster (35). Storeman. Papakura.

Murray G. Wilson (26). Carpenter. Palmerston North.

John R. Bitters (24). Assistant Maintenance Officer. Napier.

Colin Wise (25). Assistant Maintenance Officer. Wanganui.

Bruce R. Laybourn (21). Information Officer. Dunedin.

FIELD STAFF

Harold P. Lowe (49). Field Officer. Gore. Leader at Vanda Station in 1969-70, and wintered there in 1970.

Laurie K. Cairns (25). Surveyor. Nelson.

Michael F. Mahoney (31). Field Assistant. Christchurch.

John F. Shopland (25). Field Assistant. Wellington.

David E. Sidwell (23). Field Assistant. Auckland.

Ken Blackwood (38). Field Assistant. Dunedin.

Kenneth R. Lefevre (25). Field Assistant. Christchurch.

Kenneth D. Mason (27). Field Assistant. Dunedin.

Mervyn D. Allaway (33). Driller. Auckland.

Bain L. Webster (22). Driller. Wellington.

Frederick J. Ricketts (36). Driller. Auckland.

VANDA STATION

James A. Fowler (28), Wellington. Leader. He is an inspector of technical education with the Department of Education in Wellington, and has a Ph.D. in biochemistry from the University of Wales.

Michael J. Miles (23), Christchurch. Technician.

Ian Brown (44), Wellington. Meteorologist.

Dr. J. A. Fowler

VICTORIA UNIVERSITY

P. Kyle **J. Keys**
A. Freeman **R. Allis**
T. Hunt **Mrs J. Crump**

WAIKATO UNIVERSITY

M. Selby **P. J. Hosking**
C. Nelson **P. Tonkin**

CANTERBURY UNIVERSITY

J. K. Lowry **W. Farrelly**
G. Fenwick **D. Tattle**
P. Sagar

AUCKLAND UNIVERSITY

J. P. Leader

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Soil Bureau: **G. Claridge, J. Campbell.**

Geological Survey: **Dr M. G. Laird, P. B. Andrews, J. Bradshaw** (University of Canterbury) and **M. F. Mahoney.**

Oceanographic Institute: **A. Gilmour, W. de Main, J. Hunt, G. Glasby, J. McDougall.**

Physics and Engineering Laboratory: **R. Brown, M. Andrews, D. E. Randall.**

Institute of Nuclear Sciences: **G. L. Lyon, W. F. Giggenbach, P. Browne.**

MINISTRY OF WORKS

J. K. Fenwick
I. Halstead

DRILLING PROJECT

Dr P. N. Webb, New Zealand co-ordinator.

Caretakers at Cape Royds

For the fourth successive season two members of the New Zealand Antarctic Society will go south to act as caretakers at Cape Royds. The first caretakers in the 1969-70 season were Messrs P. J. Skellerup and M. Orchard. Messrs S. Smith and C. M. Satterthwaite went in the 1970-71 season, and last season's caretakers were Messrs R. G. McElrea and H. Burson.

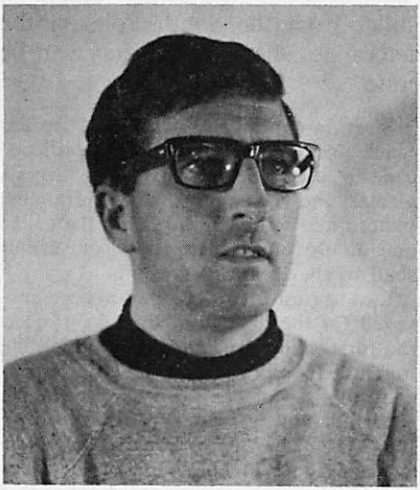
Applications are now being called for two caretakers to spend three weeks at Cape Royds, starting early in December. The Antarctic Division of the Department of Scientific and Industrial Research, which will provide special clothing, transport, food and accommodation, has suggested certain qualifications of value to anyone applying.

These qualifications include interest in one or more of the Antarctic research projects, particularly biology or meteorology, and knowledge of and interest in the historic huts at Cape Royds and Cape Evans, 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.

The two caretakers will be selected by a panel of representatives from the society, the superintendent of the Antactic Division, and the leader at Scott Base for the 1972-73 season. Applications, which close on November 13, can be sent by South Island members to the secretary of the Canterbury Branch, P.O. Box 404, Christchurch. North Island members can apply to the Wellington branch secretary, P.O. Box 2110.

AWARD OF POLAR MEDALS TO N.Z. EXPEDITION MEMBERS

Three members of New Zealand expeditions to Antarctica have been awarded the Polar Medal for distinguished services in scientific research and exploration. They are Mr W. J. Webb, of Sydney, who was leader at Scott Base in 1967-68, Mr H. P. Lowe, of Gore, who was leader at Vanda Station in 1969-70, and Mr I. P. Johnson, of Gisborne, who was technician in charge of the Scott Base laboratory in 1967-68, and spent two winters in the Antarctic.



Mr W. J. Webb

Mr Webb was deputy-leader at Scott Base in 1965-67, and wintered there in 1968. The recommendation for his award said his direction and control contributed much to the success of field party operations during both his terms in Antarctica. As leader at Scott Base he displayed powers of leadership and exceptional ability in many fields of work.

Mr Lowe, who has been selected as field leader for the New Zealand research programme this season, wintered at Vanda Station in 1970. He volunteered at short notice to take over the leadership at a critical and most difficult time. The recommendation for his award said that his capable leadership, practical ability and capacity for hard work under difficult conditions contributed to the outstanding success and scientific achievements of the winter party of four men.

Mr Johnson, who was senior laboratory technician with the 1965-66 summer party, spent the winter at Scott Base in 1966 and 1968. During both years his dedication to his duties and capacity for hard work resulted in the very high performance of all equipment in his care. The recommendation for his award said also that he was an excellent team member, and his assistance to others contributed significantly to the success of both winter parties.

Mr I. P. Johnson

U.S. SCIENCE PROJECTS FOR SUMMER SEASON

Deep-sea drilling in Antarctic waters, starting off the Ross Ice Shelf, and the drilling of a 5000ft hole on Ross Island, near McMurdo Station, as the first stage in the international dry valley drilling project, are among the major projects of the United States Antarctic Research Programme for 1972-73. The topographic and geological survey of the Lassister Coast will be continued for the third season, Siple Station will be operated all the year round, and a survey will be made in the Dufek Massif region of the Pensacola Mountains, about 500 miles from the South Pole on the Weddell Sea side of the continent, to determine whether a runway can be established on blue ice for wheeled aircraft.

This season the programme will include research at the five United States stations, and aboard icebreakers off the Oates Coast of North Victoria Land, and in the Ross Sea. The research ship Eltanin will work in the Southern Indian Ocean, and the research vessel Hero will continue to operate in the Antarctic Peninsula area, working with Palmer Station during the summer.

Winter programmes to be conducted at the South Pole, McMurdo, and Siple Stations will continue to concentrate on atmospheric sciences, while the emphasis at Palmer Station will be on marine biology. The level of scientific effort for the 1972-73 season will remain about the same as in previous years.

Antarctic deep-sea drilling will be done from the 10,500-ton drilling ship Glomar Challenger, which carries equipment capable of drilling and coring in up to 6700 metres of water, and to at least 1000 metres below the ocean floor. The Glomar Challenger will begin the first Antarctic drilling season in December, and concentrate on problems in the south-east Indian and south-west Pacific Oceans.

Three deep drilling sites have been proposed in the Ross Sea area. The Ross Sea shelf holes are designed to complement the Ross Ice Shelf drilling project, which provides for several holes through the ice. It is hoped that the results of the Ross Sea shelf holes of the deep sea project, in conjunction with the Ross Ice Shelf and dry valley drilling projects, can be used to reconstruct the area's glacial and geologic history, drainage pattern and sedimentation, and the cause and nature of the depressed continental shelf of the Ross Sea area.

Last season prospective sites were surveyed for the dry valley drilling project, the first extensive and deep scientific borehole exploration of Antarctic bedrock. This project's primary function is to drill and core sediment and rock in the McMurdo Sound region. A New Zealander, Dr P. N. Webb, of the Geological Survey, will co-ordinate this season's activities by United States, Japanese, and New Zealand scientists. The first hole will be drilled on Ross Island at Arrival Heights, near Hut Point, McMurdo Station, and surveys will also be made of future drill sites in the dry valleys across McMurdo Sound.

For the second year the United States programme will provide support for the French traverse across Wilkes Land from the advance base, Carrefour, about 25 miles from Dumont d'Urville, to the Soviet Vostok Station. The traverse is part of the International Antarctic Glaciological Project, a planned ten-year programme of collaborative glaciological studies of a large part of the East Antarctic ice sheet. Participants in the project are Australia, France, the Soviet Union, and the United States.

Last season the French traverse party completed the first stage early in January in spite of high winds, ground fog, blowing snow, and delayed resupply missions. This season's party will be flown from Christchurch to Carrefour (66deg 50min S/139deg 18min E) by way of McMurdo Station. It will retrace its 800-kilometre route to last season's stopping point (73deg 04min S/128deg 44min E) and then make scientific measurements from that point to Vostok.

The traverse party plans to begin its journey early in Novmeber, and will be supplied with fuel for its vehicles by five air drops, which will be made by Hercules aircraft of the United States Navy's VXE6 Squadron. It will attempt to return to Dumont d'Urville at the end of the season if there is sufficient time to meet the supply ship Thala Dan. If this is not possible it will be flown back to McMurdo Station from Vostok.

This season the National Science Foundation plans to make as complete a film record as possible of all phases of United States Antarctic activities. One or more film teams will make motion pictures of stations, scientists at work, and equipment. They will work from McMurdo, Pole, Siple, Hallett, and Palmer Stations, and the drilling ship Glomar Challenger.

A brief summary of each scientific activity follows.

McMURDO SOUND

Unibersity of California, San Diego. Physiology and biochemistry of freezing resistance in Antarctic fishes. Five scientists, including one woman, led by Dr A. L. DeVries, will continue last season's research on the adaptations which prevent some Antarctic fishes from freezing although they spend their lives at the freezing point of seawater. Scuba dives will be made near McMurdo Station, and three fish houses will be used, one on the sea ice five miles west of Cape Royds.

Virginia Polytechnic Institute and State University. Modelling of Antarctic fresh water and terrestrial ecosystems. This study will be done in the dry valleys for information on the biological communities, physical parameters and pollutant factors of the lakes and streams, with primary emphasis on Lakes Vanda and Bonney. The field leaders are Dr R. C. Heehn and R. Hatcher, and three groups of six will take part at different itmes of the year. The first group will go to Lake Bonney next month.

University of Minnesota. Status and population dynamics of Antarctic seals. Dr D. B. Siniff and his party will continue from McMurdo Station last season's studies of the movement and migration patterns of seals, and collect data on population characters. Radio telemetry and underwater hydrophones will be used at Hutton Cliffs, near McMurdo Station, to monitor the diving and sunning rhythms of the seals. Helicopters will be used in a seal census.

University of Oklahoma Medical Centre. Anatomical, histological, and neuroanatomical study of Antarctic seals. Dr R. E. Coalson, assisted by two men from the university, and Dr A. Watson, of Massey University, New Zealand, will work from McMurdo Station. Adult and young seals will be studied, and the second phase of the project will be conducted aboard the icebreaker Burton Island.

Stanford University. Comparative physiology of the echinoderm body wall with special reference to asteroids and echinoids. Mr B. W. Belman will work on the comparative physiology of the echinoderm body wall of sea urchins and sea stars at the Eklund Biological Centre to obtain data on respiratory rates and on biochemical and histological information. He will obtain specimens by scuba diving.

Texas Technological University. Population dynamics of terrestrial arthropods. Dr R. W. Strandtmann, who worked at Palmer Station last season, will continue this study from the Eklun Biological Centre, seeking information on population densities, distribution, and habitats. Samples will be collected from the dry valleys, the Dailey Islands, Mount Discovery, and Wohlschlag Bay.

University of Wyoming. Measurement of submicron particulate matter in the Antarctic stratosphere. Two balloons carrying dark field microscopes and photo-electric particle counters, will be flown from McMurdo and South Pole Stations to determine the variation in the density of dust particles in the polar atmosphere. Dr R. G. Pinnick's party of three will continue the work done last season. Two flights will be made from each station.

California Institute of Technology. Antarctic microbial ecology. Dr R. E. Cameron's party will continue the Jet Propulsion Laboratory's investigations at McMurdo Station, and the Wright, Taylor, and Victoria Valleys, and the Walcott Glacier, to determine the presence of micro-organisms in Antarctic soils. The party will concentrate on the proposed areas being surveyed for the dry valley drilling project.

Stanford Research Institute. Polar aurora radar system. A party led by Mr C. J. Hodges will continue operations to monitor the radio aural oval at six discrete positions from McMurdo Station. The experiment, which will continue next winter, has four basic objectives: (1) to determine the conjugacy of the radio aurora which differs from visible aurora; (2) to locate the auroral poles; (3) to determine if the auroral belt is conjugate or zonal; (4) to establish a geomagnetic storm index based on the radio auroral belt's position.

Dry Valley Drilling Project. The primary function is to drill and core sediment and rock in the McMurdo Sound region. Dr L. D. McGinnis will lead a part of 25 to 30 from the United States, Japan and New Zealand. The first hole will be drilled on Ross Island about half a mile north of Hut Point, and it is hoped to reach a depth of 5000ft. Future drill sites in the dry valleys will also be studied.

Stanford University. Unmanned geophysical observatory. The observatory will continue to operate at Arrival Heights, McMurdo Station. Three investigators will check the observatory and install new equipment in the capsule. The wind generator and the propane fuel power generator system will be evaluated.

POLE STATION

University of Maryland. Trace metals and halogens in the Antarctic atmosphere. Mr E. Gladney's party will work at the South Pole Station and near McMurdo Station, continuing a study of atmospheric particulate matter. They will examine the particulate concentration of the trace metals aluminium, copper, iron, manganese, nickel, lead and vanadium, and the halogens bromine, chlorine, and iodine.

Lockheed Missiles and Space Company. South Pole photometric observations. A summer and winter party led by Mr E. J. Weber will continue last season's studies of the Aurora Australis at the South Pole. To estimate the efficiency of protons and electrons for exciting aurora, the data obtained will be compared with that obtained from a polar orbiting satellite which will be making direct simultaneous measurements of the particles before aurora inducement.

HALLETT STATION

Iowa State University. Embryology and incubation behaviour of the Adelie penguin. A party of five led by Dr J. R. Baker will continue research on the incubation behaviour and embryonic development of the Adelie penguin. Other studies will include skua population dynamics, pathogens in skuas and penguins, the ecology of the birds at Cape Hallett, and bird banding.

SIPLE STATION

Stanford University. Magnetosphere research in Antarctica. The field leader Mr J. P. Katusfrakis, will have four assistants in summer and two in winter to continue magnetospheric and ionospheric investigations which will concentrate on the plasmapause region. VLF whistlers and other techniques involving passive VLF will be used to study the coupling of the magnetosphere and the ionosphere. These investigations will be linked with the station's geomagnetic

conjugate at Roberval, Quebec, Canada, and data from other Antarctic stations and satellites will be compared to investigate longitudinal effects.

University of Maryland. Energetic electron precipitation near the plasmapause. Eight balloons bearing energetic particle detectors will be launched from the station this summer to measure the flux and energy of particles arriving from the sun. A party of six led by Dr T. J. Rosenberg will conduct the investigation, the purpose of which is to study the relationship of electro-magnetic waves and charged particles, and their interaction.

Bell Telephone Laboratories. Fluxgate magnetometer studies. A three-axis fluxgate magnetometer will be operated on a year-round basis by Stanford University scientists who will winter at the station under the leadership of Mr H. P. Lie. Data from the station, and from three latitudinally oriented stations near Roberval, and a fourth planned in the United States, will be used for studies on the conjugate micropulsations and magnetic storm characteristics of the plasmapause region.

University of Minnesota. Micropulsation observations at Siple Station. A search-coil magnetometer which is sensitive to magnetic micropulsations will be used for measurements in a frequency range which is not accessible at present. The data obtained will be compared with satellite data to examine the relationship of micropulsations and magnetic storms and substorms.

LASSITER COAST

United States Geological Survey. Regional geology and mapping. Six geologists, including the 1971-72 Soviet exchange scientist, Dr E. Kamenev, and three topographic engineers, led by Dr P. D. Rowley, will continue the geological investigation and mapping of the Lassiter Coast area in West Antarctica. The main camp will be located near the Ferguson Nunataks (73deg 33min S/63deg 48min W) and the engineers will be placed near Mount Ballard in the Sweeney Mountains (75deg 12min S/70deg 05min W). The results of this project will tie together the geological structures of the Antarctic Peninsula in the north with those of the coastal areas of Marie Byrd Land and Ellsworth Land to the west. When completed, the study will forge the last link on the geological knowledge of the circum-Pacific mountain belt.

PENSACOLA MOUNTAINS

U.S. Army Cold Regions Research and Engineering Laboratory. Runway site survey in the Pensacola Mountains. A party of three led by Mr A. Kovacs will study the possibility of establishing a blue ice runway for wheeled aircraft in the Pensacola Mountains region. The objective is to determine the economic and operational feasibility of establishing a logistic base in the mountains through which a major amount of cargo would be distributed to outlying sites by aircraft. Three prospective sites have been selected for the survey near the Dufek Massif (82deg 36min S/56deg 30min W). The field party will be put in about 18 miles north-west of Davis Valley (82deg 28min S/51deg 09min W) and will use two tracked vehicles. It will be picked up near Mount Lechner (83deg 14min S/50deg 55min W).

ANTARCTIC PENINSULA

Research in this area will take place at Palmer Station, and in the laboratories of the research vessel Hero. The Hero will work in Arthur Harbour at Norsel Point, and will be used at Port Lockroy, Marguerite Bay, and Deception, Livingston, Adelaide, and Argentine Islands, and in surrounding waters.

University of California, Davis. Biology and ecology of shallow water benthic formaminfera. Working from Palmer Station and the Hero a team of four led by Mr T. E. Delaca will examine the distribution of shallow foraminfera, the relationships of shallow and deep water forms, their community structure, and their population dynamics. Samples will be collected by scuba diving and grab sampling. Three men will remain at Palmer Station for the winter to collect from 100 sites in Arthur Harbour.

Utah State University. Leopard seal behaviour and predation. Biotelemetry and underwater television will be used by Mr J. E. Schmidt's party of two at Norsel Point to collect information on the diurnal behaviour and predation of leopard seals, the principal predators of penguins.

University of Minnesota. Status and population dynamics of seals. In the second phase of the university programme at McMurdo Station Mr R. Hofman's party of two will work from Palmer Station to collect information on leopard seals' dirunal behaviour and predation. It will collaborate with the Utah State University party in the use of biotelemetry and underwater television equipment.

Case Western Reserve University. Peripheral vascular control mechanisms in birds. Dr D. E. Murrish's party of two will study the cardio-vascular blood flow in penguins and the giant petrel to see if they have different rheological properties from birds adapted to temperature climates. This research extends work done in the 1970-71 season. Dr Murrish will survey the Palmer Station biological laboratory as basis for possible extension of comparative physiological winter field research.

University of California, San Diego. Physiological studies on fishes lacking hemoglobin. Dr E. A. Hemmingsen and his party of three will continue their studies of the effects of temperature on hemoglobin-free ice fishes. Emphasis will be on the respiratory and vascular control mechanisms. Specimens will be collected near Arthur Harbour and at Brabant Island.

University of Maine. Ecological investigation of echinoderms. Two scientists will work from the Hero in an investigation of ophiuroids and crinoids near the Argentine Islands and in Lemaine Channel.

Smithsonian Oceonographic Sorting Centre. Collections of benthic organisms. Two scientists on the Hero will collect representative biological materials for distribution through the centre, which is the national repository for biological specimens collected in the United States Antarctic Research Programme.

Ohio State University. Glaciology in the South Shetland Islands. Between December and January Dr N. Ten-Brink's party of two will continue mass balance and climatic studies begun at Deception and Livingston Islands. The investigators will consider the glaciological effects of the volcanic eruptions and work to determine glacier movement.

ICEBREAKER PROGRAMMES

University of Idaho. Dr A. W. Erickson and his party of eight scientists will work from the Coast Guard icebreaker Burton Island on a project to determine the abundance, distribution, and status of Antarctic seal resources so that any future harvesting can be done reasonably. Surveys will be made to compare with similar surveys made previously in the Weddell Sea.

University of Oklahoma Medical Centre. Anatomical, histological and neuroanatomical study of Antarctic seals. Dr W. Felts and Dr M. Bryden will work with the University of Idaho party on the Burton Island in the second phase of the centre's study. The objectives are the same as those in the McMurdo Station project.

WEDDELL SEA

The International Weddell Sea Oceanographic Expedition, last active early in 1970, will be resumed from the middle of January to early March next year. All the projects will be carried out from the Coast Guard icebreaker Glacier.

Scripps Institution of Oceanography. Weddell Sea oceanographic investigation. Dr T. D. Foster's party of seven scientists will measure water temperature, salinity, oxygen, and nutrients to increase the understanding of the formation of Antarctic bottom water in the Weddell Sea.

University of Bergen Geophysical Institute. Thermohaline convection study and recovery of current meters. Dr T. Kvinge's group of three scientists put out a meter array from the Glacier in 1968. The main purpose of this

season's project is to recover the meters for analysis of performance and to recover the data. Thermohaline convection close to the ice will also be studied, and temperature, salinity, currents, and ice crystals will be measured.

Oregon State University. Laminar structure in bottom water. Using portable gear Dr S. Neshyba's party of two scientists will study from the Glacier the horizontal features of the laminar structure of the water column and the relationship between micro-structure and other mixing processes in a frontal zone.

University of Minnesota. Birds of the Antarctic ice pack ecosystem. Two ornithologists, Drs D. F. Parmelee and G. M. Sutton, will accompany the Glacier from McMurdo Station to the end of the Weddell Sea investigation. They will obtain data on birds of the pack ice and get specimens for study of systematics, food habits, and analysis for pesticides and heavy metals.

Instituto Antarctico Chileno. Chilean glaciological project. Six Chilean glaciologists will obtain cores from glaciers in the Antarctic Peninsula. They will be taken to Hughes Bay north of Anvers Island by the Coast Guard icebreaker Northwind.

Scripps Institution of Oceanography. Deep sea drilling project, Glomar Challenger. Attended by the Glacier, the drilling ship Glomar Challenger will begin the first of three seasons of Antarctic drilling on or about February 1. Holes will be drilled at three sites in the Ross Sea this season, the operation ending early in March. General objectives of the drilling and analysis of the core material included examination of (1) the chronology of Gondwanaland separation and areas of possible old sea floor; (2) the volcanic, glacial, and climatic history of Antarctica, particularly near the coast; (3) the biostratigraphy and sediment distribution in the Antarctic; (4) the tectonic history of the Antarctic margin, sub-Antarctic ridges, and islands.

McMurdo Sound Site Survey. Dry valley drilling project. A hole will be drilled in McMurdo Sound as part of the dry valley drilling project in September next year when the ice is strong enough to allow heavy drilling equipment to be set up. Information on the bathymetry and bottom composition of the area between Marble Point and Hut Point will be obtained by Mr R. Bjornert, working from the Coast Guard icebreaker Northwind.

INCINERATOR FOR SCOTT BASE

A high-temperature incinerator will be installed at Scott Base early this summer in an effort to minimise the effect of man on the local environment. New Zealand-made, the incinerator, in kit-set form, will be assembled at the base and used to burn everything except metals. The ash will be spread within a defined area.

Like most coastal stations in the Antarctic Scot Base has disposed of rubbish previously by placing it on the annual sea ice in McMurdo Sound in the hope that it would be carried clear when the ice broke out. But in some years the ice has not broken up, and has been washed up along the foreshore where it has deposited the rubbish.

In recent years more efforts have been made to burn rubbish after it has been placed on the sea ice, but this has been only partly successful. The need to avoid disturbance to marine life in McMurdo Sound has led to the decision to instal a high-temperature incinerator. At McMurdo Station the Americans have done the same.

Mr R. B. Thomson, superintendent of the Antarctic Division, Department of Scientific and Industrial Research, says that in future greater care will be taken in the purchase of stores for use in the Antarctic. Wrappings, packing, and other material not intended for use will be given attention. There are certain types of plastic bags and wrappings which produce toxic gases harmful to natural life when burnt.

Navy's logistic support for American scientists

United States scientific research in the Antarctic will begin officially next month. About 200 scientists from nine universities and ten research organisations will work at five stations, and aboard United States Coast Guard icebreakers off the Oates Coast, and in the Ross, Amundsen, and Weddell Seas. Nearly 2000 men from the United States Navy, Air Force, Coast Guard, and the Army, including about a dozen specialised units, will be involved in logistic support for the operations.

The Navy's 19th consecutive year of support for the United States Antarctic Research Programme began this month on September 7 when two Hercules aircraft of VXE6 Squadron made pre-season flights from Christchurch to McMurdo Station. They took some scientists from the Virginia Polytechnic Institute to make early studies of the biological communities, physical parameters and pollutant factors of the lakes and streams in the McMurdo Sound area, and others from the University of California, San Diego, who will drill holes through the McMurdo Sound ice to study the physiological and biochemical adaptations which prevent Antarctic fishes from freezing in the frigid waters.

For the first time since Operation Deepfreeze began in 1954, there will not be an admiral in command of the support force. Rear-Admiral L. B. McCuddin, last of the seven rear-admirals who have held the Antarctic command, has been posted to command the naval base at Guantanamo in south-east Cuba. His deputy commander and chief of staff, Captain H. W. Swinburne, handed over to the new commander, Captain A. N. Fowler, after they had flown to McMurdo Station on September 7.

Some of the busiest men in the Antarctic this season will be the Seabees of Mobile Construction Battalion 71. They have to complete the construction of the new Siple Station in Ellsworth Land, which will be occupied next winter, and will continue work on the geodesic dome complex to house the new South Pole Station. This station will be ready for summer and winter occupation in the 1974-75 season.

Byrd Station, deep in the heart of Marie Byrd Land, will be re-opened this season as a summer station. It was closed as a winter station at the end of last season after ten years. It will now be used primarily as a fueling stop for aircraft going to and from the new Siple Station at the foot of the Ellsworth Mountains.

Men, mail, fresh food, and cargo were flown to McMurdo Station this month by the two Hercules aircraft, but the major support operations will begin next month. At present there are more than 250 Americans in the Antarctic at McMurdo Station, the South Pole Station, and Palmer Station on the Antarctic Peninsula. There is also one scientist who has spent the winter at the Soviet Vostok Station. By the middle of November there will be more than 1000 Americans on the continent.

Military Airlift Command Starlifters are expected to make 43 turn-around flights this season to Williams Field, about six miles from McMurdo Station on the Ross Sea ice. About 1800 passengers and 20,000lb of cargo will be flown from the United States to Christchurch, and aircraft will take 1750 passengers and more than 1,000,000lb of cargo to the Antarctic from Christchurch.

About 1200 tons of cargo needed early in the season will be brought to Lyttelton, the port of Christchurch, and

nearly 1000 tons of this will go south. The Navy's Hercules aircraft will take on their flights another 500 tons of supplies and urgently needed spare parts, and about 100 tons of fresh food and mail.

This season two cargo ships, the Private John R. Towle and the Mirfak, and, for the fourth consecutive year, the Military Sealift Command tanker Maumee, will deliver supplies and fuel. The ships will carry about 10,000 tons of cargo, the Mirfak and the Towle calling at McMurdo Station in the first three weeks of January next year. About the middle of February the Mirfak will call at Palmer Station to unload 300 tons of cargo and 125,000 gallons of fuel. The Maumee will deliver 5.5 million gallons of fuel, oil, and lubricants to McMurdo Station early in February.

Weather delays first flights to American winter party

Spring begins officially in New Zealand on September 1, but there were no signs of spring at McMurdo Station where 168 Americans have been in winter isolation since February. They celebrated the return of the sun towards the end of last month; their first fresh food and mail for seven months arrived a week later than expected.

Bad weather in the Antarctic delayed the pre-season flights from Christchurch by two Hercules aircraft of VXE6 Squadron and twice the aircraft had to turn back. The third attempt in four days was successful. In past seasons these flights have been described as winter flights although they were made in the New Zealand spring. This season Operation Winfly deserved its name.

Originally the flights with scientists who planned to begin their studies early in the season, and men of the United States Navy's support force who were to prepare Williams Field for the wheeled Air Force Starlifters, were to have been made on September 1. Bad weather caused a 24-hour delay.

After a three-day wait for favourable weather the aircraft were forced to return to Christchurch on September 4 when only 20 minutes short of reaching their point of safe return. There were indications of a storm in the McMurdo Sound area as the aircraft left early in the morning. It was expected to pass but 60-knot winds, blowing snow, and poor visibility were reported when the aircraft had nearly reached the point of commitment to fly on to Williams Field.

A second attempt failed, the aircraft having reached the half-way mark on the 2300-mile flight made on September 5 when the McMurdo Station weather report indicated there had been no expected improvement. High winds with gusts of up to 55 knots were reported.

The weather was favourable for the third attempt, and on September 7 the men at McMurdo Station received about a ton of mail, and their first fresh fruit and vegetables. The men at the Pole Station will have to wait a little longer for theirs.

BRITISH SURVEY NEWS

Halley Bay Station to be Rebuilt This Season

Halley Bay, the largest British Antarctic Survey station, and the only one built on moving ice, will be rebuilt for a second time this season, although on a reduced scale. It was first established by the Royal Society on the Brunt Ice Shelf off the Caird Coast of Coats Land in January, 1956, to prepare for the International Geophysical Year.

In January, 1967, Halley Bay was rebuilt. The original buildings were by then seriously distorted, partly through being buried 50ft below the surface, and partly by differential movements within the ice which had carried the base about three miles from its original position.

The buildings are rapidly deteriorating again, and this time they will be replaced by smaller units constructed in specially designed steel tubes which, it is hoped, will reduce distortion.

Other construction work to be undertaken this season includes a 100ft concrete slipway at Signy Island, in the South Orkney Islands. This is for the use of a 25ft boat which is being built for the marine zoological programme, and will be sent south in the 1972-73 season.

Another de Havilland Twin-Otter aircraft has been acquired by the Survey. It replaces the Turbo-Beaver. Both aircraft will be flown from Canada to the Antarctic Peninsula early next month.

WINTER PROGRAMMES

Winter programmes at the bases and in the field have been progressing, but lack of sea ice on the west coast of the Antarctic Peninsula has curtailed the field programmes. There may be a record ice-free year in this area.

North of Marguerite Bay, Stonington Island, geological and geophysical work was continued on the Arrowsmith Peninsula throughout the winter, and the party returned at the beginning of July. At the same time two other parties set off from the base to complete the links between the surveys to the north and south.

South of Marguerite Bay, glaciologists continued their year's field work on the western side of George VI Sound, but took time off to visit Fossil Bluff for the mid-winter festivities. Continuous bad weather throughout June and July prevented other journeys to and from the Bluff so most of the period was occupied by general maintenance work.

An unusually low temperature of minus 37.2deg Celsius was experienced on Signy Island at the end of June, and by July the sea ice was sufficiently solid to allow marine zoologists to resume work in Borge Bay. Parties were also able to travel over to neighbouring Coronation Island.

The glaciological programme on Hodges Glacier, inland from Grytviken, South Georgia, was seriously interrupted by an avalanche which damaged much of the equipment, some beyond repair. Fortunately, no one was injured. Temperatures remained fairly high on the island, and field work was continued from the Barff Peninsula hut throughout the winter.

NEW POLAR CENTRE

A new polar centre in Cambridge where the various British Antarctic Survey departments can be brought together is now being considered. With the Scott Polar Research Institute and such a centre Cambridge will become the focus of all British polar activities.

All the B.A.S. departments are scattered around the country at present, and none are in permanent accommodation. Therefore the Survey has been negotiating with the University of Cambridge for a site on which to build a new complex to house both scientific and administrative staff.

The Natural Environment Research Council has agreed to provide sufficient funds, and it seems probable that the university authorities will agree to the project. If planning permission is granted in the near future, the complex could be completed by the end of 1974.

There is a total permanent B.A.S. staff of 53 in the United Kingdom, but this is increased to about 140 by those being trained before going south, those writing up their results, and additional secretarial staff employed during the summer. One of the advantages of being in Cambridge would be that Survey staff would have access to the Polar Research Institute library, and various university departments with related interests could assist by providing facilities.

BISCOE'S NEW MASTER

Captain J. Cole, master of the Royal Research Ship John Biscoe for the last three years, has resigned to take up a post as marine superintendent of the Scottish Marine Biological Association at Dunstaffnage near Oban. He has been with the Survey since 1960. His successor is the chief officer, Mr M. Phelps.

This year Sir Vivian Fuchs, director of the Survey, is president of the British Association for the Advancement of Science. His presidential address to the annual meeting this month was entitled "Exploration: Purpose and Personality." Sir Raymond Priestley, acting director 15 years ago when Sir Vivian Fuchs was away on the Trans-Antarctic Expedition, was president of the association then.

CZECHOSLOVAKIAN EXHIBITION

New Zealand will be represented in a permanent Antarctic exhibition which has been established in Czechoslovakia. Maps, booklets, photographs, scientific papers, Ross Dependency stamps, and other material, will be sent to the exhibition by the Antarctic Division of the Department of Scientific and Industrial Research.

A request for material was received from the Czechoslovakian Geological Survey, which has held an Antarctic collection in small rooms at its office in Prague. Now the material has been transferred to the historic State Castle at Nove Mesto, a small town about 85 miles east-north-east of Prague. It will remain there permanently as part of the Geological Survey's collection.

The present collection includes geological and biological data, maps, and photographs, all dealing with Enderby Land, Queen Maud Land, South Victoria Land, Ross Island, and the Transantarctic Mountains. It weighs about one ton, and was gathered during the 11th Soviet Antarctic Expedition in 1966-67, and the 1969-70 United States Antarctic Research Programme. Czechoslovakian scientists have used the material for studies of mechanical weathering, glaciology, and Quaternary geology.

One of the aims of the exhibition is to show the nature of Antarctica in detail, and to present the results of international scientific efforts there. The Geological Survery also wants to popularise Antarctica as the continent of science and peace.

Other Antarctic Treaty nations will be approached to provide material for the exhibition. The Geological Survey hopes to obtain polar clothing and equipment, photographs of Antarctic research stations, flags, badges, and philatelic material.

AUSTRALIAN REPORTS

Traverses from Mawson for summer programme

Preparations are being made to support the ANARE summer glaciological programme in the southern Prince Charles Mountains. A report from the Antarctic Division of the Department of Supply says that several traverses have been made from Mawson to establish fuel depots.

A biological laboratory has been installed at Mawson. The Auster Emperor penguin rookery 35 miles north-east of the station has been visited. Annual counts are made of the breeding population which fluctuates around 15,000 pairs.

The glaciology programme is being continued from Casey. Thermal core drilling is being done near the coast. It is planned to bore more holes to a depth of about 660ft and about 60 miles inland.

In Australia studies of the cores taken from the ice cap near Casey are continuing. These cores were taken from depths of 1122ft at an elevation of 825ft, and 1254ft at an elevation of 4620ft. The principal investigation includes studies of isotope ratios, crustal orientation fabrics and deformation rates. Additional samples from the ice cape surface along the flow line were returned to Australia in March this year.

Population studies of the light-mantled and wandering albatrosses on Macquarie Island are continuing. Chicks of these species were banded at the end of the summer season.

NEW ISLAND MAP

A large-scale (1:50,000) four-colour map of Macquarie Island has been printed recently. It is the first to have been published since that presented by Sir Douglas Mawson in his "Australasian Antarctic Expedition Reports."

The map was compiled by the Department of National Mapping, Canberra, from oblique air photography and terrestrial photography done by Australian National Antarctic Research Expeditions (1947-1969) and ANARE land surveys in 1950, 1958, and 1969 which provided horizontal and vertical control. Supplementary information came from Australasian Antarctic Expedition surveys (1911-1913) and from British Admiralty Chart No. 1022.

The contour interval on the map is 165ft from mean sea level, and it has transverse Mercator projection, Australian national spheroid. Names were approved by the Nomenclature Board of Tasmania.

GLACIOLOGIST'S AWARD

For the first time the Edgeworth David Medal has been awarded in the field of glaciology. The recipient of the 1971 award by the Royal Society of New South Wales is Dr W. F. Budd, senior glaciologist of the Antarctic Division, Department of Supply.

This medal is awarded to Australian scientists under the age of 35 who have made distinguished contributions to any branch of science. Dr Budd received the award in recognition of his outstanding achievements in glaciological research.

The medal commemorates Professor Sir Edgeworth David's achievements in Antarctic research. He was chief scientist of Shackleton's 1907-1909 expedition, and leader of the first party to reach and establish the position of the South Magnetic Pole. The other members of the party were Sir Douglas Mawson and Dr A. F. Mackay.

SUB-ANTARCTIC

GIANT CRABS AND LETTUCE ON CAMPBELL ISLAND MENU

Giant crabs and hot-house lettuces were on the menu when Mid-Winter's Day was celebrated on Campbell Island. All members of the expedition braved a sou'-west gale, a freezing temperature, and three inches of snow on the wharf, for the traditional mid-winter swim. The first mail, fresh fruit and vegetables for six months were dropped by the Royal New Zealand Air Force a month later.

In a report from the island this month the leader, Vince Sussmilch, says that winter arrived in earnest in early April, and truly exploded the myth that Campbell Island has little snow. For days on end snow lying to sea level became a monotonous note on the weather reports. Deep snow continued to build up on the higher peaks, and mini glaciers developed on Mount Honey.

June was a particularly vigorous month, gales being experienced on nearly half of the 30 days. The station water supply, frequently frozen, became chronically low because the gales blew off the roofs the snow normally collected for melting.

July 21 was a big day when an R.N.Z.A.F. Orion dropped our first mail, fresh fruit, and vegetables. In spite of a very turbulent north-westerly eight containers were dropped by parachute at the new dropping zone between Tucker and Camp Coves. Turbulence from Beeman Hill and Lyall Ridge affected the Orion's first run in, and later approaches were made up South-East Harbour between Mount Honey and Eboule Peak rather than Perseverance Harbour. Within half an hour of the Orion's departure the weather closed in with murk down to 100ft and a howling easterly.

In spite of the weather work at the station has continued at a tremendous pace. Improvements have been made to the outside of the station, the interior of the meteorological building has been decorated, and a large painting programme has been undertaken on the technical building and the hostel.

An ambitious plan to take much of the hard labour out of the annual servicing has almost been completed by the construction of two trailers which will hold six 44-gallon diesel fuel drums, and can be towed by the tractor. A new steeper road leading from the wharf to the new diesel fuel dump has been completed. Numerous other projects are nearing completion, and, says Sussmilch, we feel that we will certainly be leaving the station a much better place to live and work in.

Four members of the team will remain on Campbell Island for part or all of the 1972-73 season under the leadership of Graham Canfield. Two meteorological observers, H. Crompton and S. Wilkinson, will remain for the summer, and W. Clark (mechanic) and J. Plumber (electronic technician) will stay for a second year.

LAND UNDER ICE REVEALED

Some areas once believed to be part of the Antarctic Continent, like Enderby, Queen Maud, and Wilkes Lands, have been revealed as islands and archipelagoes in a new map of the continent.

The map shows that the eastern part of the continent is flat with low hills while the western part is mountainous.

New Soviet Station on Icebound Hobbs Coast

This season the U.S.S.R. may establish its seventh research station in the Antarctic. The site chosen after a reconnaissance late last season by the Ob is at Cape Burks at the entrance to Cordell Hull Bay off the Hobbs Coast of Marie Byrd Land. Cape Burks is in what the Russians describe as a still "blank" part of West Antarctica, and its approximate location is 74deg 40min S/137deg 30min W.

Nearly two years ago there was a Soviet report that the new station—the sixth on the Antarctic coast—was likely to be established at Cape Dart, which lies at the foot of Mount Siple on Siple Island in the Amundsen Sea. Siple Island lies off the Getz Ice Shelf, and it is located at 73deg 6min S/126deg 20min W. Now the Russians have decided on a site for a station—likely to be called Russkaya—which is equally difficult of access.

COOK WAS FIRST

In nearly 200 years few ships have penetrated far into the "blank" part of West Antarctic. Cook was there first in the Resolution, and came closest to the South Pole on January 30, 1774, when he reached his Ne Plus Ultra, not far from the Walgreen Coast of Marie Byrd Land at 71deg 10min S/106deg 54 W. He was the first to write of huge ice islands, fogs, gales, and blizzards.

Next came two tiny ships of the United States Exploring Expedition led by Lieutenant Charles Wilkes. In the early months of 1839 the Peacock and the Flying Fish, battered by gales, enshrouded by fog, and plagued by snow and ice, sailed southward to the edge of the pack guarding what has been called the Phantom Coast.

On March 25 the Peacock reached 68deg 05min S/96deg 06min. But the Flying Fish penetrated further south, and nearly beat Cook's record. Working along the edge of the pack and pushing south, she reached 70deg S/101deg 16min W on March 22. Her position, about 110 nautical miles north of Thurson Island, was somewhat short of Cook's farthest south, but it was actually slightly nearer the coast since it was farther east.

Nearly 100 years later Rear Admiral R. E. Byrd made two unsuccessful attempts to work his way along the coast of Marie Byrd Land inside the pack ice. He followed the route used by Scott around Cape Colbeck, but the Jacob Ruppert, having passed safely through the vast fleets of icebergs in what Byrd called the Devil's Graveyard, was stopped by a dense tangle of ice floes. And like the Resolution, the Peacock, and the Flying Fish, Byrd's ship met gales, snow, and fog—"damp, loathsome, clinging and treacherous" Byrd wrote of it in "Discovery". Nevertheless the Jacob Ruppert, a tramp lumber ship with a shell of $\frac{7}{8}$in steel, reached 70deg 02min S/116deg 35min W on January 1, 1934. Then she had to retreat as there were heavy ice fields in all directions, and a solid wall of bergs well down on the horizon.

BEAR OF OAKLAND

Byrd was more successful when he sailed south for the third time as leader of the United States Antarctic Service Expedition of 1939-41. The old sealer Bear, originally the Bear of Oakland used on his second expedition, headed east in an effort to sail inside the pack along the coast of Marie Byrd Land. She sailed more than 140 miles further eastward than any ship ever had in this area, and on January 25, 1940, was able to moor against heavy old pack ice at 74deg 43min S/143deg 52min 30sec W.

Long reconnaissance flights were made by a twin-engined seaplane carried on the ship. One of these on January 26 covered a track 120 miles eastward to about 135deg W and roughly parallel to the shores of what Byrd named the Hobbs Coast. He also named Cordell Hull Bay where the Russian station will be established.

Two men who later played important parts in Antarctic exploration were aboard the Bear with Byrd. The commander was Captain Richard Cruzen, who, as a rear-admiral, was the task force commander of the United States Navy's Operation Highjump in 1946-47. The ship's navigator was Lieutenant George Dufek, later to become the first commander of Operation Deepfreeze.

GLACIER'S TRIP

No ships entered the "blank" part of West Antarctic until 1962. Then the United States Navy icebreaker Glacier, commanded by Captain Edwin A. MacDonald, deputy to Rear-Admiral Dufek, explored and surveyed the Marie Byrd Land coastal area. She followed the 1940 track of Byrd in the Bear along the Hobbs Coast, working in an area never before traversed by ship.

The Glacier battled her way along the coast ice front and made her way through leads in the pack ice between vast accumulations of huge and closely grouped bergs. She reached Cordell Hull Bay at the end of January, and on February 1 a shore party was landed on an exposed bluff near the Cordell Hull Glacier.

An Adelie penguin rookery containing 400 birds was found by the shore party, which collected rock samples and took position sights. Nine separate peaks or promontories of recently exposed rock were sighted along the coast, and at 74deg 40min S/140deg 06min W the Glacier sighted a rocky crag about two miles square and 1000ft high. It was composed of black and coal-like rock, possibly of volcanic origin.

How far the Ob penetrated the ice-bound shores of the Hobbs Coast in its reconnaissance is not known. She was in the area extremely late in the season, but it is assumed that she used her helicopter to select a suitable site for the new station.

* * *

SOVIET WOMEN SCIENTISTS ENERGETIC PERSUADERS

Soviet women scientists were able to work in the Antarctic several years before their American and New Zealand sisters entered an all-male preserve. But they have had to be equally persistent in order to persuade administrators to allow them to join Antarctic expeditions.

Mrs Pamela Young, who worked with the University of Canterbury research unit at Cape Bird in the 1969-70 season, is described by a Soviet writer, Liya Shevchenko, as one of the first women to explore the Antarctic. But she says that nine years ago Vera Konovalova, a hydro-chemist from Leningrad, travelled deep into the Antarctic Continent, and has been there twice since then.

A woman zoologist, Vera Korotkevich, has also worked in the Antarctic, but only after persistent efforts. "I must admit that getting accepted as a member of the expedition was the most difficult part of the trip," she told Liya Shevchenko. "All the officials I met flatly refused me and said that the job in the Antarctic was purely men's work. But I insisted and finally won. Now I have every reason to say that women work no less fruitfully than men in Antarctic

conditions, and have led the way for other women who have gone down there since."

Vera Korotkevich is engaged in the study of Nemertina, the curious animals which resemble earthworms, but are flat. She discovered and described many new varieties of these in Antarctica as well as many new varieties of invertebrates. She also found and studied mosses, plankton, and benthos.

Dr Alexei Treshnikov, head of the Arctic and Antarctic Institute in Leningrad, says there are now more women in the Arctic—hundreds of thousands in fact—and it has become warmer as a result. But in the Antarctic there are none of the facilities of civilised living which exist in the Arctic, and therefore there is reluctance to let women join Antarctic expeditions.

"Nevertheless they do energetically persuade us to let them work down there," he says drily.

N.Z. DOCTOR PLANS TO SAIL 32FT YACHT SOLO TO ANTARCTIC

A New Zealand-born doctor who has sailed a catamaran round the world, and a yacht single-handed across the North Atlantic, will attempt to sail alone in his 32ft steel-hulled sloop Ice Bird to the Antarctic Peninsula from Australia. Dr David Lewis plans to leave Sydney on October 15, and expects to reach the Antarctic in February next year. The voyage south and back should take about five months.

Dr Lewis, a 49-year-old research fellow at the Research School of Pacific Studies of the Australian National University in Canberra, will skirt New Zealand on his voyage as far as the 60th parallel. He will continue in this latitude to the Antarctic Peninsula. He says that he will make the trip because of a love of adventure, and that a summer voyage will enable him to avoid such hazards as heavy seas and ice in the rigging.

The Royal Australian Navy has helped Dr Lewis with advice on making radio contacts. When he reaches the Antarctic Peninsula he intends to get in touch with British, Chilean, Argentinian, and Russian stations. He has arranged for the Scott Polar Research Institute to send him warnings of pack ice and bergs by satellite.

An authority on the early Polynesian navigators and their journeys in the Pacific, Dr Lewis has sailed in the Arctic and round Cape Horn. He has also studied the psychological effects of long sea voyages during his voyage round the world, which took three years.

Dr Lewis was educated in New Zealand and at a native school in Rarotonga. He graduated from Leeds University in 1942, and practised medicine in the East End of London for many years. In 1963 he sailed his 44ft catamaran Rehu Moana (Ocean Spray) to Greenland, and made two unsuccessful attempts to enter the Greenland Sea. A year later he competed in the single-handed trans-Atlantic yacht race. He made two other single-handed voyages.

Early in 1964 Dr Lewis gave up his medical practice, and with his family—his wife and two young children—and Miss Priscilla Cairns—sailed from Plymouth in a 41,540-mile voyage around the world, which took three years to complete, and was the first ever made by catamaran. On this voyage Dr Lewis followed the route of Captain Slocum, the first man ever to sail around the world alone.

To mark the voyage Dr Lewis was named New Zealand "Yachtsman of the Year" in 1965. When he returned to

Plymouth in 1967, not long after Sir Francis Chichester had completed his solo voyage around the world, he was also named "Traveller of the Year."

In 1968 Dr Lewis and his family, aboard the ketch Isbjorn, set off from Plymouth on another voyage to the Pacific to try to solve how the ancient Polynesians crossed oceans without navigational instruments. He was awarded a fellowship by the Australian National University for this research.

Dr Lewis covered 13,000 miles in the western Pacific during his research project, sailing 1680 miles in open sea without instruments, being guided by island navigators.

Few yachts have ventured far into Antarctic waters. One which did was a 53ft ferro-cement cutter, the Awahnee, which made a unique circumnavigation of the continent in 1970-71. The Awahnee, designed and built in 1964-65 by an American, Dr R. Griffith and his wife, Nancy, made her voyage from New Zealand at 60deg South. She was 58 days at sea and covered 12,755 miles.

Dr Griffith and his wife took their son and three New Zealanders as crew on the voyage, which began from Bluff, New Zealand's southernmost port. On March 4, 1971, the Awahnee crossed the Antarctic Circle at a point opposite the Riiser-Larsen Peninsula of the Prince Harald Coast.

In January and February of 1971 the Awahnee called at United States, British, Russian, Chilean and Argentinean base on the islands off the Antarctic Peninsula. When she returned to Palmer Station on Anvers Island the crew met an Italian yacht, the San Giuseppe.

VOLUME V INDEX

Subscribers to "Antarctic" are reminded that the index to Volume V (1968-70) has been printed. Copies can be obtained from the New Zealand secretary, P.O. Box 1223, Christchurch. The price is 35 cents in New Zealand currency or the local equivalent.

Penguins Supply Answer

Penguins have supplied the answer to Soviet designers who wondered what kind of vehicle was needed to travel through loose Antarctic snow without sinking in it.

When Dr A. Nikolayev, of the Polytechnical Institute in Gorky, visited the Antarctic he saw serious flaws in many of the machines that were being used. But he found that penguins could travel in very loose snow at 15 miles an hour by gliding on their bellies and propelling themselves with their flippers. As a result something is being built at Gorky that works on the same principle, using paddles, and a hull with a coating of polyfluoroethylene resin.

According to Dr Nikolayev, the Antarctic needs machines which can "walk" over wide gaps, can climb slopes, and can move safely along iced areas without the danger of landing in the water if they hit an unfrozen patch. Designers at the institute are now testing a "go anywhere" vehicle with foam rubber filled rotary screw propellers. It can move on water and ice, and the basic vehicle will be the starting point for a whole family of ice-cutting machines.

Machines for working frozen ground and ice have been developed by the institute. The ice-cutting machine has a spiral mill fitted with cutting bits, which bores holes in 3ft thick ice at a speed of about 450ft an hour.

A portable, reliable, and efficient machine for building airfields in the Antarctic ice is also being developed. Other equipment under development includes a hydrographic drilling unit, and a small ice-hole fishing unit with a boring device and a storage place for the catch.

SOUTH AFRICAN NEWS

Men at Sanae and Borga ready for summer trips

With the return of the sun 15 men at SANAE, the South African National Antarctic Expedition station in western Queen Maud Land are now planning trips to Borga Base 235 miles south in the Borg Massif, and Draaipunt, to stock the route with fuel and food. They and the other five men of SANAE 13 who have wintered at Borga Base will be relieved in January next year when the SANAE 14 team sails for the Antarctic.

SANAE is on the Fimbul Ice Shelf off the Princess Martha Coast. A new base was built at the beginning of last year by the South African Public Works Department when the SANAE 12 team took over for the 1971 expedition. It is about 1½ miles east-south-east of the old station.

A report from the Department of Transport, which administers the Antarctic research programmes and expeditions, says that the supply ship, RSA, left Cape Town on January 6 for the annual relief voyage to SANAE. On board were the members of SANAE 13, the Public Works Department maintenance staff, and a guest, Mr C. Read, of the British Antarctic Survey. Because of very good weather the RSA was off-loaded in only six days.

FAST TRIP TO BASE

The new team settled down quickly, and the five men assigned to Borga Base were able to leave shortly after the RSA sailed. They made a very fast trip to the base, which is at a height of 7920ft in the Borg Massif, and still had enough time to reach Pyramiden Nunatak to fetch fuel and to do some radio echo-sounding. The geologist, C. L. J. Minaar, also made a few excursions near the base but unsettled weather prevented any real geological mapping.

Other members of the Borga Base team are R. Sevcik (surveyor), J. A. Jacobs (medical orderly), I. J. H. Bennett (radio-radar technician), and W. J. H. Venter (mechanic). The team settled in well and prepared to sit out the winter, spending their time overhauling equipment and doing routine observations.

TRAVERSES PLANNED

After the winter the team will split into two parties. One will concentrate on the geological mapping of the nunataks around and to the north-west of Borga Base. The other will do over-snow traverses in the area to the south and west of Borga Base. Traverse observations will include radio echo-sounding, glaciology, gravity, magnetics, and some surveying. The whole team will return to SANAE in January.

The rest of the team at SANAE continued their routine observations. Apart from seismology and the meteorology programme, the other programmes carried out at SANAE are upper air programmes such as cosmic rays, ionosphere, geomagnetism, air glow, and whistlers and micro-pulsations.

Members of the SANAE team are: R. J. Brandt (leader), J. R. Pitcher (doctor and deputy leader), G. O. Hollamby (senior mechanic), D. J. Coetzee (mechanic), F. H. Schneider (radio technician), R. B. van Zyl (electronics and instrumentation technician), J. A. Williams (physicist, whistlers and micro-pulsations), J. N. Kriel (physicist, cosmic rays), D. da S.

Almeida (physicist, geomagnetism), N. P. Skitt (physicist, ionosphere), K. J. Moir (senior technician, meteorology), J. A. Taljard (senior technician, meteorology), J. A. Naude (senior technician, meteorology), L. G. Fourie and P. J. van Zyl (communicators).

MARION ISLAND RESEARCH

A team of eight men took over on Marion Island from the 28th team in April this year. Four biologists who had spent four months on the island returned to South Africa in the relief ship. They were taken to the island by the French supply ship Gallieni in December last year.

Biological research on the island will undoubtedly benefit from a new biological laboratory which was completed during the last relief voyage. Ionospheric and geomagnetic observations were also started in May this year. It seems as if the station is changing from a purely meteorological observation station into a scientific station.

Members of the present team, which will return to South Africa in April next year are: J. D. Langford (leader and medical orderly), H. Tiggelman (senior technician, meteorology), F. Krynauw, D. Taljaard, F. Potgieter (technicians, meteorology), J. Coetzee (technician, radio), I. Pretorius (radio operator), L. Heinonen (technician, geomagnetism and ionosphere).

GOUGH ISLAND EMERGENCY

In June this year the radio operator on Gough Island became ill and had to be brought back to South Africa for urgent treatment. Thanks to the efficiency of the South African Navy the frigate President Steyn was able to sail for Gough Island in record time.

Weather conditions at the island were extremely bad, and the ship's helicopter could not be used because of a very strong wind. The captain had to resort to the gemini boat—a rubber dinghy fitted with an outboard engine. In spite of very rough seas and, at the end, complete darkness, the radio operator was fastened to a stretcher, lowered by crane to the dinghy, and taken on board.

The RSA is due to sail for Gough Island on October 14 to relieve the present team and to take the necessary supplies. During her voyage she will also visit Tristan da Cunha to take supplies ordered by the islanders.

Members of the present Gough Island team are: J. R. van der Merwe (leader and senior technician, meteorology), S. I. Basson, J. Coetzer, C. M. Moolman (technicians, meteorology), H. J. Fourie (technician, radio), P. J. S. van Niekerk (radio operator), P. J. Jacobsen (medical orderly). The new team will be: C. Hattingh (senior technician, meteorology), J. M. Hoon, J. J. Neethling, D. I. Rosswell (technicians, meteorology), M. A. Perks (technician, radio), P. H. Vosloo (radio operator), C. Schultz (medical orderly).

COLLECTION OF WILD LIFE

Emperor and Adelie penguins, and seals, for the Canterbury Museum's national Antarctic centre will be collected in January by a museum zoologist, Mr G. A. Tunnicliffe, who made similar collections of wild life in 1967.

Permission has been granted by the Ross Dependency Research Committee for the following specimens to be taken: Seven Adelie and five Emperor penguins; one Antarctic petrel and one Antarctic tern; one leopard seal and pup; one crabeater seal and pup; and one Ross seal and pup. Mr Tunnicliffe hopes to fill the quota as far as possible with animals which have died naturally.

SECOND-IN-COMMAND
Armitage of the Discovery

By A. G. E. Jones

The men who led the polar expeditions at the end of the 19th century and at the beginning of the 20th century are well known. Those who (as seconds-in-command) contributed so much to the success of the ventures are largely forgotten.

One of these men was A. B. Armitage, who served for three years with the Jackson-Harmsworth expedition to Franz Josef Land and then for three years with Commander R. F. Scott in the Discovery.

Armitage's work has been overlooked partly because he was reticent about the part he played, and partly because he was involved in no great tragedy to catch the headlines. If expeditions had been dispatched in the 1890's when Sir James Murray and Sir Clements Markham were urging that they should be sent, Armitage might have had a chance to play a more prominent part; but when he returned with the Discovery in 1904 he was too old to lead an independent expedition. And he had deprived himself of an opportunity to make his mark in polar history by throwing in his lot with Scott.

If he had been born a couple of decades later he would have found more scope. But, as it was, he made a not insignificant contribution to two expeditions, as scientist and second-in-command.

Albert Borlase Armitage was born at Balquhidder in Scotland on July 2, 1864. His father, a physician, was spending a summer holiday there, and soon afterwards the family settled in Scarborough where he was brought up as a boy.

At the age of 14, Armitage joined the Worcester for his nautical training and in 1879 he passed out with a first class in seamanship and a first class extra in navigation. His first voyage was in the Plassey to Calcutta, Demerara and London. Then he served as first mate in the Lucknow to Calcutta and the West Indies, carrying Indian labourers to the Caribbean in each case.[1]

In 1886 he entered the service of the Peninsular and Oriental Steam Navigation Company as fifth mate of the Bokhara, a screw steamer of 2944 tons, then served in the Victoria, and the Surat, a steamer of 3142 tons, all three voyages being to the Far East. Promotion came steadily, and in 1888-89 he was the first mate in the Siam, Ganges, and Bengal, large vessels trading to the Far East.

Armitage became third officer of the Bengal in 1889, afterwards serving in the Arcadia (in which he made his first visit to Australia), the Sutlej, and the Parramatta, each in turn a larger vessel. He was appointed second officer in the Bombay on a voyage to China in 1892, and it was when he returned to England in 1894 that he was given the opportunity of taking part in polar exploration.[2]

JACKSON-HARMSWORTH EXPEDITION

It was the young, enterprising Alfred Harmsworth, founder of the "Daily Mail," who changed the course of Armitage's career. Harmsworth, who had just become a Fellow of the Royal Geographical Society, wished the Union

Jack to be the first flag flown at the North Pole.

The expedition was planned by Frederick George Jackson who had travelled in the Australian deserts and the tundra of Siberia. He had the hope that Petermann Land in Franz Josef Land would be found to extend northwards for a considerable distance and that with pony sledges he would be able to reach a high latitude in addition to achieving an extensive scientific programme.[3]

Jackson needed a good man as observer; he approached the P & O through Captain Wilson-Barker, captain-superintendent of the Worcester, specifying that he must be an old Worcester boy. The directors of the P & O gave Armitage the opportunity of taking the appointment, which he accepted. Shortly before the Windward sailed for Franz Josef Land, Harmsworth appointed him second-in-command. He also had charge of the astronomical, meteorological and magnetic observations.[4]

TO FRANZ JOSEF LAND

It is difficult to describe the part which Armitage played in this expedition. Jackson was a man who he never really got to know, a man who spoke in a staccato way, barking at his crew; and Armitage himself wrote little about his experiences.

Jackson's narrative, "A Thousand Days in the Arctic," published in 1899, was largely an extract from his journal, with little comment and appraisal of the work of the members of the expedition, but he did refer briefly to Armitage:

> "To the energy and industry of Mr Armitage is due the carefully recorded meteorological, astronomical and magnetic observations extending over three years and he in common with all members of the party lent every assistance to the advancement of every branch of science coming under our notice, for each man helped the other to the utmost of his ability. We have been together through rough times, and many dangers and hardships together, and I know the good material of which he is made."[5]

It was due to his experience as a navigator that Armitage rated Nansen's chronometers when they met him in Franz Josef Land, thereby allowing Nansen to plot his track accurately. The Royal Geographical Society gave Armitage its Murchison Award in 1899 for his valuable scientific observations.

Two important points arose from his experience in the Arctic. Firstly, he was impressed with the value of ponies for sledge travel, believing that Siberian ponies would do better than dogs. His ideas were followed by Shackleton and Scott in the Antarctic where the lower temperatures and different snow conditions led to their failure.

SCURVY PRECAUTIOUS

Secondly, Jackson had made up his mind before he started that, though he would have a considerable variety of tinned food, he would use fresh meat as much as he could. Leigh Smith's party, which had wintered in Franz Josef Land under very hard conditions and without lime juice, depended on newly killed fresh meat and had escaped scurvy. Jackson concluded that scurvy was caused by eating tainted food and that lime juice was ineffective. With the help and guidance of Dr Koettlitz (who later served as surgeon in the Discovery) there was no scurvy on Jackson's expedition. Armitage took this valuable knowledge with him to the Antarctic.[6]

In October, 1896, when he was still in Franz Josef Land, Armitage was granted seniority as chief officer and as such he was appointed to the Osiris, twin-screw steamer, 1728 tons (then fitting out for the Port Said service) in May, 1898, and he made more than one voyage while serving on that run. In 1899 he became chief officer in the Java, a much larger steamer, in which he made two voyages to the Far East.[7]

NATIONAL ANTARCTIC EXPEDITION

When he was in Hong Kong, Armitage received a letter from Sir Clements Markham, president of the Royal Geographical Society, telling him about the proposed National Antarctic Expedition,

and asking him to join as navigator and second-in-command. Although when he met Scott he could see that he would have to act as adviser and dry nurse, he felt that he could work with Scott and agreed to go. On January 27, 1901, he was appointed mate of the steam yacht Discovery, 736 tons, Robert F. Scott, master, at a salary of 1s a month for a voyage described as: "London to Portsmouth—thence to Lyttelton, N.Z., calling at any intermediate ports and places—thence to any places in the Antarctic regions, and the Australian colonies to and from for any period not exceeding five (5) years and back to the port of final discharge in England."

Armitage was asked by Scott to procure clothing and equipment, and was put in charge of the magnetic observations at sea.[8]

Markham agreed to his appointment being independent of Scott, that he should be landed (if possible) with a hut and equipment for two years, seven men, one of the surgeons and a team of dogs with freedom to carry out such sledging as he chose; but when the Discovery reached the Antarctic Scott implored him to give up his programme as it would cripple his (Scott's) efforts and because Scott could not do without him. Armitage consented to stay with the main party and passed two seasons in McMurdo Sound.[9]

DISCOVERY'S VOYAGES

As navigator of the Discovery Armitage took her farther east into the ice than any craft had been in such a high latitude, and discovered King Edward VII Land. He described this part of the voyage in the following words: "On endeavouring to proceed, we found ourselves embayed. Young ice was forming rapidly . . . we had been steering in a circle in a large bay formed in the fast ice. We managed to push a little way into the pack, but it was so heavy and the young ice forming so rapidly, that we determined to return to McMurdo Sound . . ."

After more ice experience, Scott felt that he would not have made the same decision; but following a lapse of more than 70 years it would be difficult to apportion the responsibility between Scott and Armitage. The Discovery made for McMurdo Sound where Scott set up his winter base.[10]

Lieutenant Armitage, R.N.R.

During the winter, Armitage re-worked his summer navigational data, corrected his magnetic observations and occasionally rated the chronometers by taking star sights with the large theodolite, in addition to his duties as mate. During the winter the sledge equipment was prepared; and it is worth noting that, whereas Scott discussed the merits of McClintock's and Nansen's sledges and even went back to Parry's expeditions, he made no reference to Jackson's more recent experience.

It must have been galling for Armitage, with three years of Arctic experience behind him, to have his advice ignored by Scott; but as Armitage said,

"Scott was of that calibre, that type of man who must prove a thing for himself more than once. And in the Polar regions the proof is only too often death!"[11]

In the spring Armitage made a sledge journey to bring in provisions cached in the previous autumn. In the summer of 1902-03 the major sledge expeditions took place. Scott, Shackleton and Wilson made their way south to latitude 82deg 16min 33sec S, and returned in poor shape; but Armitage mentioned that Shackleton was not as sick as Scott, and he and Dr Koettlitz protested when Shackleton was sent home in the Morning.[12]

FIRST ON THE ICE CAP

Armitage was given the task of exploring the mountains on the western shore of McMurdo Sound. First of all he made a reconnaissance with Ferrar (the geologist) and four men and provisions for 14 days, making his way to the Ferrar Glacier. Signs of scurvy among his party caused him to return, but had he been able to continue for another two hours he would have found the way up the glacier which was used by Scott in the following season. When he got back to the Discovery he consulted Wilson and Royds and the symptoms of scurvy were disappearing before Scott's return.

Then with Skelton (the engineering officer) and four men, supported by Koettlitz and Ferrar, Armitage made his way through a valley to the south of the Ferrar Glacier and up the glacier itself. By Christmas Eve his party was well to the west of the Royal Society Range and on January 2, 1903, they camped at 8200ft at the source of the Ferrar Glacier. As they pressed south-west they found a more gradual ascent, and on the 4th they made their last outward camp, where they measured inclination, declination and total magnetic force and dug a hole in the snow. Next morning, on January 5, they left their camp and made their way to their highest point, at 9244ft by theodolite angles and 8727ft by aneroids.

Armitage reported: ". . . the horizon was very slightly elevated between south and east: at the other position exactly the reverse was the case. In the west-south-westerly direction from us we could see two, apparently detached, ice-capped mountains . . . we were, in fact, on the summit of the ice cap . . . having proved the way for others who, with the knowledge now at their disposal, would be able very considerably to add to it . . .

"We ascended 70ft in the first two miles; this was the highest elevation we reached, being about 9,000ft. We then proceeded along a dead level for two miles, then we gradually descended 30ft in a mile. At this point we stopped; the weather was beautifully clear, and observations showed that the horizon was rather below our level in every direction except to the north and north-east, whence we had come. On all sides the surface was quite smooth, and there was very little sign of wind; it looked as though the plateau on which we stood was the summit of the ice cap."

Armitage had, in fact, obtained practical proof of a continental area, a point which had long been in doubt; even Scott himself had thought that the mountains of South Victoria Land might prove to be an isolated area of land.[13]

In "The Voyage of the Discovery," Scott praised the work Armitage had done: "In the following year I was able to traverse this glacier at considerable speed and treat its difficulties and obstacles lightly, but this, of course, was largely due to the fact that I was travelling over a route which was to some extent known. One is apt to forget the benefits conferred by the experience of others, and therefore . . . I take the opportunity of acknowledging the debt which we owed to them."

Armitage's party brought back photographs, rock specimens and a survey of the glaciers and rugged cliffs of the valleys. But as Scott commented: "It was evident that this party had reached the inland ice-cap and could claim to be the first to set foot on the interior of Victoria Land; but it was clear, too, that they had been forced to terminate their advance at an extremely interesting point, and to return without being able to supply very definite information with

regard to the ice cap . . . This party appeared to have been on a lofty plateau, but the very short advance they had been able to make over it could not give a clear indication of what might lie to the westward; the nature of the interior of this great country was therefore still wrapped in mystery."[14]

Having been the first to discover the plateau, Armitage hoped to be allowed to continue his work in the next season; but Scott decided to do it himself, and also refused to allow Armitage or anybody else to attempt a further southern journey, saying there was no value in it.[15]

SCURVY ON SHIP

When Armitage returned to the Discovery he found that scurvy had broken out on board. Scott had too great a belief in the tinned meats which had been prepared hurriedly and had a sentimental objection to killing seals for the winter meat supplies. Dr Koettlitz and Armitage, from their experience in the Arctic, knew the anti-scorbutic value of fresh meat, and implored Scott to lay in a stock, but he would not listen. In his narrative, Scott said of the outbreak, ". . . whence it has come, or why it has come at all with all the precautions that have been taken is beyond our ability to explain."

Armitage and Koettlitz served out meat regularly and increased the allowance of bottled fruit, and Koettlitz examined every man on board. The meticulous way in which Scott had completed the scale of provisions in the agreement and had carefully issued lime juice showed that he had not grasped the cause of scurvy. He owed much to these two officers with previous polar experience.[16]

DIFFERENCES WITH SCOTT

Another cause of contention was Armitage's status. Markham, having served in the Assistance in the Franklin search, had long dreamed of another Royal Navy polar expedition, and for this reason he chose a naval officer as master of the Discovery. Armitage, having become sub-lieutenant in the Royal Naval Reserve in 1892 and having been promoted lieutenant in 1901, was acceptable when the expedition started; but differences with Scott grew during the course of the voyage. Scott, who did not feel at ease with men other than those from the Royal Navy, was able to send Shackleton (the only other Merchant Service officer) home on the score of sickness, and the crew list shows how he disposed of nearly all the merchant seamen.

Armitage wrote: "I was at first necessary; later I was an interloper. What hurt me most was that I was not allowed to carry on with my sledging work during the second season, distinctly in contravention of my agreement; one which was not signed but was more binding—a word of honour."

When the Morning arrived in 1902-03, Scott received information suggesting that it might be as well for Armitage to return home, and advised him to go home because of his wife and child; but Armitage misunderstood the reasons and positively refused to return.[17]

A lesser difficulty was over his pay out of the funds of the expedition. It was agreed that he should be paid not more than £50 per annum below Scott's salary, and that was carried out. It was also agreed that his pay with the expedition should begin when he left his P. & O. ship and should be continued until he joined a P. & O. ship; but this was not done and he was nine or ten months without pay.[18]

SERVICE AT SEA

On their return to England, Scott gave Armitage permission to publish an unofficial account of the expedition, and this appeared in 1905. Scott's two-volume work did not appear until later in the autumn of 1905 and the prior appearance of "Two Years in the Antarctic" led to some friction.

When he returned to England in August, 1905, Armitage was 40 and too old for further polar exploration; and having had six years' leave of absence from his company, devoted himself to his career in the P. & O. He obtained his provisional master's ticket in London

on October 29, 1891; but when he returned to the company's service it was as chief officer in the Caledonia and the Macedonia, both handsome steam ships in the India and Australian services.

WAR-TIME SERVICE

On January 17, 1907, he became master of the Isis, 1728 tons, employed on the express service from Brindisi to Alexandria or Port Said. He was in command of her until 1915 when, at Bombay, he took command of the Salsette, which was sunk, close in shore, near Weymouth, in 1917.

Armitage then took command of the Marmala, a comfortable passenger liner and cargo ship, making voyages to New York, Canada, Australia and India. He then became master of the Mantua, a twin-screw steamer of 10,902 tons in which he made voyages in 1922-24 to Bombay, China and India.[19]

It was at Kobe, in the Mantua, that he hoisted his flag as commodore, and he kept it flying for just over a year, retiring on September 30, 1924. He then had the rank of commander, R.N.R.

From 1926 to 1933 Armitage was resident governor of the Royal Merchant Seamen's Orphanage at Wokingham. He gave a certain amount of his time to writing. In 1925, when he was at the end of his career, and when both Markham and Scott were dead, he published a biography, "Cadet to Commodore," in which he described plainly the differences in the Discovery expedition which had been implicit in "Two Years in the Antarctic." In 1931 he published "Cold Lands," a children's book, largely about the Arctic, which added nothing of note to polar literature.[20]

Armitage died on October 31, 1943, at the age of 79. For some years he had taken an active part in the Antarctic Club.

WORK ASSESSED

It is not easy to appraise Armitage and his work. Scott took him because, "he is as good an ice-man as any"; and after a year or more of service summed him up as "an excellent chap but entre nous a little old for this work." Perhaps relations might have been happier if Scott had been a great enough man to recognise the value of the experience of a slightly older man with more knowledge of polar work.

Armitage tells that at a dinner after the return home of the Discovery, ". . . some of the old veterans came up to me as we were rising from the table, hands outstretched and said, 'Lieutenant Armitage, we wish to shake hands with you and tell you that we are well aware that you were the working man of the expedition.' "[21]

RIVAL OF SCOTT

Frank Debenham, who knew Armitage later in life, felt that he lacked power of leadership; but since the comment came from a man who lacked leadership himself, even in academic circles, the remark is of doubtful value. A man who had made his way from apprentice to commodore in the competitive world of the Merchant Service must have been more able than his outward appearance suggested.

When the second season in the Discovery was approaching Scott told him that he intended to make a journey to the west, to make a more detailed examination of the Ferrar Glacier, and to learn more about the inland ice. He left Armitage in charge of the ship, much to his disappointment as he had set his heart on sledging over the barrier to the south. He had to content himself with a short journey of a couple of weeks to the south-west part of McMurdo Sound to complete that portion of the map. Scott's assessment of him as a rival is a sufficient acknowledgment of his ability.[22]

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SOUTH AFRICAN AWARDS

For the first time the South African Antarctic Association's highest award has been made to members for work on sub-Antarctic islands. Previous recipients of the BP Antarctic Gold Medals have all been associated with the Antarctic Continent itself.

This year the recipients of the medals are Professor E. M. van Zinderen Bakker, head of the department of botany at the Orange Free State University, and Mr P. A. le Roux, of the Department of Transport Weather Bureau. Mr le Roux has served on Marion and Gough Islands, and Professor van Zinderen Bakker has served on Marion Island.

In 1965-66 Professor van Zinderen Bakker led a team of geologists and biologists to Marion and the other Prince Edward Islands, and has done much to promote international scientific interest in the sub-Antarctic Islands. He is the South African representative on the biology working group of the Scientific Committee for Antarctic Research, chairman of the S.C.A.R. committee of specialists on quaternary research, and director of a research programme on ecological energetics on the islands, initiated in 1971-72 as part of the South African Antarctic Research Programme.

Professor van Zinderen Bakker recently published "Marion and Prince Edward Islands," which he edited with Dr R. A. Dyer and Professor J. M. Winterbottom.

Mr le Roux led the 1961-62 expedition to Marion Island, and the 1962-63 expedition to Gough Island. When the Department of Public Works erected a new base at Gough Island, he was instrumental in having the scientific equipment moved—over hazardous terrain and under extremely difficult conditions—without loss of life or equipment.

On the death in the mountains of Mr J. Smalberger, leader of the 1963 Gough Island expedition, Mr le Roux took over the leadership and accompanied a State pathologist and rescue team to recover Mr Smalberger's body.

When the Marion Island base was destroyed by fire in 1965, he accompanied a commission of inquiry to the island. In 1969 he led another team to Gough Island to recover the bodies of two men who had died of exposure.

NO NEW ZEALAND SUPPORT FOR LONE TRIP TO POLE

A British paratrooper's plans to travel alone by dog sledge to the South Pole this season will receive no support in New Zealand. The Ross Dependency Research Committee has considered the project and decided not to give it any encouragement. Also it will not receive support from the Antarctic Division, Department of Scientific and Industrial Research.

Trooper Tom McClean, aged 29, who rowed a 20ft dory across the Atlantic from Newfoundland to Ireland in 1969, announced in London last month that he had been planning his trip to the Pole for six months. He estimated that the journey would take seven weeks, and he hoped to buy or borrow 30 dogs from Scott Base for an insulated house sledge in which he would live.

Although he has taken part in paratroop exercises in the Canadian Arctic, Trooper McClean has never used a dog team. He has been told by his adviser, a British polar veteran, Colonel N. A. C. Croft, that he could learn the technique in four weeks.

Trooper McClean spoke in London of carrying 300lb of food for himself and 600lb for the dogs. A 100ft rope ladder would be attached to the sledge in case he encountered crevasses.

The return journey from the Pole would seem to be the responsibility of the United States Navy's Antarctic support force. Trooper McClean apparently believes the Americans will bring him back, and if they decline to support his project because a search and rescue operation is needed, he is prepared to sign a document saying that he does not want to be rescued.

To reach the Pole, using the route up the Skelton Glacier followed by Sir Edmund Hillary's party, Trooper McClean would have to sledge 1000 miles from Scott Base. Mr J. H. Miller, chairman of the Ross Dependency Research Committee, who was second-in-command to Sir Edmund Hillary, and has done 5000 miles of sledging in the Antarctic, says the art of dog driving and dog care cannot be learnt in four weeks.

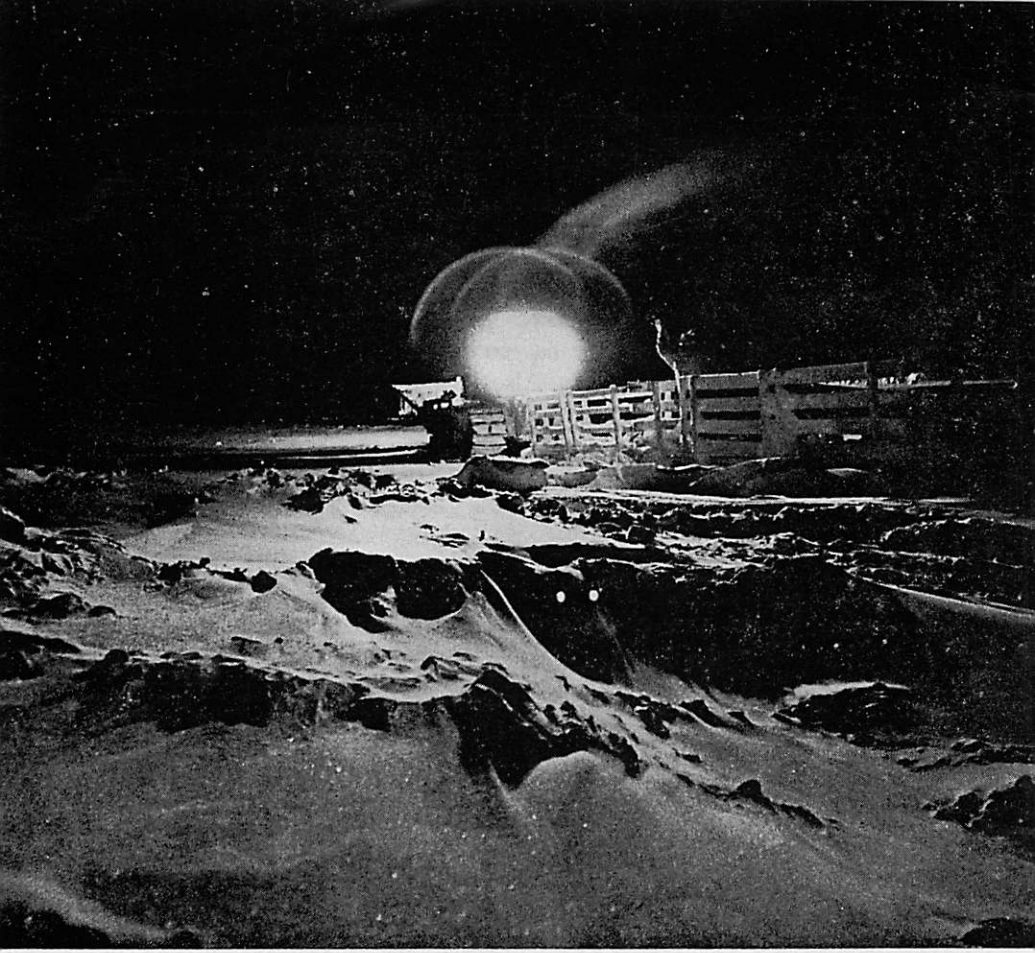
Sir Edmund Hillary has expressed concern about Trooper McClean undertaking the journey to the Pole alone. He says that all the routes involve travelling across crevasse country. To do this alone would inevitably be dangerous.

TEN FLIGHTS BY R.N.Z.A.F.

Ten flights will be made this summer between New Zealand and the Antarctic by Royal New Zealand Air Forces Hercules aircraft to support the New Zealand and United States Antarctic research programmes. This is the largest number since the support operation began in 1965, and double the number of flights last season.

Because of other commitments and wing modifications which have to be made to all five Hercules aircraft in the United States, the R.N.Z.A.F. was unable to meet a request from the United States National Science Foundation for additional flights. It was suggested that the R.N.Z.A.F. should make supply drops of fuel to the Amundsen-Scott South Pole Station because the United States Antarctic support force will have only three ski-equipped Hercules aircraft this summer. The first of the Navy's new Hercules aircraft is not likely to be delivered until the 1973-74 season.

The R.N.Z.A.F. flights will be made probably in November and December.



In the middle of the dark Antarctic winter the bulldozer at New Zealand's Scott Base drags two empty ice sledges out to the nearby pressure ridges to be filled with ice. The base uses about seven tons of ice for its water supply each week.

—Photo by R. K. McBride, Antarctic Division, D.S.I.R.

ICE SHELF NAMED FOR U.S. CAPTAIN

An ice shelf of 125 square miles, including several large islands, off the coast of Marie Byrd Land, is a substantial retirement gift. It will not belong to Captain H. W. Swinburne when he retires from the United States Navy next month after more than 30 years service, but on the maps of Antarctic it will bear his name.

The Swinburne Ice Shelf is located between the Rockefeller Mountains and Roosevelt Island. Captain Swinburne has been honoured for his service since August, 1969, as deputy commander and chief of staff of the Navy's Antarctic support force. He handed over the command to Rear-Admiral L. B. McCuddin's successor, Captain A. N. Fowler, this month.

Wright Valley May Have Been 40-mile Fiord

Some three to four million years ago the Wright Valley was not an ice-free or "dry valley" but a major seaway or fiord which extended 40 miles inland through the Trans-antarctic Mountains from McMurdo Sound and the Ross Sea. The site of New Zealand's Vanda Station in the valley was well below sea level at this time.

Until now geologists from many countries have accepted a purely terrestrial history for the Wright Valley and other Antarctic dry valleys. This new fiord hypothesis has been proposed by Dr P. N. Webb, of the New Zealand Geological Survey, after laboratory analysis of fossil discoveries made last summer.

This summer New Zealand, American, and Japanese scientists will co operate in a joint rock drilling programme in the dry valleys near Vanda Station. One of the aims of the venture is further clarification of the early marine history of these unique valleys.

Dr Webb is the co-ordinator of the drilling programmes. His knowledge of the dry valleys goes back to the summer of 1957-58. He and another third-year geology student from Victoria University of Wellington were members of a team from the Trans-Antarctic Expedition summer party which made the first extensive geological and biological examination of the remarkable dry valleys which lie to the north of the Ferrar Glacier. In the 1958-59 season Dr Webb was a member of the Victoria University team which spent 52 days in the Wright Valley, making a biological, geological, and geophysical examination of it.

In his fiord hypothesis Dr Webb says that about 5,000,000 years ago the dry valley region of Antarctica was enveloped by a great ice cap, so immense that its weight depressed the underlying mountains below sea level. A huge glacier flowed out through the Trans-Antarctic Mountains from this ice cap to the Ross Sea, gouging out a 3000ft deep elongate trough which forms the present-day Wright Valley.

During a period of warmer climate which followed this glaciation, the Wright Glacier melted and almost retreated from the valley. The land was, however, still depressed below sea level, and the sea was able to penetrate the valley for a distance of 40 miles. The scenery at this time must have closely resembled that of present-day Fiordland and coastal Norway.

MARINE PROTOZOA

A glacier still entered the fiord near its head and floated on sea water towards the coast, dropping boulders and "glacial rock milk" as it melted. Marine life included scallops, sponges, and tiny radiolaria and foraminifera. It is on this latter group of complex marine protozoa that the fiord hypothesis is based. Many of the foraminifera from Wright Valley are identical with those found in the fiords of Alaska and British Columbia.

During the period that a fiord occupied Wright Valley, the ice cover on the surrounding alpine areas melted and allowed the depressed land beneath to spring back to somewhere near its former height. The floor of the fiord rose above sea level near its mouth, trapping a huge area of sea water in a landlocked lake. In the last 800,000 years this lake slowly shrank in size and left large areas of ice-free ground and small saline ponds. Lake Vanda is one of the few reminders of this former major seaway.

Six Discovery Expedition Letters Given to Museum

When the Discovery sailed from Lyttelton for Port Chalmers on December 21, 1901, all aboard knew the real reason for the tragic death of a young able seaman, Charles Bonner. He died after a fall from the mainmast when the crowded steamers which escorted the Discovery down the harbour had turned back.

Contemporary photographs of the Discovery's departure show Bonner standing at the top of the mast. Scott wrote of the tragedy in "The Voyage of the Discovery" but gave no reason for it, presumably out of consideration for Bonner's family. The real story did not appear in print until 1967 when Dr Wilson's Discovery diary was published.

In a diary entry on the day of departure Wilson wrote: "It was a dreadful time for such an accident to happen, and some of the men wept like children. It was a terrible lesson too to them because it was afterwards found that he (Bonner) had taken up a bottle of whisky to drink at the maintop." Wilson described Bonner as a general favourite, a very quiet man, and said that everyone was sorry to lose him.

REASON FOR DEATH

Scott referred to Bonner's death and the reason for it in a letter to Mrs A. E. G. Rhodes, wife of the Mayor of Christchurch, written aboard the Discovery on the way to Port Chalmers. He says: "Of course drink is at the bottom of this. What a curse it is. Are we to be faced with this problem every time the expedition reaches port."

This letter is part of a collection of six written by Scott and two other members of the expedition, the surgeon-botanist, Reginald Koettlitz, and the first lieutenant, Charles Royds, to Mr and Mrs Rhodes, and their two children, Rose Mairehau and Tahu, who were then seven and eight. These letters, and one from Lieutenant William Colbeck, who commanded the relief ship Morning, have been presented to the Canterbury Museum by Mrs Eva Deans, granddaughter of Mr and Mrs Rhodes.

Scott and his officers, and Lieutenant Colbeck, had become friends of the Rhodes family during their stay in New Zealand, and had enjoyed the hospitality of "Te Koraha," the Rhodes home in Christchurch. Mrs Deans has given their letters to the museum on behalf of her mother, now Mrs R. M. Hutton, and her grandfather.

In his first letter Scott refers to Bonner's death, thanks Mrs Rhodes on behalf of the ship's company for the hospitality they had enjoyed, and mentions the enclosure of a small silver gift. This was a Discovery medal.

CHILDREN THANKED

Two other letters to Mrs Rhodes are written from Winter Quarters, Victoria Land. In one Scott writes of the gloomy prospect of abandoning the Discovery, and then in a later postscript refers to the ship's release from the ice. His second letter thanks Mrs Rhodes for the letters and cakes sent in the Morning from Lyttelton.

Dr Koettlitz also wrote to Mrs Rhodes, thanking her children for cakes. He also mentions the return of Shackleton, and the death of Vince, who slipped over a cliff in a blizzard during the first year.

Scott's fourth letter was written to seven-year-old Rose Mairehau Rhodes. He addresses her as Marie, and explains what the expedition is doing in the Antarctic. The children wrote to their Discovery friends for the letter from Royds is in reply to one from eight-year-old Tahu.

Colbeck's letter was written from Hobart. He and his crew had been welcomed at "Te Koraha," and he wrote to

express his regret that he could not say goodbye personally before leaving Lyttelton to join the Terra Nova at Hobart.

Another letter written aboard Shackleton's Nimrod by the chief engineer, Harry J. L. Dunlop, has been lent to the museum by Mrs H. W. Dollan, of Wellington. It was written to her father, Captain W. Paterson, of the Shaw, Savill, and Albion Company, at Lyttelton, and was brought back by the Koonya which towed the Nimrod 1510 miles south. In the letter Dunlop refers to the rough trip, says all the scientists have been seasick, and mentions that a horse (the pony Zulu) had to be shot.

WHALING COMMISSION FIXES QUOTAS FOR 1972-73 SEASON

Reductions of up to one-third in the 1972-73 quotas for fin whales in the Antarctic and the North Pacific were agreed to by the International Whaling Commission at its 24th annual meeting in London. American and British scientists told the commission that the fin whale was in the same danger of extinction as the blue whale before it was protected in 1966.

A call by the United States for a 10-year moratorium on all whale catching throughout the world was rejected on the majority vote by the commission. But the two major whaling nations, the Soviet Union and Japan, agreed to consider further reductions in the fin whale quota next season.

The American motion was supported strongly by conservation organisations and some of the member nations. It was rejected on the ground that regulation by species and stocks was the only practical method of whale conservation.

A fin whale quota of 1950 for the Antarctic was set by the commission. This compares with a catch of 2683 last season. For the North Pacific the quota was set at 650, compared with a catch of 1600 last season.

New quotas were set for sei whales, which are about half the size of fin whales, and are not so seriously threatened. The Antarctic quota was fixed at 5000, compared with a catch of 5464 last season. For the North Pacific the quota fixed was 3000. Last season the catch was 2993.

Larger quotas were fixed for sperm whales in the Antarctic and North Pacific, and the total ban on catches of females was lifted. For the Antarctic the quota was 8000 males and 5000 females, and in the North Pacific it was set at 6000 males and 4000 females.

The commission also set a quota for the minke whale, which has not been covered previously by its regulations. The small, swift minke has, until recently, been considered too elusive to catch in any significant numbers. But modern methods have resulted in catches, and the limit for next season was set at 5000.

The ban on the killing of right, bowhead and gray whales, which has been in effect since the commision was established, was extended to cover blue and humpback whales. There is thus a moratorium on the killing of these five species.

Since the middle 1960's killing of blue and humpback whales has been prohibited for short periods, subject to extension as required. Where the ban in one area has been for three and five years respectively, and was due to expire before the commission's next meeting, the decision was made to continue the prohibition indefinitely.

ANTARCTIC BOOKSHELF

DIARY OF THE TERRA NOVA EXPEDITION TO THE ANTARCTIC 1910-1912

By Edward Wilson. Edited by H. G. R. King

Published by Blandford Press, London, 1972

pp. xxiii and 1-279. Illustrations and maps. Index. English price £6.50

Scott's last expedition of 1910-1913 must surely be the most documented of any venture into the Antarctic, and doubtless there will be more books about it in the future.

Apart from the leader himself, the one person who seems to have captured and held the public's imagination is Edward Adrian Wilson, the chief of the scientific staff, who had already served with Scott on the Discovery Expedition, 1901-1904. There is a mystique surrounding the name of Wilson, who has been described by his biographer as "a great and truly noble-hearted Englishman," a very Bayard among men "who nothing common did or mean."

The success which attended the publication of Wilson's Discovery diary in 1967 made it inevitable that his Terra Nova diary would follow, and now we have it in the present volume.

The book is similar in style and format to the Discovery volume, although much thinner and with fewer illustrations. Although Wilson's diary has already been much quoted, i.e. by his biographer George Seaver, by Cherry-Garrard in his "Worst Journey," and in Volume II of "Scott's Last Expedition," it is good to have now the full text of the journal. This reviewer has found the 20 pages covering the 28 days devoted to the famous winter journey to Cape Crozier, of greatest interest, though for many readers the account of the heart-breaking return from the Pole will stir their hearts once again.

The South Pole diary is interesting in another way. The photograph of the title page with its Maori motifs suggests that it was given to Wilson while the expedition was in New Zealand on its way south but the diary entries for October 30 to November 25 are omitted so we can only conjecture who was the donor of the book which was to become a part of history.

A reading of the diary evokes many feelings. The hut built at Cape Evans still stands after more than 60 years maintained in its nearly-original condition by the New Zealand Government. Visiting it one has a feeling of timelessness and can hear again the chatter and laughter of the young men who, although they did not know it, were soon to be plunged into a war from which the world would emerge never to be the same again. It was the end of an era, and for Scott's men almost the end of the Heroic Era of exploration.

For many people the charm of Wilson is not his unselfish character but his ability as a water colour artist. No painter before or since has so succeeded in capturing the delicate pastel colours of the Antarctic landscape or its wild life. This book reproduces 27 of Wilson's paintings but the reviewer gets the impression that they have suffered in printing, the colours appearing harsh and untrue to the originals. Compare for instance, the plates opposite pages 121 and 241 in the diary with the same ones opposite page 68 (Vol. II) and page 258 (Vol. I) of "Scott's Last Expedition."

It is good to have the diary now in its entirety and the editor and publishers are to be commended for a job well done. At the end, as he was dying, Wilson was to write "all is well." A

few years later Rupert Brooke, in another context, wrote "Now God be thanked Who has matched us with His hour." Either would have served as Wilson's epitaph.

—H.F.G.

AMERICANS IN ANTARCTICA 1775-1948

By Kenneth J. Bertrand

American Geographical Society. Special publication No. 39, 1971. pp. xvi and 1-554. Illustrations and maps. Index. Price $US25

Many people believe that the United States of America did not enter the field of Antarctic exploration until the commencement of the International Geophysical Year in 1957, although a few of the more enlightened will have heard of Charles Wilkes and his explorations in the 1840's, and will know that it was an American, Richard Byrd, who flew over the South Pole in 1929.

It will come as a surprise to them, therefore, to learn from this large and comprehensive book that American sealers were operating around the Falkland Islands as early as 1775.

The author, Kenneth J. Bertrand, who is professor of geography at the Catholic University of America, states in his preface that "the research on this book has extended over a quarter of a century, beginning in 1946 with an invitation to engage in research on the history of geographic names for the advisory committee on Antarctic names of the U.S. Board on Geographic Names. Membership of the advisory committee since 1948 has afforded the author an opportunity to participate in the national ordering of Antarctic nomenclature for which continued delving into the history of exploration has been necessary . . . The book itself began to take form 15 years ago."

From this it will be evident that Professor Bertrand is well qualified for the task he has undertaken, and even the most cursory study of his book will show how well he has acquitted himself. Where previously the information on the various forays by Americans into the Antarctic field has been scattered through dozens of books and hundreds of specialist papers and journals, now these have all been gathered together between two covers.

Beginning with an introductory chapter in which he surveys the whole field of Antarctic discovery from the earliest times, the author goes on to recount in great detail the activities of the American sealers from 1775 to 1820, devoting no less than 138 pages to this hitherto largely neglected phase of Antarctic history.

Regarding the often debated question of whether an Englishman or an American was the first to sight the Antarctic Continent, the author has this to say: "No purpose can be served by detailing the long and often heated controversy over whether Bransfield or Palmer first saw the Antarctic mainland" A long bibliography is given which will send the reader to the primary sources, and thus enable him to form his own conclusions.

One of the most valuable chapters of Professor Bertrand's book is that devoted to the United States Antarctic Service Expedition, 1939-1941, about which no popular account has appeared. Here in 75 pages is gathered together the material which has appeared in scores of articles devoted to one phase or another of this important contribution to Antarctic discovery.

Every one of the 24 chapters has its separate footnotes and a lengthy bibliography which does much to enhance the book's value as a work of reference. There are 26 maps and adequate illustrations.

"The book terminates with Operation Windmill, 1947-48." Says the author, "Although 1948 was not so much the end of an era as a time of mutation or interchange in Antarctic exploration, it is a convenient point to end this account of American activity.

Subsequent effort was centred around the IGY. It and the programmes which have followed on a comparable level are another story."

Perhaps, therefore, we can look forward to a further scholarly volume from this highly competent authority.

—H.F.G.

COASTAL AND DEEP-WATER BENTHIC FISHES OF THE ANTARCTIC

by Hugh DeWitt

Antarctic Map Folio Series, Folio 15. Published by the American Geophysical Society, 1971, 10pp, 5 pl. $US6

The fish fauna of the Antarctic continental shelf is probably as well known taxonomically as any shelf fauna in the world and as such has been reviewed before (Marshall, 1964, Andriashev, 1965). Consequently DeWitt's treatment is in a few places a rehash of previous work. However, new interpretations of old data and logical synthesis of new data make this paper an interesting contribution to Antarctic ichthyology.

A synopsis of the major Antarctic fish families is presented and the Nototheniidae are considered the most characteristic element in the fauna. Many of these species are labelled pseudoabyssal because of the depressed nature of the Antarctic continental shelf, but DeWitt distinguishes the true deep-sea element in the fauna. In the section on endemism oceanographic and palaeontological data are used in developing a theory to account for the endemic evolution of the fish fauna. Evidence is presented to show that at present the continent is isolated geographically, environmentally and through ocean currents. The endemic fish fauna implies that this has been the situation for a long time.

Citing evidence from work on continental drift, DeWitt placed Antarctica's separation from other continents at 65 million years or more. The glacial history implies that the continent has been isolated by cool water for perhaps 40 million years which DeWitt concludes is ample time for the development of all five families in the Notothenioidei.

In the section on patterns of distribution fishes which have evolved outside the Antarctic and penetrated recently are discussed. Of the 14 species discussed all have reached the Antarctic via the Scotia Ridge except Notothenia microlepidota which inhabits the shores of New Zealand and the islands south to Macquarie.

Circumantarctic endemic species make up 20.8 per cent of the fauna. The distribution maps show more circumantarctic representatives of Trematomus, which appear well adapted to the extreme cold, than Notothenia, which is confined more to the warmer West Antarctic. They also show a number of species of Trematomus endemic to East Antarctica. However, it is pointed out that there are few records from parts of the Weddell Sea, the Bellingshausen Sea and the Amundsen Sea. As these areas become better known species now thought to be endemic to one area or another may well have their ranges extended, thus changing the arbitrary boundaries set up to divide East and West Antarctica.

The old classification system of Nybelin (1947) based on depth is revised by DeWitt using new data collected on Eltanin cruises 22 and 27. Andriashev's (1965) depth distribution work based on the East Antarctic is updated to include West Antarctica and South Georgia. New data strongly emphasize Andriashev's conclusions concerning the increase in fish species between 300 and 600 metres.

DeWitt uses 31 maps to illustrate the distribution of 119 species of Antarctic fish. Simple, clear, and easy to interpret, they are an improvement on the maps compiled by Norman (1938), and they include many of the taxonomic advances which have occurred since Norman's classic work. An interesting omission from the McMurdo Sound area of the distribution map is the giant Antarctic cod, Dissostichus mawsoni, for it is well

known in that area by both seals and men and has been cited by a number of authors, including DeWitt (1965).

Although this paper is well done and contains new information, it may have been written a bit prematurely, for it appears that information not yet available from recent Eltanin collections may change considerably our present ideas concerning Antarctic fish distributions.

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THE STRUCTURE AND PHYSICAL PROPERTIES OF THE EARTH'S CRUST

Edited by John G. Heacock

Geophysical Monograph 14, American Geophysical Union, 1971, 348pp, $US19

Like most of its forbears, this volume is an assembly of scattered investigations. Presented at a symposium held in July, 1970, at the University of Colorado, the papers are unified by the necessity to decide whether or not an electromagnetic wave-guide, consisting of a resistive zone of dry basement rocks enclosed by conducting wet surface layers and conductive hot mantle layers, exists in the crust.

The papers are grouped under several sub-titles. The first group is devoted, not to earth resistivity as might be expected, but to seismology, for it is from some seismologists that the communications experts have received the most encouraging evidence that zones of contrasting physical properties exist in the crust and upper mantle. Landisman, Mueller and Mitchell open the proceedings with their evidence for seismic velocity inversions in the crust in various parts of the world. Some of their arguments appear to be tendentious and, indeed, Jack Healy follows their paper with a "cautionary tale," clearly finding their evidence "not compelling". Thereafter the papers degenerate into the irrelevant, the vague, the parochial and the esoteric, leaving one with the feeling that this is just another symposium, except that the editor has provided a review introduction which does attempt to tie them together.

Two points stand out for New Zealanders cum geophysicists cum Antarcticists. As usual, American geophysicists give unduly high weight to their own, highly localised phenomena. Characteristic of this are the several references to the limiting depth (about 10km) of earthquakes on the San Andreas Fault. To geophysicists in New Zealand the characteristics of the San Andreas Fault system do not appear to have universal significance. Secondly, the several references to relatively aseismic regions as "areas that either are now, or have recently been, the site of widely distributed crustal loads" make no mention of ice-covered Antarctica and its virtual complete aseismicity, a point developed by New Zealand geophysicists in several papers.

In spite of what I have said above I found the volume both interesting and useful, for it is often desirable to review the extent of our ignorance. The problem of refining our knowledge of the structure of the earth's crust is appallingly difficult, which is why so many of these papers appear to have so little to convey, except ignorance. This is a specialist volume and not light reading for an Antarctic sleeping bag during a blizzard

—Trevor Hatherton.

"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.

Subscription for non-members of the Antarctic Society, NZ$3. Overseas NZ$3.50, includes postage (air mail postage extra). Details of back issues available may be obtained from the Secretary, New Zealand Antarctic Society, P.O. Box 1223, Christchurch, New Zealand.

The New Zealand Antarctic Society

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 plans to co-operate in securing suitable locations as repositories of Polar material of unique interest.

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 membership fee is NZ$2.00 (or equivalent local currency). Subscription to "Antarctic" is a further $2.50.

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Printed at the Raven Press, 241 Cashel Street, Christchurch