

CANADA

W. E. van Steenburgh* and Mary J. Giroux**

A NEW chapter is being written in the history of Canada's polar regions. The past two decades have seen a marked acceleration in research activity, as opposed to exploration. The resultant knowledge is gradually bringing the Canadian Arctic into focus against the backdrop of the Canadian economy.

Basic research is essential for the proper assessment and development of the tremendous resource potential of this vast region of Canada. Already geophysical and geological research have revealed an oil and gas storehouse of great promise, estimated at one million cubic miles of oil and gas-bearing sedimentary rocks in Canada's northern territories, the bulk of which is in the Arctic Islands. It has been calculated that this could amount to as much as 13 billion barrels of oil beneath the permafrost of the Northwest Territories, another 3 billion in the Yukon, and 33 billion in the Arctic Islands. Other mineral wealth brought to light includes gold, silver, pitchblende, iron ore, lead, zinc, asbestos, and tungsten.

On the purely scientific side of the ledger, there have been a number of interesting discoveries. Two unusual geophysical anomalies have come to light, for instance, and palaeomagnetic investigations on Ellef Ringnes Island have disclosed that, in Mesozoic time, the apparent magnetic pole was in a quite different part of North America.

Knowledge of the Canadian Arctic is not easily won. Research in these regions is costly, and the logistic problems involved demand careful planning and efficient use of facilities and equipment. These factors have influenced the character of the research undertaken and, indirectly, the source of the funds available for the work.

The basic source of such funds has been, and still is, the government — whether the moneys are spent directly by the interested departments of government or are dispersed through independent research institutes, such as The Arctic Institute of North America, or through university-oriented arctic research.

Research in the Canadian Arctic falls into three main categories: government, special projects under independent direction, and university research.

* Deputy Minister, Department of Mines and Technical Surveys, Ottawa.

** Editorial and Information Division, Department of Mines and Technical Surveys, Ottawa.



Hellgate, a narrow strait of fast-running water between Devon and Ellesmere islands, was used to test experimental airborne hydrographic equipment. Named "the electronic fish", an echo sounder is towed by helicopter along fixed lines, relaying 50 soundings per second to Decca equipment installed in the aircraft. (Polar Continental Shelf Project.)

Government

POLAR CONTINENTAL SHELF PROJECT

The largest single federal government program in the Canadian Arctic is being carried out by the Polar Continental Shelf Project, a cooperative research venture set under way by the Department of Mines and Technical Surveys in 1959, in which not only the branches of the department but also other federal government agencies and universities are taking part. The project is a long-term investigation of the continental shelf north and west of the Arctic Archipelago, the water above it, and the adjacent islands, sounds, and seas. It will eventually cover all parts of the archipelago not investigated by other agencies in its field of interest. The program includes oceanography, hydrography, submarine geology, terrestrial geology, seismic studies in the Arctic basin and inland, gravity investigations, magnetism, physiography of the land forms, glaciology of the Meighen Island ice-cap, sea-ice studies, marine biology, botany, and entomology.

Field work from 1959 to 1963 was concentrated between Meighen Island and Brock Island, extending about 200 km. both north and south, supplemented by individual studies throughout the Queen Elizabeth Islands. In 1964 and 1965, field work was carried out mainly from Mould Bay in the central section of the Arctic continental shelf and the adjacent islands and

straits, and extended to Banks Island in the southwest and northern Greenland in the northeast.

Approximately 396,000 sq. km., covering most of the Sverdrup and Parry Islands (roughly the western half of the Queen Elizabeth Islands) and the continental shelf and adjacent continental slope from approximately longitude 100°W. to 125°W. have been covered with aeromagnetic surveys. The magnetic anomalies determined by these surveys afford a means of calculating the depth of the crystalline basement rocks. The pattern of anomalies shows the character of geological structures in different parts of the area and makes it possible to follow the extension of important geological and crustal features.

Marine geologists are studying sedimentation in the arctic environment, both offshore and inshore in selected areas of local or representative regional sedimentation. They have found that, in the fairly recent geological past, the western Queen Elizabeth Islands stood several hundred metres higher than at present and that evidence for glaciation of the region is more convincing below present sea level than on the present-day islands.

Geologists have also found that radiometric age determinations of rocks of Ellef Ringnes Island support the results of palaeomagnetic investigations, confirming indications from other parts of North America that, in Mesozoic time, the apparent magnetic pole was in a quite different part of North America and that either the pattern of the magnetic field has migrated widely or North America has shifted steadily in relation to the magnetic field.

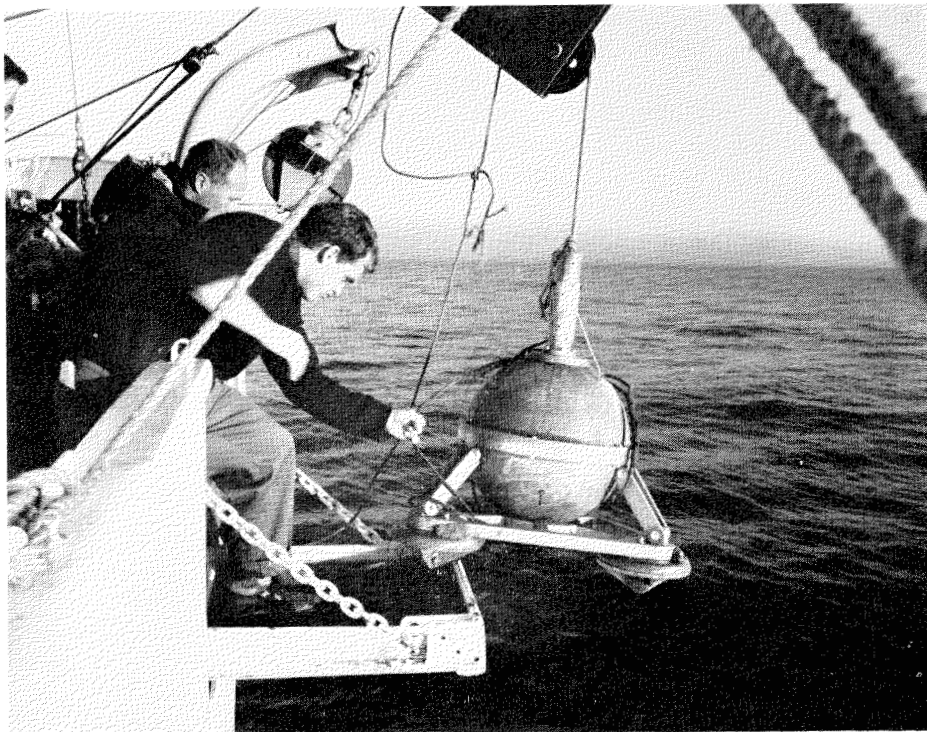
From their work to date, oceanographers have found a relatively complex but apparently uniform and comparatively stable arrangement of the water masses on the continental shelf and within the archipelago.

Geophysicists are investigating two unusual anomalies, one on northeastern Ellesmere Island and one near Mould Bay and Crozier Channel in the eastern Parry Islands. Analysis of data obtained to date has indicated that large bodies of anomalously high electrical conductivity exist in the crust and upper part of the mantle in both locations. Heat-flow determinations near Mould Bay and gravity and aeromagnetic profiles have so far failed to provide positive confirmation of this hypothesis.

Seismologists have found that (a) there is marked crustal thinning (38 km. to less than 20 km.) under the continental shelf, (b) the continental-shelf area may be underlain by accumulations of sediments in small restricted basins separate from the Sverdrup Basin, and (c) that the deeply buried sedimentary formations of the Franklinian Geosyncline have properties similar to the exposed formations farther northeast.

In gravity, scientists have covered 550,000 sq. km. of the islands and the waters between them and about 120,000 sq. km. of the continental shelf and continental slope areas with a network of gravity stations 10 to 20 km. apart. In 1965 they ran their first extensive ocean gravity-profile over the continental shelf slope to a water depth of 2,100 m.

Geographers have made regional physiographic studies of Ellef Ringnes and Borden islands, a survey of land forms and surface materials on



A gravimeter is lowered over the side of the Canadian Scientific Ship *Hudson* to the floor of Hudson Bay. The Marine Sciences Branch of the Department of Mines and Technical Surveys took thousands of such readings during a geophysical investigation of the floor of Hudson Bay in 1963.

Meighen Island, and a study of the raised marine features of Melville Island.

Glaciologists have made a detailed and many-faceted study of the Meighen ice-cap and are directing current studies to the physics of the ice mass and its response to its geophysical and geological environment.

THE OBSERVATORIES BRANCH

In addition to its work with the Polar Continental Shelf Project, the Branch is engaged in geomagnetic, gravity, and seismic activities throughout the archipelago.

It has established permanent geomagnetic observatories at Baker Lake, Resolute Bay, Mould Bay, and Alert. A temporary observatory at Yellowknife and several variation stations were in operation throughout the International Geophysical Year, and the Defence Research Board has continuously operated a standard three-component variometer set at Churchill since 1957. The records from these stations have formed the basic observational data for several research projects.

In gravity, the immediate objective is to complete the regional gravity survey at the mapping scale of 1:500,000, which will take eight to ten years.

More intensive, detailed surveys are carried out in anomalous areas or areas of unusual interest to delineate the anomalous structures in greater detail. Surveys have been carried out, for instance, of the Muskox area south of Coppermine in Northwest Territories to assist with the analysis of this major ultrabasic complex. In a major gravity study in 1965 the Observatories Branch, in cooperation with the Marine Sciences Branch, completed an extensive survey of Hudson Bay in which it measured some 1,000 gravity stations to contribute to the evaluation of the oil potential of this major sedimentary basin.

The Branch operates first-order, fully instrumented seismological stations at Alert, Resolute Bay, Mould Bay, and Frobisher Bay in the archipelago, and at Coppermine, Baker Lake, and Yellowknife on the mainland. The records are used in international cooperative programs in seismology and have been used in published Canadian research on seismicity, travel-time residuals, magnitude studies, P-wave signal character and surface-wave crustal studies.

The Observatories Branch installed at Yellowknife, jointly with The Atomic Weapons Research Establishment of the United Kingdom, an array of nineteen short-period, vertical seismometers in the form of two crossed arms, each 22.5 km. in length. The array is being used as a major research facility to establish a criterion for distinguishing between nuclear blasts and earthquakes and to study the earth's structure.

THE GEOLOGICAL SURVEY OF CANADA

The Geological Survey is concentrating more and more of its effort on topics of major economic and scientific interest while completing the reconnaissance program, which is expected to take some ten years. The Arctic is an excellent laboratory for such basic studies: it poses problems peculiar to the Arctic and others that are world-wide and, because of the paucity of vegetation cover, arctic geology is displayed in a unique fashion.

Survey studies range from work on the tectonic evolution of the Franklinian eugeosyncline and miogeosyncline to the study of lithofacies development in relation to geological systems, a feature of paramount importance in petroleum exploration. They include structural studies of the folds of Bathurst and Cornwallis Islands, of Grinnell Peninsula on Devon Island and of the piercement domes of the Sverdrup Basin; geochemical studies under permafrost and other arctic conditions; the development of geophysical tools and methods under arctic conditions for mineral exploration and as geological aids to investigate the third dimension.

The Survey is initiating a major study to establish the degree of reliability possible in the forecasting of mineral deposits, given reconnaissance geological data, and conversely, the degree of follow-up required in regional geological mapping to provide an acceptable measure of reliability. It has chosen an experimental area extending from Hudson Bay to Lake Athabaska, where mapping at eight miles to the inch is completed and four-mile-to-the-inch mapping is being carried out to provide further data on critical

areas. The project will include studies in pleistocene geology, geochemistry, geophysics, and metallogeny to establish how these specialties can reveal information on the mineral potential of a region in addition to that obtained by systematic geological mapping.

A survey project of much interest in 1965 was the geophysical investigation of Hudson Bay. Survey geophysicists obtained seismic profiles of the Bay in cooperation with the Bedford Institute of Oceanography at Dartmouth, N.S., and carried out an aeromagnetic survey over part of the Bay.

THE GEOGRAPHICAL BRANCH

In 1961, the Branch set under way the Baffin Island Project, a long-range program of studies in geomorphology, glaciology, climatology and meteorology. The project includes a study of the Barnes ice-cap and of selected small glaciers. To date, thirty research papers have been published on the results which show that the pre-1962 concepts of the history of glaciation of the Canadian Arctic are in need of fundamental revision.

For the past ten years, the Branch has collaborated with the University of British Columbia in an extensive study of the Mackenzie River delta. A major monograph and several research papers have been prepared on the geography of the delta.

The Branch is carrying out, in collaboration with the Polar Continental Shelf Project, a precise survey of ice conditions in the high Arctic to facilitate more accurate forecasting of sea-ice conditions.

DEFENCE RESEARCH BOARD

The Defence Research Board (DRB) carries out basic studies on arctic and cold-weather problems affecting man and his machines, and research in the physical sciences affecting communications, movement, and navigation in and under the sea, on land, in the air and outer space. It supports and coordinates research in the north by means of grants and contracts to universities, government agencies, and non-government research organizations.

The Board started its geophysical program in northern Ellesmere Island in 1953. Its early studies were concerned mainly with the ice shelf off the north of the island, the source of the floating ice islands, from which it obtained valuable data on the geophysical parameters of the Arctic Ocean. A recent DRB study concerns the partial breakup of the Ward Hunt Ice Shelf to form new islands, which will probably become important platforms of research in the future.

From 1957 to 1962, which included the International Geophysical Year, the Board centred its geophysical studies at Lake Hazen in what is known as Operation Hazen. The main scientific effort was in glaciology and the related field of meteorology.

Since 1963 the Board has concentrated its geophysical studies on Tanquary Fiord in Operation Tanquary, with the emphasis on oceanography. Tanquary Camp is well situated for air and sea support. At the end of 1965,

the Board had occupied over a hundred oceanographic stations and had obtained a general picture of the oceanography of the area, including some interesting and unexpected findings, which require further investigation. The Board plans further work in the region, including traverses up all the fiords of northwestern Ellesmere Island.

The well-rounded geophysical program includes sea-ice, meteorological, and glacier studies. Because of the availability of sufficient background material, work in these areas has been on specific problems.

Sea-ice studies by the DRB-supported Ice Physics Group at McGill University have been concerned with detailed and refined measurements of energy fluxes at the air-sea interface. Studies of under-ice acoustic attenuation are planned for 1966. In meteorology, attention has been focused on radiation and wind field measurements as well as on routine synoptic measurements. In glacier studies, which have been carried out with a University of New Brunswick group, supported by the National Research Council, three projects have been completed: the terrestrial and aerial photogrammetric mapping of Per Ardua Glacier at the head of Tanquary Fiord, the aerial photogrammetric mapping of the Otto Fiord Glacier to show its remarkable 5-km. advance since 1950, during which numerous icebergs have been calved into the fiord, and the determination of strain rate on the Ward Hunt Ice Shelf (the strain rate has been shown to be negligible).

THE NATIONAL MUSEUM

The Human History and Natural History branches of the National Museum carry out widespread investigations relating to the archaeology, physical anthropology, ethnology, botany, zoology, and vertebrate palaeontology in the Canadian North.

Since 1950, the Museum has sponsored, or co-sponsored, archaeological work at localities on most of the Arctic Islands, along the Ungava shore of Hudson Strait, and on the islands in Hudson Bay. It carried out a survey of the arctic coast of Yukon and the Mackenzie Delta and did extensive work along the west coast of Hudson Bay and in the Barrenlands.

It has carried out, or sponsored, ethnological investigations of the Indians and Eskimos at Great Whale River, of the Indians in Yukon Territory and Northwest Territories, the Eskimos in the Northwest Territories and at various localities in the archipelago. It has also studied the physical anthropology of the Eskimos of the Eastern Arctic and of the Eskimo blood groups of Southampton Island.

The Museum has carried out and sponsored botanical work in the Canadian Arctic for over fifty years. Thousands of specimens of arctic flora have been collected and deposited at the National Herbarium of Canada and scores of publications have been issued on the collections. For example, included in the series of National Museum of Canada Bulletins is the comprehensive "Illustrated flora of the Canadian arctic archipelago" by A. E. Porsild.

Museum scientists have studied marine, fresh-water, and terrestrial fauna of the arctic and subarctic zones of Canada, including the birds, mammals, plants, marine and fresh-water invertebrates, parasites, and fossils from Prince Patrick, Ellesmere, and Ellef Ringnes islands; marine and fresh-water fishes from southeastern Alaska, the Beaufort Sea, and eastern Hudson Bay regions. Nearing completion are two large projects: the mammals of north and central Yukon and the mollusks of the Hudson Bay watershed.

THE DEPARTMENT OF AGRICULTURE

Organized arctic entomology had its real beginning in northern Canada in 1947 when the Department of Agriculture, in cooperation with the Defence Research Board and several Canadian universities, set under way its Northern Biting Fly Program and its Northern Insect Survey. The former continued until 1955 and the latter until 1962, when the Department initiated a third program, Studies on Arctic Insects, which is a direct continuation of the earlier programs but which differs in emphasis by concentrating on the ecology, adaptation, and evolution of the arctic fauna.

The Northern Biting Fly Program resulted in a considerable amount of biological knowledge of northern mosquitoes, blackflies, tabanids, and midges, and the development of the methods of aerial spraying and ground dispersal of insecticides now employed by various arctic communities. The Northern Insect Survey resulted in the largest collection of arctic insects ever assembled. Many new species have been described, contributing to the general understanding of insect systematics. It was found that the tree-line is a major biological boundary and that the arctic insect fauna is extremely limited with less than 1,000 species.

The primary field site for the study of arctic insects is Hazen Camp on northern Ellesmere Island where over three hundreds species of insects, arachnids, and collembola have been collected, a quite unexpected figure which gives entirely new significance to insects in the high Arctic. The program has also established that not all insects of the Arctic occur in great numbers.

THE DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

Canadian Wildlife Service is responsible for research on and management of migratory birds throughout Canada. It also carries out general wildlife research in the National Parks and in the North, in its advisory capacity to the National Parks Service and Territorial Governments.

The Service's ornithological research in the Arctic underwent a marked change in emphasis in the early 1950's from a cataloguing of species distribution to detailed four- to five-year life-history studies. Major investigations have been undertaken on lesser snow geese, thick-billed murres, Atlantic brant, Pacific brant, Ross' goose, two races of Canada geese, and gulls.

In the Territories, the Service has studied species used for food and clothing (caribou and moose), species with commercial importance (fox, beaver, muskrat, polar bear, etc.), and those species of basic biological interest (musk ox). An intensive study of barren-ground caribou has been under way since 1948.

The Inuvik Research Station was established in 1963 to permit a more coordinated approach to government research activities and to encourage universities and private research institutes in Canada and elsewhere to expand their interests and activities in the area. The site was chosen primarily because of the wide range of ecological conditions in the vicinity.

The station has general laboratories, frozen storage for specimens, a general workshop, photographic and dark rooms, offices for permanent staff and visiting scientists, a combined library and seminar room, and a fish and animal specimen room. It also has special facilities for cosmic-ray measurement for the National Research Council.

The research program at the station is supported by a small staff of government employees on a year-round basis and a maximum of sixteen visiting scientists in any month from government, industry, and universities can be accommodated. The station is administered by the Department of Northern Affairs and National Resources.

Grants. The Department of Northern Affairs and National Resources encourages and supports research in the Canadian Arctic through the allotment of grants to universities and institutes mounting scientific expeditions in the Far North. The program was set under way in 1962 when six agencies received grants totalling \$60,000. By 1965-66 these had increased to \$145,000 and were awarded to ten agencies. The grants are made on the recommendation of the Scientific Research Sub-Committee of the Advisory Committee on Northern Development.

FISHERIES RESEARCH BOARD

Fish and marine mammals have been the traditional and essential sources of food, clothing and shelter for the residents of Canada's arctic regions, making habitation possible in the land of the midnight sun. In recent years, another factor, revenue from commercial fisheries, has further enhanced the importance of these resources, creating an increasing demand for scientific information on them.

The Department of Fisheries, through the Fisheries Research Board, has steadily expanded its research activities in the Canadian Arctic from a limited physical and biological investigation of eastern arctic waters in 1948 to the establishment, in 1964, of its Arctic Biological Station to make a thorough study of the fishes and marine mammals in arctic and subarctic waters.

To date over a hundred species of fresh water, marine, and anadromous fish have been identified in northern Canadian waters. However, residents are using only a small percentage of these, including arctic char, which is

the best known and most valuable fish to the natives, anglers, and commercial fisheries alike.

The Station's fisheries' investigations centre on the analysis of catch statistics, exploratory fishing, life-history studies, management experiments, and fundamental limnology. It is seeking, for instance, more biological information on arctic char to ensure its optimum use. Its studies have shown that Greenland cod might support a new fishery around Cambridge Bay. In the western Arctic, it is assisting the commercial fisheries, for whitefish and lake herring, that are developing in the Mackenzie Delta. Many of the freshwater fisheries in operation on lakes in the Northwest Territories are based on earlier studies by Board scientists.

Northern marine mammals include the walrus and various whales and seals. Station scientists are studying analysis of catch statistics and life history and growth rates and are making population estimates through aerial surveys and tagging experiments. They have investigated the biology of the walrus, narwhale, beluga, and harp seal quite thoroughly, and have started the study of the ringed seal, which is of such widespread value to the natives.

The study of marine plankton and benthos has been a major project of the Board since 1947, and it has made considerable progress in understanding the primary and secondary productivity in relation to fish production in northern waters.

NATIONAL RESEARCH COUNCIL

Cosmic Rays in the Canadian Arctic. The past ten years have seen a marked growth in research in cosmic rays and related fields. In Canada, this has been reflected in the establishment of cosmic-ray recording stations at Alert, Churchill, Inuvik, and Goose Bay, in addition to the station at Resolute, which was established in 1949 and operated by the National Research Council continuously since that time. In lower latitudes, recording stations have been established at Sulphur Mountain, Ottawa, Deep River, Calgary, and Victoria. The station at Churchill is operated jointly by the National Research Council and the South West Center for Advanced Studies at Dallas, Texas.

Research in cosmic rays is carried out by the National Research Council in close collaboration with Atomic Energy of Canada Limited, the University of Alberta, and the University of Victoria, B.C. The data obtained at the recording stations are exchanged with fifty other stations throughout the world, including those in the USSR, Australia, and Antarctica.

Building Research. To assist the Canadian building industry, the National Research Council carries out studies of building in the North, particularly of problems associated with construction on permafrost and with superstructure design. NRC scientists are making field studies of engineering structures at different locations in the Canadian North to assess the performances of various types of building foundations and the general effects of construction on permafrost. In superstructure design, they are studying

materials and systems of construction in relation to such problems as ventilation, heating, and control of water vapour, and they are evaluating the use of prefabrication methods and components for northern use.

The Arctic Institute of North America

A full description of the work of the Institute and the purposes for which it was founded appears in the first part of this Anniversary issue of *Arctic*. Here only a brief account will be given of the three long-term projects supported wholly or in part by the Institute.

The Devon Island Project was initially an extensive coordinated effort, covering many disciplines, carried out during the period 1960-63. Primary objectives of the project were threefold: (1) the study of the relationships between the marine environment, the Devon Island Ice Cap, and the adjacent atmosphere, with special regard to heat budget, energy flow, and moisture transfer, (2) a detailed investigation of the oceanography and marine biology of Jones Sound, (3) a detailed investigation of the archaeology, biology, and geology of Devon Island.

In 1960 AINA installed temporary buildings and facilities on the north coast, west of Cape Sparbo, and in 1961 it established a satellite station on the ice-cap a few miles to the south of the main base. These facilities were used during the summers of 1960-63 and during the winter of 1961-62. The program was carried out by a group of researchers which, in 1961, reached a peak of twenty-one persons from several nations. Two research teams from McGill University and the University of London, re-opened the Devon Island facility for the summer of 1965 as a base of operations for future field programs in geomorphology and glaciology.

The Icefield Ranges Research Project is situated near the Alaska-Canada border, at the southwestern corner of the Yukon Territory and in the heart of the St. Elias Mountains, which encompass the most extensive glaciated area in North America. It is sponsored jointly by the Arctic Institute of North America and the American Geographical Society and was established in 1961 as an outgrowth of a concept to study a glaciated area in terms of its total environment. Senior scientists from Canada and the United States are there given opportunities to conduct field research in climatology, glaciology, geophysics, geography, and other related sciences. Continuing and short-term investigations thus carried out are adding yearly to the general fund of knowledge which is growing from the study of this vast, unique, and little-known area which also provides a training ground for graduate and undergraduate students and teachers selected from colleges and universities in the two countries concerned.

Transportation Study. AINA is initiating a study of all aspects of transportation in the Canadian Arctic, a vital factor in the exploration, scientific investigation, administration, and economic and social development of these regions. The study is aimed at producing a comprehensive review of existing transportation systems and projecting or suggesting future systems or

requirements from which industry and government can initiate more specific policies and plans. The study is expected to involve four professional researchers and take three years to complete. It will cost an estimated \$500,000.

Universities

Several Canadian universities are carrying out research projects in the Canadian Arctic and are making a valuable contribution to the growth of knowledge on Canada's northern regions. Funds are derived mainly from federal, provincial, and private sources. A very brief description of a few of the many arctic activities of some of the universities follows.

The McGill Committee on Northern Research, McGill University, was established in 1963 within the Faculty of Graduate Studies and Research to serve as a liaison between departments and individuals carrying out research or conducting training programs to this end. The Committee acts as a clearing house within the university in stimulating research, encouraging academic programs, and advising the Dean of Graduate Studies. The university has long been engaged in northern research, and the work continues to expand. Departments particularly active include Sociology and Anthropology, Physics, Meteorology, Geography (including glaciology), Geology, Civil Engineering and the Marine Sciences Centre. The research is supported from a variety of sources; much of it comes from university funds. The University maintains an interdisciplinary research station at Schefferville, Quebec, which, during more than ten years of intensive effort has produced numerous valuable treatises and reports.

The Jacobsen-McGill Expedition to Axel Heiberg Island has carried out extensive research on Axel Heiberg Island since the establishment of the first research station on the island in 1959. The expeditions are the joint undertaking of McGill University and Dr. G. Jacobsen of Montreal and are directed to the study of the evolution of the mountainous and strongly glacierized and glaciated areas of the central point of western Axel Heiberg Island. The first major operation was in the summer of 1960 when twenty-seven scientists and assistants worked in the field. Smaller groups have continued the field investigations in each of the subsequent summers. Research work includes botany, glaciology, glacio-meteorology, geology, geomorphology, gravity, seismology, surveying, zoology, and permafrost research. In the summer of 1965, the first two specialized automatic climatological stations (AGMCS) were established for a long-term study of the meso-climatic changes and their effects on glaciers.

Le Centre d'Etudes Nordiques (Centre of Northern Studies), Laval University, was established in 1961 and is interested primarily in the Quebec-Labrador peninsula, a choice territory for research purposes because of the varied terrain, the various peoples and cultures, etc. Projects include a study of the physical anthropology of the Spotted Island region and of cultural evolution among the Mistassini Indians. In 1964 the Centre set under way a concentrated study of the central part of the peninsula west of the Bay of

Ungava. The investigation involves studies in archaeology, geology, anthropology, physiography, and biology.

The Arctic Studies Group, Department of Anthropology, University of Montreal, carries out projects in social anthropology, archaeology and the translation of literature on the Arctic to train students in arctic research. Projects include a study of the social anthropology of the East Hudson Bay area, archaeological work in the Bathurst Inlet area and the translation of Russian material on the Arctic.

The Committee on Northern Studies, University of Manitoba, was established in 1962 to foster and stimulate research in the Far North. For many years prior to 1962, the University had been active in research work in the Canadian Arctic. Projects include the study of edible molluscs in Hudson Bay, a microbiological survey of subarctic soils and micrometeorological studies on Ice Island T-3.

The Committee on Arctic and Alpine Research, University of British Columbia, is carrying out various research projects in the Canadian Arctic ranging from the development of an under-ice sampling vehicle to a study of the geomorphology of Garry Island. Other projects include a study of biogeoclimatic zones and their plant associations in Northwest Territories and Yukon and studies of permafrost in the Mackenzie Delta area.

The Institute for Northern Studies, University of Saskatchewan, was established in 1960 to promote, encourage and engage in research on the northern regions of Canada and to train specialists for future work in these regions. The sphere of interest is roughly northern Saskatchewan and Northwest Territories. The Province of Saskatchewan and the federal government participate in funding the Institute. Studies include biological investigations on forest vegetation, fungi, mammals, biting insects, birds; economic surveys of water transportation, mining, fishing, timber, furs; the geology of some mining camps; the geophysics of the earth's crust and engineering design of radio communication for remote areas.

The Boreal Institute, University of Alberta, was established in 1960 to promote the study of the Canadian Arctic through the university curriculum and to provide an information centre on the region. Already the Institute library has acquired thousands of books and pamphlets and is proving a valuable source of material for students preparing theses on the Far North. Institute projects range from a recent study of volcanic ash-fall in Yukon to studies of the simatic dykes, intruding the Archean rocks of the Yellowknife district, and the education of the Eskimo.

The Somerset Island Expeditions, University of Ottawa, were initiated in 1964 to make geological, geographical, and physical studies of Somerset Island. The initial work is concentrated in the Boothia Arch area, but it is hoped eventually to make a complete study of all aspects of the Island.

The University has also established the Canadian Research Centre for Anthropology with the immediate aim of carrying out studies on the district of Mackenzie.

Cape Dyer-Baffin Island Geological Expeditions, University of Toronto, are being carried out by the University's Institute of Earth Sciences to make a thorough study of the basalts of Baffin Island and to compare them with the well-studied basalts of West Greenland in connection with the debated hypothesis of continental drift.

In Conclusion

The research described above is only a part of what is being undertaken in the Canadian Arctic by universities and agencies, private groups and individuals; for a whole volume at least would be needed to give a complete picture of all the activities that are under way in the North, or are being planned. For instance, the human and economic aspects have only been touched upon here; and yet it is becoming increasingly recognized that research in these fields is essential to the development of a region so full of possibilities, full of unknowns — a region that will test all of our scientific skills in the baring of its full resource potential.