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The following meetings have been held:

Eighty-seventh Meeting. 13 January 1959. The Annual General Meeting. Two films were shown: "City of Gold", a record of the Gold Rush days at Dawson City and "The Living Stone", a colour film taken in the Cape Dorset area in 1958. Both films were produced by the National Film Board.

Eighty-eighth Meeting. 10 February 1959. "Mineral resources in northern Canada" by Mr. K.J. Christie.

Eighty-ninth Meeting. 10 March 1959. "Research in the Lake Hazen area of northern Ellesmere Island during the I.G.Y." by Dr. G.F. Hattersley-Smith.

Ninetieth Meeting. 14 April 1959. "A recent expedition to Bylot Island" by Mr. Louis Lemieux.

Ninety-first Meeting. 19 May 1959. The Annual Dinner. The Honourable Alvin Hamilton, Minister of Northern Affairs and National Resources, was the guest speaker.

Research in the Lake Hazen region of northern Ellesmere Island in the International Geophysical Year [1]. By G. Hattersley-Smith [2]

"Operation Hazen" was organized by the Defence Research Board to carry out meteorological, glaciological, geophysical, and geological investigations in the Lake Hazen region of northern Ellesmere Island during two summers and one winter, 1957-8. Biological and archaeological work was also undertaken by officers of various government departments in the summer of 1958. The organization was entrusted to the Defence Research Board Geophysics Section, which is headed by Mr. T.A. Harwood. The present writer was in charge of the operation in the field during the two summers, and Mr. C.R. Harington of McGill University was in charge of the wintering party.

1 Published by permission of the Chairman, Defence Research Board of Canada.

2 Geophysics Section, Defence Research Board.

Twenty scientists took part in the operation, including officers of the Fisheries Research Board, the Geological Survey, the Human History and Natural History branches of the National Museum, and the Wildlife Service, and members of McGill University, the Universities of Toronto and Alberta, and Michigan State University. The following is a brief review of the logistic arrangements for the operation, and of the scientific work based on preliminary reports.[1]

The expedition was magnificently served by the R.C.A.F. Air Transport Command, 436 Squadron from Downsview, who provided the spring airlift in both years, and 408 Squadron from Rockcliffe, who provided airlift to the glacier in 1957; and by the Air Defence Command, 121 Communication and Rescue Flight from Sea Island, who provided airlift to the glacier and ice cap in 1958. In 1957 the airlift involved ten landings in late April and early May by C-119 (Flying Boxcar) aircraft in transporting the party of eight, two tractors, two dog teams, and 35 tons of stores, fuel, and equipment to Lake Hazen via Resolute and Thule Air Base. The first two landings were made on an unprepared strip. A bulldozer, carried in on the first flight, was used to prepare a 3,500-foot airstrip on the lake ice for subsequent landings. An airlift of similar proportion was carried out in 1958, in transporting the party of twenty, three dog teams, and 30 tons of fuel and equipment. In addition a C-130 A (Hercules) aircraft of the United States Air Force, equipped with skis, brought in 9 tons of fuel at the end of March. In May 1957 the base camp, consisting of two Attwell shelters and a Jamesway hut, the latter taken over from the "Shoran" station on Johns Island, was established on the north shore of the lake, opposite Johns Island. The establishment of the camp on Gilman Glacier at 3,500 feet called for an airdrop by 436 Squadron and three landings by DC-3 (Dakota) aircraft of 408 Squadron, whose Commanding Officer, W/G J.G. Showler, pilots, and aircrew, went out of their way to assist the operation. The camp was reopened in 1958, when fourteen Dakota landings were made by 121 C. and R. Flight in connection with manning and restocking the camp and flying parties to outlying field stations. Three pyramid tents, containing valuable equipment, which were pitched in August 1957, were found standing in excellent condition after the winter. The expedition was greatly indebted to F/L M.W. Utas, of 121 C. and R. Flight, and his aircrew - to his experienced judgment and skilful

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1 (Defence Research Board). "Operation Hazen: narrative and preliminary reports for the 1957 season". Ottawa: January 1958, iii + 57 pp., illus., maps.

"Operation Hazen: narrative and preliminary reports for 1957-58", Ottawa: March 1959, iv. + 88 pp., diags., maps.

airmanship, and to the efficient teamwork of the crew. During the spring airlift in both years, valuable assistance was received from an experienced tractor driver/mechanic Sgt. D. Engel, R.C.E., and in 1958, from an experienced radio technician, Sgt. J.E. Robertson, R.C.S.

In early June 1958, the Chairman of Defence Research Board, Dr. A.H. Zimmerman, and a party of senior Canadian and United States service officers and government officials, visited Lake Hazen for two days in a North Star aircraft, which used a 5,000-foot runway on the lake ice.

The 1957 summer party was relieved in mid-August by the winter party, who arrived at the head of Chandler Fiord in U.S.C.G.C. Eastwind. The transfer of the winter party and 15 tons of stores and fuel for the 1958 summer, and the evacuation of the summer party with two dog teams, specimens, records, and certain equipment were effected by helicopter in 35 hours flying. Evacuation in mid-August 1958 was carried out by U.S.S. Atka. The expedition owed much to Capt. R.F. Rea, U.S.C.G., Cdr. W.H. Reinhardt, U.S.N., and ships' companies for their outstanding services. Five men, who remained behind to complete scientific work, were brought out by an R.C.A.F. Canso aircraft of 121 C. and R. Flight under the command of F/L E.M. Neil, on August 20. The airlift and sealift operations were most ably coordinated by L/Cdr. J.P. Croal, R.C.N., at that time seconded to the Defence Research Board. In early august 1958 Dr. Terris Moore of North Vassalboro, Maine, visited Lake Hazen in his Piper Super Cub aircraft which he had flown solo from the United States. He most kindly flew members of the expedition on a number of service and reconnaissance flights in the area.

During the 1957 summer, only two members of the party of eight were based on the lake; the remaining six worked from the Gilman Glacier camp. In the 1958 summer, thirteen members of the party of nineteen, including the four men who wintered, were based on the lake; the remaining six were based on the glacier. In 1958, twelve members of the party were working on Defence Research Board projects; the remaining seven were working for other government departments. The work from the Lake Hazen base camp will be described first.

The winter party consisted of four graduates from McGill University, working under contract for the Defence Research Board, Messrs. C.R. Harrington, J.M. Powell, C.I. Jackson, and D.I. Smith. They successfully achieved their main objective, a complete record of synoptic meteorological observations. They also made studies on micrometeorology, auroral activity, ice growth and snow cover on the lake, ground temperatures, and local wildlife. Their year-long meteorological record is the first of its kind from an inland station north of the Canadian Arctic mainland. The mean temperature for December was -47.7°F, and the minimum temperature of the winter -68.5°F. The Lake Hazen trough proved to be a gigantic frost hollow with an intense surface inversion, with temperatures at the lake commonly 25°F lower than at Alert. Cloud cover was very rarely below 1,000 feet, except in the month of September, and the 3,000-foot hills north of the camp were usually free of cloud. In September, the lake remained open for three weeks after the air temperature fell below freezing on the third of the month. This period was characterized by a local climate with an air temperature of about 20°F and with a persistent layer of low stratus or strato-cumulus. After the lake froze, the temperature fell very rapidly. In the winter, ice crystal fog could cause difficulties in aircraft operations; ice fog did in fact persist for several hours after take-off of the C-130A aircraft in March. The mean annual temperature for 1957-8 was about -6°F.

In May 1958, as part of the Defence Research Board geophysical programme, absolute gravity stations were established at Lake Hazen, Ward Hunt Island, Clements Markham Inlet, Gilman Glacier, and Fort Conger by Dr. F.S. Grant of the University of Toronto. These stations were tied into the Canadian-Greenland network by observations at Churchill, Resolute, and Alert. The gravimeter was kindly made available by the Gravity Division at the Dominion Observatory.

Dr. R.L. Christie of the Geological Survey of Canada was primarily concerned with the bedrock geology, and in 1957 carried out a reconnaissance of the Lake Hazen - Conybeare Bay area; in 1958, with his assistant, Mr. B.P. Walker, he extended his reconnaissance southeastward to Judge Daly Promontory, eastward to Fort Conger, northeastward to Alert, and northward to Clements Markham Inlet. In the early part of the summer, he travelled by dog sledge; later he used the dogs for packing. The Dakota aircraft was used to lay depots in Archer Fiord, and at Fort Conger, and to fly the geological party to Clements Markham Inlet, whence they traversed back to Lake Hazen on what is believed to be the first crossing of the United States Range. Dr. Christie has described his work in separate notes for the Arctic Circular (see Vol. XI, pp. 2 - 7 and 63-6).

Prof. R.E. Deane of the University of Toronto, was employed by the Defence Research Board during both summers to carry out research on the Pleistocene geology of the lake area and on the limnology, bathymetry, and sedimentation in the lake. Four possible sites for airstrips were surveyed; the most favourable is probably the one situated about a mile west of the base camp. The ice on the lake in the spring was about 5 feet thick. In the 1957 summer the lake became completely ice-free, but in 1958 about 4/10ths of ice cover remained west of Johns Island, although the eastern part of the lake was ice-free. Temperatures in the lake did not rise above 3°C, except in the shallow east and west ends. The glacier-fed rivers were cold, but two rivers at the east and west ends of the lake showed temperatures up to 12°C. Before the melt, the water in the lake was very clear. In the summer, muddy river water sank to the bottom, and flowed under the lake water into the deeper parts of the basin; it gradually mixed with the clear lake water, but reached the surface only in the shallow ends of the lake. The level of Lake Hazen rises gradually during the summer through about 4 feet. Throughout the winter it slowly discharges via its only drainage, Ruggles River, and the level is gradually lowered until the following spring, when the cycle starts over again. In consequence, the upper half mile of Ruggles River remains open throughout the year. In the lower part of the river a 25-foot thick development of river ice stretches across the floodplain, through which the present river has carved a channel. Echo and line soundings over a wide area of the lake showed the greatest depth of 864 feet between Johns Island and Ruggles River. The bottom profiles slope steeply on the north side, and rise gradually towards the south side. Bottom cores up to four feet long will provide useful information on the sedimentary history of the lake. The very straight north and south shores of the lake suggest a basin which originated partly through faulting and partly through glacial erosion.

Dr. M. Brochu of the Geographical Branch of the Department of Mines and Technical Surveys, studied the sedimentology of the periglacial deposits, the glacial morphology, and the development of surface drainage and cryoconite features on Gilman Glacier. Mr. D.I. Smith, of the winter party, studied the geomorphology of the area. The whole area was undoubtedly covered by ice at one time. Erratics occur nearly to the summits of the mountains in the Garfield Range, indicating a considerable thickness of ice in an area which is now largely deglaciated. A very interesting exposure of apparent glacier ice, buried beneath several feet of fluvioglacial material, was found at the mouth of the river four miles east of the base camp and about ten miles from the present glacier in the valley of this river. Henrietta Nesmith Glacier was found to have advanced only 5 feet between September 1957 and May 1958. Vegetation occurs right up to the snouts of the glaciers, so that there is little evidence of recent retreat, though evidence of some thinning from high strand lines above at least one marginal lake. The maximum level of marine submergence in the area, shown by marine fossils and driftwood on old beaches near the mouth of Ruggles River, was 180 feet.

Prof. J.H. Soper of the University of Toronto, employed by the Natural History Branch of the National Museum, and Mr. J.M. Powell, of the winter party, investigated the botany, plant ecology, and micro-climate of the area. A total of 100 species of flowering plants was found,35 of which also thrive on nunataks up to 3,500-4,000 feet. A few poppies were found at nearly 5,000 feet. The collection included one probable new species (a member of the Cruciferae), five first records for Ellesmere Island, and sixteen farthest north records. Soper also made a fine collection of colour slides of individual plants and plant associations.

The biology of the lake was studied by Mr. I.A. McLaren of the Fisheries Research Board. He assessed the quality and quantity of the plankton, and measured the primary production of the waters or the amount of carbon fixed by the phytoplankton. The figures for the latter were extremely low, possibly among the lowest available for lakes studied at a comparable season. He collected bottom cores from one of the small lakes near the base, where below 1 metre of sediment there was old lake ice, indicating that the cores may represent the entire sedimentary history of the lake. Much of McLaren's time was taken up with examination of more than 500 arctic char, which species thrives in the lake. They ran up to about 33 inches in length; the heaviest weighed 8 lb. McLaren also made a collection of chironomid (midge) larvae.

The wildlife of the area was investigated by Mr. J.S. Tener of the Canadian Wildlife Service, who was primarily interested in the life-cycle and breeding of the muskox. He examined about 240 old skulls and made a collection of teeth for age determination by growth ring count. Seventy-one muskoxen, including 5 calves, were seen during the summer of 1958. Several skulls and a skeleton, found on Gilman Glacier and on nearby nunataks, showed that muskoxen occasionally stray up the glaciers. Tener estimated the total population of the lake area at 200. Three Peary's Caribou were seen in 1958. The wolf population on the north side of the lake appeared to be about 12, and hares were fairly common. Foxes were common and appeared to range all over the glaciers and ice cap. Lemming were very common in 1957, but extremely scarce in 1958. A small collection of certain mammals was made for the National Museum.

Dr. M.S. Maxwell of Michigan State University, employed by the Human History Branch of the National Museum, excavated archaeological sites on Chandler, Fiord, Conybeare Bay, at the east end of Lake Hazen, at the mouth of the river flowing from Gilman Glacier, and at the head of Ruggles River. The latter site, which had been partially excavated by Greely in 1882, showed three stages of building - the latest occupants being an elderly man and his wife, whose partial skeletons were found. A number of sites were recorded, but not excavated, in the foothills up to fifteen miles north of the lake. The archaeological sites range in age from possibly as early as the 10th or 11th century to the mid-fifteenth century. Some 235 artifacts were collected for the National Museum, a few of which showed certain Dorset characteristics, possibly dating back to the beginning of Thule culture. The outstanding artifact of the Ruggles River house was a walrus ivory needle case, possibly of Alaskan design, and considered to be an heirloom handed down from generation to generation.

The geophysical programme on Gilman Glacier and the ice cap required accurate elevations and positions. The survey programme was the responsibility of Mr. K.C. Arnold, working under contract for the Defence Research Board through McGill University. It involved the running of a sub-tense bar level traverse from Chandler Fiord, southeast of Lake Hazen, to Clements Markham Inlet on the Arctic Ocean, a total distance of 110 miles. This traverse took two summers to complete, using dog teams, motor toboggans, and pack-dogs for transport. For the northernmost leg of the traverse the survey party were landed by Dakota aircraft in Clements Markham Inlet, and followed Christie's trail back to Gilman Glacier. The closing error was less than 4 feet, which makes no allowance for the effect of the tides. It was also necessary to establish a triangulation network from a base line near the snout of Gilman Glacier. By means of cairns on nunataks, this network was extended up both sides of Gilman Glacier to the area of Mount Oxford. Observations from these cairns were made on about 30 stakes in order to measure the surface movement of the glacier during both summers and over the course of a full year. Surveys were also made of the snout of Gilman Glacier to assess its advance or recession. The whole survey was tied to the Geodetic Survey "Shoran" station on Johns Island.

The seismic and gravity work was carried on for the most part concurrently with the survey. In 1957 Dr. F.S. Grant, assisted by Mr. H. Sandstrom, and Mr. J.D. Filo, all of the

University of Toronto, and working under contract for the Defence Research Board, concentrated on seismic work and obtained six profiles of Gilman Glacier between the snout at an elevation of 1,300 feet and the area ten miles east of Mount Oxford at 4,500 feet. In 1958 the seismic programme was limited to two weeks in the month of May, after which the seismic equipment was flown out. Mr. J.R. Weber of the University of Alberta, working under contract for the Defence Research Board, through McGill University, assisted by Messrs. H. Sandstrom and C.R. Harington, shot a refraction profile at the Gilman Glacier camp, and a refraction and a number of reflection profiles on the highest part of the ice cap within six miles of Mount Oxford, where they were landed by Dakota aircraft at nearly 6,000 feet. Later in the summer Weber and Sandstrom carried a continuous gravity traverse along the line of the level traverse from Grant's gravity station in Clements Markham Inlet via Gilman Glacier to Mount Oxford, down Gilman Glacier and across the plateau to the Lake Hazen base camp, thence down Ruggles River to the head of Chandler Fiord. An extensive gravity survey over the whole of Gilman Glacier and on regions of the ice cap as far west as Mount Oxford was also carried out. A Worden gravimeter was used. The gravity data are being used to extrapolate from the ice thicknesses obtained at the seismic control points; it is also hoped that the data will provide useful information on the structure of the United States Range. Reference is made later in this account to the results of the survey and geophysical work.

For a proper understanding of the budget of a glacier, a meteorological and micrometeorological programme is essential. Mr. J.R. Lotz of McGill University, working under contract for the Defence Research Board, undertook this work in both summers. Meteorological observations were made three times a day at 0800, 1400, and 2000 hours for most of May, all of June and July, and for the first ten days or so of August, until the station was evacuated. Observations were made of screen temperatures, wind direction and speed, relative humidity, visibility, precipitation, and cloud. Continuous thermograph, hygrograph, barograph, and sunshine records were kept. Micrometeorological work was carried on in late May, throughout June and July, and in early August, and involved making most of the above observations every two hours from 0800 to 2200. In addition, wind speed and temperature were measured at four levels up to 10 metres (33 feet) on a mast. Measurements of net radiation and short wave solar radiation were also made. The highest temperature recorded during the two summers was 46.6°F on 25 June 1957, and the lowest -8.9°F in early May 1958. The 1957 summer was warmer than the 1958 summer, which was reflected in the amount of ablation at the camp-80 cm. of ice in 1957 and 43 cm. in 1958. The prevailing wind was northwest or down-glacier. Winds seldom exceeded 10 m.p.h.; the highest were 35-40 m.p.h. in blizzards in early May 1957 and early July 1958. Work on the correlation of the various meteorological factors with the ablation in the melt season on Gilman Glacier is proceeding.

In the glaciological work, Dr. G. Hattersley-Smith was assisted in 1958 by Mr. R.B. Sagar, of McGill University working under contract for the Defence Research Board, and by Arnold and Lotz, and other members of the party in both years; work was concentrated on Gilman Glacier and on areas of the ice cap to the north and west, from which the glacier is nourished. Data were also obtained on snow accumulation and the position of the equilibrium line over a wide area extending from glaciers above Tanquary Fiord in the west, to glaciers above Clements Markham Inlet in the northeast, and northwards to the upper reaches of the glaciers above M'Clintock and Disraeli bays on the north coast. Where possible, nunataks were visited for geological specimens and data to supplement Christie's work. The general level of the ice cap is between 6,000 and 6,500 feet with nunataks rising to 7,000 feet or higher. Mount Oxford was identified and found to be only 7,248 feet high, not 9,000 feet as stated by A.W. Moore of the Oxford University Ellesmere Land Expedition, who climbed it in 1935. The highest mountains are situated on the flanks of the ice cap, namely between the heads of M'Clintock and Milne bays and between the head of Tanquary Fiord and Henrietta Nesmith Glacier. The highest mountain in Ellesmere Island, and in Canada east of the Rocky Mountains, is probably in the latter area, where there is a peak reaching a height of about 8,250 feet.

Near Mount Oxford, a 6 1/2 metre (21-foot) pit was dug, and a 7-metre (23-foot) borehole sunk from the bottom of it, for accumulation, density, and temperature measurements in the firn. The snow depth here in early July was 40 cm. (15 1/2 in.), which is close to the average measured at 30 stations on top of the ice cap. The temperature in the firn fell rapidly from near freezing point to a steady temperature of -24°C (-11°F) at 3 metres (10 feet), which was maintained to the bottom of the borehole at 13 1/2 metres (44 feet). Ice layers and density variations together were used to give an annual stratigraphy which is believed to be correct within one or two years over the past twenty years. Calculations for the years 1938-58 gave an average annual accumulation in water equivalent of 12 1/2 cm. (5 in.). It is significant that the lower part of the section was free of ice layers, which is believed to indicate little or no summer melting in the decade or so before 1930. Subsequent summers were marked by appreciable melting, particularly in the early 1930's and in the years since 1944.

On the north side of the ice cap, glaciers descend steeply to the trough-like valleys at the heads of the fiords, where meltwater lakes and snow-free valley sides showed that the thaw was well advanced by the end of June. These glaciers occupy valleys extending far back into the mountains, which were probably dissected by rivers in preglacial time; they were thus able to channel ice from the highest accumulation areas of the ice cap, and their valleys underwent powerful glacial erosion. Between Mount Oxford and the area between Yelverton Bay and Tanquary Fiord, the ice cap is by no means a flat table-top, but shows an undulating hill and dale topography with a local relief of about 400 feet. On the south side of the ice cap the glaciers flow away much less steeply than to the north, and probably move more slowly. There are considerable variations in thickness of the ice from 230 to 850 metres (750 to 2,800 feet) within five miles of Mount Oxford, indicating buried mountains.

The equilibrium line on three southward-moving glaciers - Gilman, Henrietta Nesmith, and a glacier above Tanquary Fiord - was found to lie at an elevation of about 4,200 feet (1,260 metres), slightly higher in 1957 and slightly lower in 1958. It was judged to be at approximately the same elevation on the northward-flowing glaciers above Disraeli and M'Clintock bays. At 4,500 feet (1,370 metres), on the upper part of Gilman Glacier, accumulation occurs by firn formation, by refreezing of slush, and by refreezing of meltwater at the bottom of the snow pack. The glacier is up to 800 metres (2,600 feet) thick here, and the surface moves at a rate of about 4 cm. (1 1/2 in.) per day. At the Gilman Glacier camp site at 3,400 feet (1,030 metres), the glacier is about 600 metres (2,000 feet) thick, and the surface is moving at the rate of 5-6 cm. per day, a movement which is maintained at least to within two miles of the snout, where the glacier is still 400 metres (1,300 feet) thick. The temperature distribution in the upper 25 metres (82 feet) of the glacier during the summer of 1958 was measured at the camp by thermistors; these measurements gave a mean annual temperature of -18.5°C (-1.2°F), or nearly 5°F higher than at the Lake Hazen base camp for the year 1957-8.

The equilibrium line is located not far above where Gilman Glacier debouches from the ice cap. The snow cover in 1957 was 23 cm. (6 1/2 cm. water equivalent), averaged at a network of ten stakes spread across the glacier about a mile above the camp; the mean depth was similar in the spring of 1958. Owing to wind action, the snow is appreciably less on the glaciers than on the ice cap. The mean ablation at these stakes in 1957 was 78 cm. of ice (70 cm. water equivalent), and about 48 cm. of ice (43 cm. water equivalent) in 1958. In the centre of the glacier, two miles from the snout and five miles below the camp, the ablation was 1.6 metres (5 feet) in 1958, and probably about 2 metres (6 1/2 feet) in 1957. Ablation at the sides of the glacier is appreciably greater than at the centre due to the insolation at the bare rock walls. This is in part compensated by lateral spreading of the glacier measured at 6 metres (20 feet) over a width of 1,800 metres (6,000 feet) at the glacier camp between July 1957 and July 1958. The snout of the glacier has remained in roughly the same position at least for several decades, as shown by vegetation to within a few feet of the ice. The forward movement appears to be roughly compensated by the amount of melting at the snout in the summer. Preliminary calculations indicate that Gilman Glacier and its accumulation region lost roughly 20 per cent more water through melting in the summer of 1958 than was gained by snow accumulation in the previous winter. For the budget year 1956-7 the imbalance was appreciably greater. Studies were also made of marginal, surface, and tectonic features of Gilman Glacier, which are very well shown in a fine series of vertical air photographs taken by 408 Squadron in early August 1958.

It is concluded that, on the south side of the mountains, the main glaciers - that is, those supplied from the high ice cap - are thinning in their lower reaches, owing to higher summer temperatures in the last few decades, as in the North Atlantic area generally, but are not yet receding at their snouts. There can be no doubt that some of the small, local ice caps, which do not rise above 4,500 feet (1,370 metres), and associated glaciers, are both thinning and receding at their edges by several yards each summer. Small patches of snow-drift ice at the lower levels are disappearing from year to year. It is more than likely that similar thinning and recession is occurring on small, low level ice caps elsewhere throughout the Queen Elizabeth Islands.

It is hoped that the results of all branches of the work on "Operation Hazen" will eventually be published by the various scientists as papers in the journals, or in government reports. Acknowledgement is made to the following for permission to refer to the field work of their officers on "Operation Hazen"; the Deputy Minister, Department of Mines and Technical Surveys: the Deputy Minister, Department of Northern Affairs and National Resources; the Chairman, Fisheries Research Board, Department of Fisheries.

Anthropological work in the Eastern Arctic, 1958. By W.E. Willmott

During the summer of 1958 the Northern Research Coordination Centre of the Department of Northern Affairs sent several teams of anthropologists to study various Eskimo Communities. Dr. T. Yatsushiro of McGill University spent the summer at Frobisher Bay, Dr. and Mrs. R.G. Dailey of Toronto at Rankin Inlet, Mr. J.D. Ferguson and Mr. E.Y. Arima at Coppermine, Miss Sarah Wolfe at Churchill, and myself at Port Harrison. My study was to provide a comparison with the other centres, where rapid expansion of various facilities were having marked effects on the Eskimo way of life. By contrast, Port Harrison life has not changed radically for several decades. Most of the Eskimos still live in camps and make their living off the land, hunting and trapping, although they do have a somewhat higher standard of living and more items of our material culture every year.

I flew to Harrison from Moose Factory on June 29 on the first aircraft after the break-up. For the first ten days I lived in the Northern Affairs 512 house, a standard Eskimo dwelling, becoming acquainted with the residents and collecting vital statistics in the R.C.M. Police detachment where Cst. and Mrs. Ross Gibson, now of Pictou, N.S., were warmly hospitable and helpful. I also spent some time in the Hudson's Bay Company store, whose manager, Mr. Ross Peyton, was a constant source of information and encouragement, and collected health statistics and observations from Nurse Ruth Horley, then in charge of the nursing station. Throughout the summer, I was grateful for occasional meals and frequent conversations with many of the white residents.

After ten days of my own cooking I moved into the tent of an Eskimo family, Lucassie and Eva Naujakulluk, in order to observe more closely the daily life among those Eskimos who live in the settlement itself. For two weeks I made myself a terrible nuisance following them around, asking impossible questions whose answers I had difficulty understanding, and being constantly in the way: a real qualluna'aluk !

After the annual gathering for the visit of the C.D. Howe, I returned to camp with the family of Johnny Inukpak, leader of a camp north of Cape Dufferin. I remained for three weeks with this camp, joining the men in carving soapstone, visiting their soapstone mine, hunting, and twice returning to Harrison to trade our handicrafts (Mr. Peyton could not accept my carvings because they were not genuine Eskimo). In this brief visit I collected observational material on life habits as well as interview material on kinship patterns and terminology. Not having an interpreter, and being entirely new to the language, I rapidly picked up a small vocabulary and unconsciously trained the Eskimos to speak a sparrow-Eskimo (even simpler than pigeon) so that I might understand their movements and plans.

I returned to Harrison for the last three weeks, and passed the time making further observations, checking them by interview, and touring all the camps by canoe with Nurse Bill Cowley. I was also able to do some work in organizing my material.

The data collected tend to show that the nature of the community organization varies between camp and settlements Eskimos, and this is closely related to economic differences. In the camps, where the Eskimos depend more on the hunt, there is strong solidarity, usually personified in the power of a leader. In the settlement, the community is held together by the white establishments, and there is no one leader among the Eskimos. The household also differs between camp and settlement. The camp household is not clearly defined, its members eat, play, and even sleep in any one of the tents; while in the settlement a household more closely approaches our concept of a family, eating together three times a day and always sleeping in the same house. In this case as well the difference parallels economic differences; the settlement household is economically independent while the camp household shares a common lot.

This clear dichotomy between settlement and camp is complicated by a third identifiable type of local group: those camp Eskimos who have lived previously in the settlement or who live so close they can come in daily. This group shows less community solidarity than the true camp, but more than the settlement. In some respects it seems to represent a type of organization midway between the two, and if we think of these as historical changes, it represents a transitional stage. The danger of this comparison is shown by the fact that this intermediary stage probably approximates the traditional Eskimo local group more closely than does the modern camp.

On September 9 Jim Bell of Austin Airways agreed to squeeze me into a Beaver aircraft he was flying down from Dorset, and we had an excellent trip to Moosonee, passing over the eastern Belcher Islands and stopping only at Fort George to refuel. I was home in Montreal two days later.

Whatever the value of this field study may be to the vast science of anthropology, it is hoped that it will be of some value to the understanding of the Harrison Eskimos by the Department of Northern Affairs. It certainly is of tremendous personal value in introducing me to Eskimos whose joyful company remains for me a treasure and an example.

Geomorphological studies on Southampton Island, 1958. By I.H. Davis

During the summer of 1958, I made a detailed field investigation of the geomorphic processes acting on limestone under arctic conditions in the area between the Boas River and South Bay, Southampton Island. I was accompanied by J.A. Cooke as field assistant. The greater part of the expense was covered by a Carnegie Arctic Scholarship, with additional assistance from the Banting Fund through the Arctic Institute of North America.

We arrived at Churchill late in May and flew to Coral Harbour on May 29 in the monthly supply aircraft. A disused shack belonging to the Department of Transport was placed at our disposal, and this served as our main base camp, as well as a store for equipment and supplies. During the first week in June we laid out a series of food caches to the northwest of Coral Harbour using a snowmobile, and a second line of coastal caches was made on a sledge trip with Natakok, a local Eskimo. The early part of June was occupied in a study of the soil structures on the higher parts of the abandoned beach ridges, which were by then clear of snow. A soil temperature survey begun in 1957 at Coral Harbour was also continued during this period.

Between June 25 and July 6 we investigated the outliers of limestone in the higher, more rugged areas of Precambrian gneiss north of Coral Harbour. Fossils taken from limestone strata near the contact with the gneiss suggest that the basal beds of the limestone are of Middle Ordovician (Trenton) age. Detailed surveying of slopes developed in limestone was initiated in this area, and extended to more westerly parts of the field area later in the summer. Between July 6 and 11 we examined the faulted contact between gneiss and Palaeozoic limestone in the area of the lower Kirchoffer River, using an inflatable rubber canoe to ferry our equipment across the river.

During the remainder of July we made an extended traverse to the northwest. At first we followed the topographic boundary between the Precambrian and the Palaeozoic rocks, reaching the wide bend of the Boas River near the 430-foot ridge called "Sadliarotak". We then moved southward to the gently undulating country around Salmon Pond at 300 feet above sea level. Some time was spent in the upper valley of the Sutton River and around "Ivitarolik", a long narrow lake on the eastern side of the only major esker on the island. While we were in this area, and as we continued easterly to Rocky Brook, the weather deteriorated and visibility became extremely poor with thin driving rain and fog. On July 30 we reached a point one mile from the mouth of Rocky

Brook, and from there returned directly to our base camp.

The period of bad weather ended on August 3, and we began our second extended traverse, this time following the coast to the southwest. The investigation of the lower valley of Rocky Brook was completed, and several days were spent studying the valley of Sixteen Mile Brook. On August 11, with the assistance of Mikketook, a local Eskimo, and canoe, we examined the coastal morphology from the mouth of Sixteen Mile Brook to Bear Cove Point.

The remainder of August was spent in a detailed investigation of the lower Sutton River valley and the limestone areas on both sides. The low limestone plains near the coast are covered with a series of abandoned beaches, separated by lagoons and marsh. The higher tabular plateaus are covered with frost-shattered fragments of limestone of varying sizes, often arranged in polygonal patterns. Vegetation is virtually absent on the higher areas, except around lakes where there is more available ground water. In the extreme west of the area studied, the drainage pattern is very confused, with large interconnecting lakes and intermittent streams.

The destruction of our most southerly supply cache by bears made it impracticable to visit The Points ridge in the southwest of the island, and the party was picked up at the mouth of Sixteen Mile Brook by Peterhead boat and returned to Munn Bay on August 28. Owing to academic commitments, Cooke left Coral Harbour by air for Churchill the following day, but I remained until September 29 to complete the programme of soil temperature readings.

The main purpose of the field study was to examine the relative efficacy of mechanical and chemical weathering on limestone under arctic conditions. In other climatic regimes much of the erosion of calcareous rock is caused by solution; percolation of ground water along joints in the bedrock causes the formation of caverns and, in certain areas, the distinctive karst topography. On Southampton Island the occurrence of permafrost inhibits free circulation of ground water. The thinly bedded limestone is very susceptible to shattering by the freeze and thaw action of water percolating along the bedding planes resulting in the production of a deep layer of angular shattered material on the surface. The action of this mechanical weathering is confined to the 'active layer' which melts each summer. This layer is as much as 8 - 9 feet deep on the higher plateaus, 7 feet on the gravel covered outlier at Coral Harbour, and a matter of a few inches in the low lying marshy areas near the coast.

Many streams disappear beneath the shattered regolith and may be heard flowing at the permafrost level, where this is near the surface. Solution effects on the limestone appear to be limited to a slight modification of the angular fragments and there is no evidence of caverning. Caves are rare along the coasts of the area studied and were seen only at "Nunariak", north of Ruin Point, where they appear to be formed by marine erosion.

The general conclusion is that mechanical weathering due to frost action is the dominant erosion process acting on the limestone of the western part of Southampton Island; chemical solution plays a very minor role.

Bird Sanctuaries in Southampton Island

In June 1959 two bird sanctuaries were established in Southampton Island to protect the nesting grounds of Snow and Blue geese. King Eider, American Brant, and many other species of migrating waterfowl also nest in the region.

The Harry Gibbons Bird Sanctuary, in the southwestern part of the island, has an area of 575 square miles which includes the delta of the Boas River, and extends inland for approximately 25 miles. It is named for Harry Gibbons, who died in 1954. Mr. Gibbons was well known to many scientists working on Southampton Island as guide, Eskimo interpreter, and helpful companion. The Boas River goose colony has been studied more intensively than any other in the Canadian Arctic, and some 20,000 geese have been banded in the area since 1952.

The East Bay sanctuary has an area of 450 square miles, which includes the whole of the bay on the east coast of the island. The East Bay colony was reported to Mr. Alan Loughrey of the Canadian Wildlife Service by the Eskimos in 1952, but it was not until 1957 that a detailed study was made by Mr. T.W. Barry, also of the Wildlife Service. Most of the Blue Geese taken between Winisk and Cape Henrietta Maria come from this colony, which is also one of the main nesting grounds for American Brant.

Like the Dewey Soper Bird Sanctuary and the Bowman Bay Game Sanctuary, established two years ago on Baffin Island to protect the Blue Goose nesting grounds (see Arctic Circular, Vol. 10, 1957, pp. 14-15), the Southampton Island bird sanctuaries will be supervised by the Wildlife Service. Within the sanctuaries killing, capturing, taking, hunting, injuring, or in any way molesting migratory birds or their eggs is forbidden. Section 9 of the Migratory Birds Sanctuary Regulations has been amended to allow local trappers to carry guns between October 1 and June 1 in the new refuge areas on Southampton Island.

Subscriptions for 1959

Members are reminded that their subscriptions for 1959 ($2.00 for Ottawa members, or $3.00 for combined membership for husband and wife, and $1.00 for out-of-town members, other than institutions), are payable to the Treasurer, Mr. J.E. Cleland, P.O. Box 68, Postal Station D, Ottawa.

Owing to currency regulations it is not always convenient for members of the Arctic Circle residing in Europe to pay their subscriptions to the club in Ottawa direct. Through the courtesy of the Director, the Scott Polar Research Institute will now receive the subscriptions of members from the United Kingdom and from the Continent of Europe and will transmit them to Canada from time to time. European members should forward their 1959 subscriptions (5/-) to the Director, Scott Polar Research Institute, Cambridge, England and mark them "Arctic Circle Subscription".

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Members are earnestly requested to advise the Treasurer, Mr. J.E. Cleland, P.O. Box 68, Station D, Ottawa, promptly of any change of address.

Editorial Note

The Editor would welcome contributions from those who are at present in the Arctic or have information about work in the Arctic. All material for the *Circular* should be sent to

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U.S. Navy airship flight to Ice Island T3. By W/C K.R. Greenaway

In August 1958 an airship from the United States Naval Air Development Center, South Weymouth, Mass., flew to Ice Island T3 to determine the use of lighter-than-air craft in supporting research in the Arctic. The flight was the first to the Arctic by a lighter-than-air craft since July 1931 when the 'Graf Zeppelin', with the late Dr. Hugo Eckener in command, flew over the Barents and Kara seas. No airship had penetrated the North American Arctic since the 'Norge' flew from Kings Bay, Spitsbergen, to Teller, Alaska, via the pole in May 1926.

A ZPG-2 airship of standard configuration was used by the U.S.N. to make the flight. This airship was powered by two engines; its over-all length was 348 feet and its height was 110 feet. The ZPG-2 could maintain an airspeed of 40-43 knots for 75 hours with a 14-man crew, provisions and survival equipment, and about 4,000 pounds (350 cu.ft.) of useful lift available for cargo. The still air range was 3,000 nautical miles under these conditions.

Routes. Resolute weather station, Cornwallis Island, was selected as the northern base for the operation. Although quarters for the personnel were very limited, both the airship and the support aircraft, a Constellation, could be accommodated simultaneously. Several long-range flights out of Resolute were planned, including a flight to Ice Island T3 to deliver scientific equipment.

Two routes to Resolute were considered, one via Argentia, Newfoundland, along the coast of Labrador to Frobisher Bay, across Foxe Basin to the Gulf of Boothia and Prince Regent Inlet; the other via the Hudson and Mohawk valleys, Lake Ontario, Ottawa valley, Lake Timiskaming, Fort Churchill, along the west shore of Hudson Bay, up Roes Welcome Sound, and across Rae Isthmus to the Gulf of Boothia and Prince Regent Inlet.

Several factors had to be considered when selecting the route and planning the flight. For economical cruising an airship should be flown at low altitude on long-range flights. When the airship climbs, the pressure ceiling of the ballonets is usually exceeded and helium has to be released, this reduces the lift capability and an increase in engine power is required to offset the loss in lift. This, of course, has an adverse effect on range. Ideally, the engines should be used for forward motion only. Air temperatures were another factor to be considered. An increase in temperature causes the helium to expand and when the pressure limits of the ballonets are reached, helium is released and the subsequent loss in lift has to be offset by an increase in engine power.

The inland route via Fort Churchill was chosen because of its shorter distance and prevailing light winds, although a lower flight altitude could have been maintained on the coastal route. However, the inland route presented no real altitude problem. The increase in air temperature over the land during the day was not considered sufficient to cause trouble. This, of course, was not the case as was shown later.

Preparations. All unnecessary equipment was removed from the airship to reduce the weight, and several modifications were made to adapt the ship for high latitude operations. The gyro magnetic compass was modified to cut out magnetic slaving of the directional gyro so that the compass system could be used beyond Churchill where the magnetic heading became unreliable. An N-1 gyro compass system was also installed as a safety measure. The N-1 has a random drift of one degree per hour in the 'free' gyro mode and has been used in aircraft for high latitude flying for a number of years. The extra effort to install the second compass system was well worth while; shortly after leaving Churchill, the primary gyro compass failed and the N-1 was used to maintain direction for the remainder of the operation. In order to use the sun for heading checks, regardless of its relative bearing, astro compass mounts were installed in four positions, two fore and two aft. A development model of the APN-77, a doppler navigation system for helicopters, was installed to provide drift and ground-speed information when over the Arctic Ocean. Unfortunately, this equipment went unserviceable before reaching the area. Neither the APS-33 search radar, which was one of the primary navigation aids, nor the driftmeter, required modifying for use in northern latitudes.

During June and early July a party from the Naval Air Development Center visited Ottawa to arrange for the use of Churchill and Resolute. Helium, mooring facilities, and ground handling personnel were required at both bases. Temporary masts were erected at Churchill and Resolute; two flights were required to airlift the masts. Thirty men were needed at each site to assist in ground handling the airship in addition to the 7 key ground handling personnel flown in by the support aircraft. Ground handling personnel were provided by the U.S. Army First Arctic Test Center at Fort Churchill and the R.C.A.F. at Resolute. Arrangements were made to use the limited helium supplies retained by the U.S. Army at Churchill and the U.S. Weather Bureau at Resolute, if required.

Personnel. The airship flight crew consisted of four pilots, two navigators (one R.C.A.F.), two flight mechanics, two riggers, two electronic technicians, one radio man, and one electrician.

The Canadian observers on the operation were Commodore O.C.S. Robertson, R.C.N., Canadian Joint Staff, Washington, and Mr. N.G. Gray, Dominion Hydrographer. The U.S. observers included representatives of the U.S.N. Office of Naval Research, U.S. Navy Underwater Sound Laboratory, U.S. Hydrographic Office, Columbia University, and the Associated Press. All observers took part in the arctic portion of the flight, but several of the group travelled to and from the area in the support aircraft.

The support group, who travelled in the Constellation, included an aerologist, two airship pilots, a ground handling officer, and six ground handling and maintenance personnel.

South Weymouth to Churchill. A detailed study of aeronautical charts showed that it would be possible to fly all the way to Churchill under 2,000 feet above sea level by following the Hudson valley to Albany, the Mohawk valley to Lake Ontario, across the Rideau Lakes to the Ottawa River, up the Ottawa valley to Earlton, just north of Lake Timiskaming, and then direct to Churchill, a distance of about 1,460 nautical miles.

The airship departed for Churchill at 11 p.m. on July 27. The time had been chosen so as to take advantage of the lower night temperatures for the initial stage of the flight when the airship would be at maximum weight. The weather forecast indicated that the flight should be completed in about 36 hours.

Higher air temperatures and more widespread fog and cloud than had been forecast were encountered shortly after take-off, The possibility of navigating the Hudson valley at the flight plan altitude of 1,500 feet was ruled out and the airship was diverted to Lakehurst Naval Air Station, the most favourable base. The ceiling at South Weymouth had dropped below minimum.

Favourable winds and slightly lower temperatures were forecast for July 30 and a 1 a.m. take-off was planned. Minor engine trouble delayed departure about four hours. The flight up the Hudson and Mohawk valleys was made in daylight in good visibility at an altitude of 800 feet; at noon the airship passed over Kingston, Ontario, and headed for the Ottawa valley. Again, high air temperatures plagued the operation, as helium had to be released frequently to keep within the pressure limits of the ballonets. Higher and higher power settings had to be used as the lift capability was reduced. This raised the fuel consumption beyond acceptable limits and made it impossible to reach Churchill. A decision was made to divert to Akron, Ohio, where the Goodyear Aviation Company had suitable facilities. Cleveland was reached at dark, but severe thunderstorms along the south shore of Lake Erie throughout the night prevented mooring until 9 a.m. the next morning. The night was spent over Lake Erie, a safe distance off shore.

At Akron the ship was lightened to the maximum extent commensurate with flight safety and crew fatigue. The crew complement was reduced by one pilot and four technicians, and about 1,000 pounds of equipment was unloaded. The two failures to reach Churchill clearly indicated that another attempt would have to wait until surface temperatures along the route dropped from the mid-80's to the low 70's.

By August 2 the temperature had dropped, and with a forecast of favourable winds the airship left Akron airport at 1.30 the following morning, and headed across Lake Erie and western Ontario to Lake Huron. The Akron-Churchill flight was planned to take advantage of the lower temperatures over the water, by following Lake Huron to Sault Ste. Marie and across Lake Superior to Lake Nipigon, and then direct to Churchill. Arrangements were made by the support group, waiting at Churchill, to refuel at Lakehead airport if fuel consumption was again higher than predicted. In the afternoon, fifteen hours after departing Akron, the airship was over Lake Superior abeam Lakehead airport. Although the flight was proceeding as planned, it was decided to take advantage of the excellent weather at Lakehead airport and take on extra fuel as an added precaution.

The airship landed on the runway and was refuelled on the taxiway without mooring. A fuel truck with an extra long hose was used and the airship was kept in position by means of the engines assisted by about 25 ground handlers. The operation, which included taking on 1,000 gallons of fuel, extra oil, and two pilots, who had arrived on the support aircraft, was accomplished in forty minutes, much less time than that required to untangle the traffic jam on the roads leading to the airport caused by the airship's arrival. After refuelling, the airship departed for Churchill via Lake Nipigon and Trout Lake, arriving at 7.30 on the morning of August 4, 32 hours after leaving Akron.

While circling the Churchill area, waiting for the ground handling crew to assemble, at least 200 white whale were seen in the mouth of the Churchill River and in the bay to the east of the river mouth. Many calves were observed in the herd. After the second pass over the river mouth at 50 feet the whales became alarmed and headed for the open bay. The airship provided an excellent platform for observing their activities. By 9 a.m. the mooring operation had been completed.

Churchill to Resolute. Plans were made to depart for Resolute on the morning of August 5. However, high winds, which prevented unmooring the airship, and a strong headwind component over most of the route, caused a delay of two days. Normally, local high winds would not have delayed the departure, but with a deep ditch and rough ground near the mast, the airship could not be safely manoeuvred in high winds. Several times during the delay, gusts up to 50 m.p.h. were measured. Although the temporary mast was not designed to withstand winds over 30 m.p.h., it held the airship with no apparent difficulty. A crew remained aboard during the blow in case an emergency arose.

By the morning of August 7, the winds had dropped and the weather was favourable; nothing worse than a crosswind component was forecast on the route. The flight plan distance via Roes Welcome Sound was 1,080 nautical miles and the flying time was estimated to be about one day.

Take-off was made in fog. At 500 feet the airship emerged on top and course was set for Roes Welcome Sound. In the vicinity of Marble Island the fog and cloud dissipated and the weather remained clear until reaching the Gulf of Boothia. Shortly after leaving Churchill, the primary compass system failed, and the N-1 system, installed for such an emergency, was used for the remainder of the flight.

Several polar bears were seen on ice pans off Chesterfield Inlet. As soon as the airship approached, they became panic-stricken, diving and swimming first in one direction and then the other. One bear dived into the water dragging a partially eaten seal.

Rae Isthmus was crossed in twilight and clear weather. On entering Committee Bay, fog covered the water area and the remainder of the flight was made at 800 feet between the fog bank and intermittent layers of stratus. The N-1 gyro held a steady heading during the many hours when no sun sight was possible. It was fortunate that the primary direction system failed when in good weather over Hudson Bay and not while flying between layers in Prince Regent Inlet. Radar bearings from prominent landmarks were taken to maintain track.

At Resolute the ceiling was 300 feet and the radar was used to assist the instrument approach. An excellent landing was made under adverse conditions at 8.30 a.m. on August 8, 24 hours after departing from Churchill.

Resolute via T3 to Churchill. The temporary mooring mast had been erected 300 yards to the west of the Resolute runway. The R.C.A.F. personnel, on short notice, had done an excellent job of grading the mooring area and preparing a taxiway. In the process, however, the permafrost had been exposed and the surface was muddy and soft spots had developed.

Taxiing to the mast and the mooring was carried out without difficulty, but the problem of getting the airship, with maximum fuel load, back to the runway over the soft taxiway caused some concern. Several flights out of Resolute had been planned, but in view of the poor condition of the taxiway, it was decided to make only one 40-hour flight. The flight would include crossing the archipelago to T3 at 79 N., 121 W. and then proceeding to Ellesmere Island before returning to Resolute Bay.

Light winds and clear skies were forecast for the next 36 hours for the western part of the archipelago and along the route to T3. Hence, only a 12-hour stop was planned and take-off was set for 9 p.m. local time. As had been expected, difficulty was experienced in getting the airship from the mast to the runway. At one point, even a fork lift was used to help extract the starboard undercarriage from a soft spot in the taxiway. As a result, the take-off was delayed four hours.

On reaching an altitude of 500 feet a westerly heading was set for the southwest tip of the Bathurst Island group. When off Cape Cockburn, course was set direct to Mackenzie King Island passing to the east of Byam Martin Island. This route was the shortest low altitude flight path across the archipelago to T3.

Ideal weather prevailed, the winds were light and the visibility unlimited. No open water or leads were seen between Byam Martin Island and Mackenzie King Island. Six caribou were observed a short distance inland on the east coast of Mackenzie King Island. Low stratus and fog covered most of the remainder of the route to T 3. Tops of the clouds and the fog varied between 300-800 feet. No icing was encountered when flying through the ragged tops of the layers as the air temperature was several degrees above freezing. The fog and clouds were broken sufficiently to permit drift observations and to make heading checks by using the reflection of the sun on open patches of water. The configuration of the airship prevented observing the sun direct when checking the heading. The final alteration of course into T3 was made with the aid of a radio compass bearing on the beacon at T3. On reaching T3, altitude was reduced to 200 feet but visibility was poor and no attempt was made to unload the scientific gear; however, several bags of mail were dropped.

After spending about an hour in the vicinity of T3, course was set for Resolute via Borden Island, the Findlay Group, and the Bathurst islands. By returning direct to Resolute sufficient fuel was available to continue on to Churchill if the weather were favourable, thus avoiding the hazardous ground conditions at Resolute. Stratus cloud and fog, topped at 500-800 feet, prevailed until reaching Borden Island where the skies became clear. Twelve caribou were seen on Lougheed Island, and eight muskox and a polar bear were observed inland at the head of May Inlet, Bathurst Island.

Seventeen hours after its departure, the airship was again over Resolute. Consultation by radio with the Meteorological Officer indicated that good weather could be expected along the route to Churchill. It was then decided to proceed direct to Churchill as 36 hours fuel remained and the flight time to Churchill was estimated to be 27 hours. The flight crew, as well as the support personnel, were greatly relieved at not having to face a second landing at Resolute with the possibility of encountering serious trouble taxiing to and from the mast. Weather conditions were excellent along the return route, and on the evening of August 10, Churchill came in sight, 44 hours after the original departure from Resolute.

Churchill to South Weymouth. Radio reports received while approaching Churchill indicated that the favourable flight weather over Ontario would hold for another 36 hours. As a result, it was decided to depart for South Weymouth immediately after refuelling. The airship was held on the runway by the engines and ground handling personnel. Sufficient fuel for the flight to South Weymouth was pumped on board. The navigator checked the weather charts and filed the flight plan during the refuelling.

At 10.40 p.m. Churchill was cleared and course set for South Weymouth. Shortly after sunrise, the Severn River was crossed and at noon the airship passed over Cochrane, causing considerable excitement. Nearly everyone in town was out in the streets. During the evening, several thunderstorms were circumnavigated north of Mattawa, but otherwise the flight across Ontario and down the Ottawa River, and across the Rideau Lakes to Lake Ontario, and down the Mohawk valley and Hudson valley, was uneventful.

At 8.25 a.m. on August 12, the airship landed at South Weymouth, 32 hours after leaving Churchill, having completed almost 78 hours of continuous flight after taking off from Resolute on August 8.

The total distance flown during the operation was 4,700 nautical miles. It is interesting that at no time did the flight altitude exceed 2,100 feet above sea level.

The operation demonstrated that a ZPG-2 airship can provide low altitude, slow speed, visual and photographic reconnaissance over a wide radius in the Arctic, and that it is also an excellent platform for scientific investigations. Mooring and ground handling facilities superior to those available at Resolute are required at forward bases to ensure safe operating conditions.

Firth River archaeological activities, 1956 and 1958. By Richard S. MacNeish

Since my last note in the Circular (Vol. 8, 1955, pp. 70-2) describing archaeological materials from the Firth River excavation in 1955, two further field seasons have been completed: 1956, which was mainly excavation at the main site, known as Engigstciak, and 1958, in which we made a survey along the river and did some digging at Engigstciak. In 1956 Dr. Ross MacKay and Dr. William Matthews of the University of British Columbia made studies of the geology of the main site which complemented the archaeological work. I will mention the 1958 survey first.

Mr. Gordon Lowther of McGill University, myself, and Alex Irish, a local Eskimo, were flown in from Aklavik to the upper regions of the Firth River along the Alaskan border. Here we began our survey and continued down to the coast, returning to finish the season at Engigstciak, 276h iking hours and 96 Firth River crossings later. We found a number of sites; although of very varying ages, all the cultures represented were familiar to us from our 1955 work. One of these sites was from our earliest British Mountain phase, eight were from our second archaeological culture called Flint Creek[1], seven were from New Mountain, one was from our Firth River material, one was from Joe Creek, two were from Cliff, one was from the Whitefish Station culture, and twelve were late Eskimo remains of house sites of what I am calling the Herschel Island phase. Only the Buckland Hills culture was not represented. This survey provided considerable information on the ecological adaptation of these ancient people to the Firth River country and also indicated that the Old Crow River - Firth River pass was a well-travelled route in early days.

Now to return to our archaeological activities at Engligstciak in 1956 and in the last three weeks of 1958.

We found seven new patches of muck underlying the whole site and containing British Mountain artifacts. These artifacts are quite large, are all made from crude flakes, and have many resemblances to early upper Paleolithic material in Siberia. We do not know their age, but we do know that they date from a period when the climate was a good deal warmer than it is today. At this stage of culture we have little evidence of the making of blades, though we have a fair number of crude flake burins. Basically, this culture is one that makes unifacial implements out of flakes struck from discoidal cores, the so-called Mousterian chipping technique.

We also found considerable material from our second culture at Flint Creek. Most of the Flint Creek artifacts came from an area where a number of bison, either an unknown extinct species or a rather large form of wood bison, had been killed by the Flint

1. Previously referred to as the Engigstciak Complex in the Circular. Ed. A.C.

Creek people. These people initiated the blade technique at Engigstciak. Distinctive burins also occur at this time. The projectile points seem to have vague relationships to those of Yuma, particularly Agate Basin type points, as well as to the long double-pointed (Lerma) points that occur throughout the Rockies on the earliest horizons as far south as Mexico. Comparisons with Russian material reveal some similarities of this horizon with those of late Paleolithic remains on the Lena River. Dating again is rather difficult. We do know that these people were existing in this area during a somewhat colder period and at present there seems to be a considerable gap between this phase and the British Mountain occupation. There is probably also a gap between the Flint Creek and the third, or New Mountain, occupation.

The New Mountain occupation has micro-tool Cape Denbigh-like material, which was fairly abundant. The artifacts bear resemblances to the earliest Neolithic of Siberia as well as to the Cape Denbigh material at Bering Strait in Alaska, some early remains in the Brooks Range, and the earliest remains at Igloolik and in Greenland. This material seems to indicate a migration, probably the first, across the arctic shores from Alaska to Greenland. There is a little evidence that while these people were basically caribou hunters, they also hunted marine mammals.

In the next three stratigraphic layers we got large amounts of pottery to supplement the rather sketchy material from the first excavation. All these three cultures seem to be basically in the Cape Denbigh-like tool tradition with pottery in addition. The tools and pottery bear considerable resemblance to the Neolithic and Bronze Ages of Siberia. The earliest pottery is cord-marked and fabric-impressed and defines the Firth River horizon. The next horizon, Buckland Hills, sees some continuation of the cord-marking but two new types come in, dentate stamping and grooved paddle pottery. The third horizon, called Joe Creek, has mainly grooved stamped pottery, though two sherds of check stamped ware were found. Both the pottery and the artifacts make this latest horizon very similar to that of the Choris site from eastern Alaska, which in Giddings's opinion represents the earliest Eskimo remains there.

During both seasons we added a little to our knowledge of our last three occupations, which are all Eskimo, though we did not concentrate on this problem. We found that the latest Eskimo horizon was quite widespread in the interior, but that the early Eskimo was relatively rare. Although we excavated quite large amounts of material from our three late micro-blade cultures with pottery, this occupation was not widespread. The earlier New Mountain material occurred with some frequency in the interior, but the Flint Creek, which seems to be a boreal forest adapted culture, was the most widespread and abundant in the Firth River area.

At present these materials are being worked on and the final report is almost finished. The geology studies have given some assistance and pollen and faunal studies have been completed, Some attempts will be made to show the Asiatic relationships of these materials. One thing is now becoming very clear, that rather than large scale migrations from Asia into the New World, there was a steady flow of traits and people over a long time period; these traits were re-formed and re-used and integrated into New World complexes that then travelled east as units in the New World along various routes, even though they did not cross Bering Straits in these units or follow any specific route.

A light floatplane operation in the far northern islands, 1958

During the summer of 1958 Dr. Terris Moore flew his Piper Super Cub floatplane from New England to northern Ellesmere Island, and returned by way of Alaska. It would appear that this is the first light, or, more correctly, ultra-light, floatplane flight to have been made to the far northern islands. In 1956 Mr. Welland Phipps had taken a similar Piper Super Cub, but equipped with wheel landing-gear, to northern Ellesmere Island (for a description of this flight see Circular, Vol. 11, 1958, pp. 7-9) and in 1958 he took the same aircraft to the northwestern arctic islands (see Circular, Vol. 11, 1958, pp. 59-61).

Dr. Moore's flight was made to support a field party from Columbia University and in addition he had arranged to standby for a rendezvous with a U.S. Navy airship, making the first airship flight in the Canadian Arctic (see pp. 19-26). Unfortunately weather conditions prevented this rendezvous. While at Eureka Dr. Moore visited the Canadian I.G.Y. party at Lake Hazen and made a number of local flights for them.

Leaving Ottawa at noon on July 25 Dr. Moore flew to Churchill, with overnight stops at Moose Factory and Fort Severn. At Churchill he was delayed for two days by low ceilings. Continuing north he had to land at an unnamed lake fifty miles south of Baker Lake and was also held overnight at the settlement by high head winds. The next day he followed the coast of Boothia Peninsula and stopped overnight at an unnamed pond ten miles south of Bellot Strait and then cut across to Prince of Wales Island to visit Mr. T.H. Manning's camp. Dr. Moore then flew back to Somerset Island

and thence to Resolute where he spent two nights. On August 3 he continued through Eureka to the Columbia University party in Tanquary Fiord.

Dr. Moore remained on Ellesmere Island until August 16. During this time, he made a number of flights in the northern part of the island including flights from Eureka weather station to Tanquary Fiord, Hare Fiord, Lake Hazen, and Alexandra Fiord; and from the I.G.Y. base at Lake Hazen to Fort Conger, Ward Hunt Island, and to a rendezvous with the U.S. icebreaker Atka in Thank God Harbour off west Greenland. These flights involved about 46 hours of flying time and covered 4,140 miles. In addition 2 1/2 hours were spent above Eureka testing equipment up to an altitude of 7,000 feet.

On the return trip to Alaska Dr. Moore was accompanied by Mr. Nile Albright, a member of the Columbia University party. Passing over Cornwall Island and Grinnel Peninsula on their way south, they landed at Resolute. From there they flew down Prince of Wales Island and cut across to Spence Bay before turning west. Landings were made at Gjoa Haven, Cambridge Bay, Coppermine, Port Radium, Fort Good Hope, Aklavik, Fort Yukon, Fairbanks, and Anchorage. The return flight to New England was by southern routes. From July 25 to September 5, when the party reached Anchorage, the Super Cub had covered some 14,835 miles in 161 1/2 hours flying time.

The aircraft's small size proved to be no handicap as the scientists taken on flights in 1958 were living at well-supplied bases. Simple observational equipment, notes, specimens etc. were readily carried in the light floatplane. Again, because the small floatplane could find landing places almost anywhere, bad weather was less of a handicap than it would have been with a large aircraft. Although one of the worst storms of the season happened to hit the route of flight on the way north it was possible to continue beneath very low ceilings and when conditions became unflyable to land and wait it out.

The Super Cub equipped with wheel landing-gear flown by Mr. Phipps made the passage north in about half the time taken by the floatplane. The reasons for this are: (1) an aircraft with wheel gear can cruise about 10 m.p.h. faster than one on floats; (2) the wheel-equipped aircraft can land and refuel at regular airports where refuelling is quickly and easily arranged; (3) both Super Cubs need 40 to 50 gallons of extra fuel in addition to the 30 Canadian gallons carried in regular wing tanks. The wheel-equipped aircraft carried this extra fuel on transit flights in a 50-gallon drum with a pump for refuelling in flight; the drum was specially installed in the cabin, and occupied the passenger and baggage space. The floatplane carried its extra gasoline in the middle compartments of the floats, and therefore had to land to refuel. This was done by hand-pumping gasoline out of the float compartments into a 5-gallon can, and pouring from this into the wings. This is a time-consuming process, but it made it possible for the floatplane to carry a passenger on the return flight, which the wheel-equipped Super Cub could not have done.

It would appear that in the summer months an expedition with two Super Cubs, one on floats and the other on wheel gear, could work anywhere in the Canadian Arctic, providing the aircraft were flown by experienced pilots.

Change of Address

Members are earnestly requested to advise the Treasurer, Mr. J.E. Cleland, P.O. Box 68, Postal Station D, Ottawa, promptly of any change of address.

Editorial Note

The Editor would welcome contributions from those who are at present in the Arctic or have information about work in the Arctic. All material for the Circular should be sent to:

Mrs. Graham Rowley,
245 Sylvan Road,
Rockcliffe,
Ottawa 2, Ontario.

T H E   A R C T I C   C I R C U L A R

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(February 1960)

The following meetings have been held:

Ninety-second Meeting. 13 October 1959. "Population and ethnic groups in northern Russia" by Dr. B. Zaborski.

Ninety-third Meeting. 10 November 1959. "The Polar Continental Shelf Project" by Dr. E.F. Roots.

Ninety-fourth Meeting. 8 December 1959. "Changing transportation patterns" by Mr. C.F. Maclellan.

The Polar Continental Shelf Project, 1959.* By E.F. Roots

The Polar Continental Shelf Project came into being as a result of a Cabinet directive, dated 5 April 1958, recommending that oceanographic, hydrographic, geophysical, geological, and related studies be undertaken on the continental shelf underlying the Arctic Ocean adjacent to the Candian Arctic Archipelago, together with studies on the islands where relevant, and in the straits and sounds between the islands. The project has been organized by the Department of Mines and Technical Surveys, and is set up, for administrative purposes, as a separate unit of that Department, with its scientific programme responsible to the Director-General of Scientific Services. Various branches of the Department are contributing directly to the project, as are also other government departments and agencies. There is no fixed date for the completion of the project, and it is expected that the scientific and survey programme will continue for a number of years.

* Published by permission of the Deputy Minister, Department of Mines and Technical Surveys. P.C.S.P. Interim Paper No. 7.

For its first field season, the Polar Continental Shelf Project mounted two separate parties, one based at Isachsen on Ellef Ringnes Island, on the edge of the oceanic part of the continental shelf, and the other operating from C.G.S. Labrador in southern Foxe Basin and western Hudson Strait.

The party working in the Isachsen district was in the area from mid-March until mid-October, and comprised twenty-two persons, although not all were there at once and no individual spent more than five months in the field. The main object of the field work in 1959 was to provide a surveyed base and to test equipment and methods. It is planned that 1960 will be the first full season of survey work and research.

At first field work will concentrate on that part of the continental shelf to the northwest of Meighen, Ellef Ringnes, and Borden islands, comprising a block roughly 200 miles long and extending up to 250 miles out to sea. Upon completion of studies in this area, similar blocks will be investigated in turn, first to the southwest and then to the northeast of the Meighen-Borden block.

All oceanographic, hydrographic, submarine geological, and geophysical information is to be plotted on a Transverse Mercator coordinate system based on the fixed points of the geodetic Shoran network. Positions of stations off shore will be determined with reference to fixed points on land by electronic positioning devices.

Most of the first season's work was devoted to fixing the position of stations and to testing electronic positioning devices. A base line has been run by means of tellurometer and theodolite across the Prince Gustaf Adolf Sea from Isachsen to Borden Island and another from Isachsen to Meighen Island by way of Amund Ringnes Island and the Fay Islands. A third line has been surveyed from Isachsen across northwestern Ellef Ringnes Island to Cape Isachsen and out over the Arctic Ocean. These three lines fix the precise positions of the three stations which will be used as the main survey bases for 1960 and the sites for the stations have already been prepared.

Master and slave Decca electronic positioning stations have been erected on a 22-mile base line between Isachsen and Noice Peninsula on western Ellef Ringnes Island and phase stability and field strength trials made to evaluate the practicability of using low frequency electronic positioning methods for navigation and surveying. Radio-wave transmission with these conditions of permafrost and sea ice has been found generally satisfactory and there have been no insurmountable obstacles from auroral or other interferences. It appears that it will be quite possible to erect an electronic positioning system which will give acceptable accuracy up to at least 250 miles.

At intervals along the main base lines hydrographic soundings have been made; regular oceanographic measurements of temperature and salinity, and samples of the water, have been taken at all standard depths, together with bathythermograph casts and current measurements (the last of questionable validity). Tidal records have been obtained and a study is being made of the complications introduced by temperature, wind, and possibly other factors on the tides in ice-covered waters.

A start has been made on the gravity and magnetic programmes. More than 80 gravity measurements have been taken with a temperature-compensated specially damped Worden gravimeter on land and on sea ice, including a traverse across a typical gypsum piercement dome. A gravity and magnetic traverse of the Meighen ice cap has been completed, which should give information on the rock floor beneath the ice. Magnetic surveys have been made of various parts of Ellef Ringnes and Meighen islands, and have been found to be of value in tracing geological contacts and interpreting geological structures in this region of poor exposures and much surface frost action.

Geological studies to date include the taking of grab samples and cores from the floor of the Prince Gustaf Adolf Sea and from the Arctic Ocean near Cape Isachsen, studies of the stratigraphy of northern Ellef Ringnes Island, an investigation of unusual igneous rock structures, and re-examination of parts of the gypsum structures. Oriented rock specimens have been taken for study of their remnant magnetism, which should aid in their correlation and give information on changes in the position of the earth's magnetic pole in the geological past.

The physiographic work includes a survey of the land forms of the Ringnes Islands, the problem of sediment transport in seasonal arctic rivers, examination of patterned ground, observations on the formation and distribution of ground ice, and the preparation of air photo interpretation keys for selected areas.

A fairly complete glaciological programme has been begun, which should run for at least three years. Studies have been started on the Meighen Island ice cap, which is an excellent example of a small symmetrical isolated polar ice cap. Longitudinal and transverse profiles have been made across the ice cap and stakes have been inserted at intervals for measurement of accumulation, ablation, and movement. Cores have been taken and pits dug for recrystallization studies and preparations have been made for hydrological studies next year of a stream issuing from the ice cap. A geological and botanical reconnaissance of the area recently exposed around the margins of the ice cap, and of the material discharged from beneath the ice, has yielded results of considerable interest; this work will be continued, in greater detail, in 1960. Seismic surveys will also be initiated in 1960. It had been intended to make comparative studies on a large ice cap and valley glacier on nearby Axel Heiberg Island and so to obtain information on the physiographic and climatological history of the region, but the Jacobsen-McGill Arctic Research Expedition, which had independently planned to make such studies, offered to carry out the research and this cooperation was welcomed by the Shelf Project. Observations of movement, stratification, acculululation, and runoff were also made on a group of small "glacierets" on Ellef Ringnes Island near Isachsen. Other glaciological work in 1959 included a survey of the movement, changes in thickness, and nature of the sea ice in the vicinity of Ellef Ringnes Island. An extensive series of experiments has been carried out to test the efficacy of accelerating the melting of sea ice and snow by artificially changing the index of solar absorption.

Weather conditions made field work difficult at times. The early spring was somewhat colder than usual for this region, and the tellurometer traverses and oceanographic work were begun in temperatures of forty degrees below zero. This provided a severe test of equipment and operating techniques. Temperatures remained below zero until mid-May, then increased rapidly, reaching a maximum of about 56° F in August. The weather was excellent for flying in the spring, but during the summer flying was hampered by continual low ceilings and fog, which caused numerous delays in the field work on the ocean areas and on the ice cap. The party remained in the field until early October, at which time supplies for the 1960 operation were brought in.

For the first month the expedition was supported by one Beaver and one Otter aircraft, both ski-wheel equipped. In late April the Beaver aircraft was replaced by a second Otter. Although the sea ice was very rough in parts, it was nevertheless possible for a skilful pilot to set a party down in most cases within a few hundred yards of the desired survey points, which were normally spaced five miles apart. The Otter has proved to be an excellent aircraft for this work and a single machine has made as many as twenty landings on untested, unprepared sea ice in the course of a working day. Landings have been possible on sea ice in this area up to mid-July. Thereafter the Otter landed on bare ground or, occasionally, on snow patches. Four hundred and forty-three landings on unprepared ground were made during the course of the season's work.

Land transport was provided by the sturdy and reliable motor toboggans, which gave excellent service, and by an amphibious snowmobile, which was used with indifferent results.

The party varied in size during the summer, with a maximum of seventeen in the field during May and June. Those taking part were:

Department of Mines and Technical Surveys

W.W. Anderson	oceanographic technician
K.C. Arnold	geographer
R.D. Bataille	magnetic observer
H.W. Blandford	hydrographer
D.A. Cowtan	student assistant
R.M. Eaton	hydrographer
F.P. Hunt	surveyor
A.J. Kerr	hydrographer
R.M. Moskal	assistant geographer
C. Primavesi	cook
O.A. Renaud	cook
E.F. Roots	coordinator
D.K. Smith	gravity observer
W.R. Smyth	cook's helper
D.A. St. Onge	geographer

Computing Devices of Canada Limited

D.G. Grainger	electronic technician
D. Loader	electronic engineer
R. Unicombe	electronic technician

McMurray Air Services, Limited

H.D. Burry	pilot
D. MacKay	pilot
S. Laurent	helper
A. Swartman	aircraft engineer

In addition to its field work in the area of Ellef Ringnes Island, the Polar Continental Shelf Project undertook a programme of oceanographic and marine geological studies in the Foxe Basin and western Hudson Strait area. This programme was carried out under an arrangement made by the Joint Committee on Oceanography (Canada) and used the facilities of C.G.S. Labrador, which was refitted for oceanographic work and kindly made available by the Department of Transport at the conclusion of her convoying and icebreaking duties in subarctic waters. The work comprised a carefully planned series of traverses in the region of Foxe Basin, western Hudson Strait and northeastern Hudson Bay. Regular determinations of temperature, salinity, and oxygen have been made and water samples taken at standard depths in a programme designed to throw light on the complex interchange of arctic water with the enclosed waters of Hudson Bay. Plankton hauls were made at regular intervals. Samples have been taken of bottom materials as a preliminary step to a proposed programme of systematic study of the sedimentation in Canada's largest inland sea, and the structures underlying it.

The oceanographic work on the Labrador began in early September and continued until mid-October. Thirteen hundred miles of traverse were run while directly engaged in oceanography, and eighty-five complete oceanographic stations were occupied. This programme was carried out with the generous assistance of oceanographers from the Atlantic Oceanographic Group of the Fisheries Research Board and the Great Lakes Geophysical Group. Those who took part included Capt. Cuthbert and the crew of C.G.S. Labrador and the following oceanographic staff:

A. Aesma - Great Lakes Geophysical Group - oceanographic technician
D.V. Anderson - Great Lakes Geophysical Group - oceanographer
G. Clark - Atlantic Oceanographic Group - oceanographic technician
A.E. Collin - Polar Continental Shelf Project - senior oceanographer
A. Lambert - Great Lakes Geophysical Group - oceanographic technician

Jacobsen-McGill Arctic Research Expedition to Axel Heiberg Island

A scientific expedition to Axel Heiberg Island, jointly organized by the Department of Geography of McGill University, Dr. F.K. Hare Chairman, and Dr. George Jacobsen of Montreal, began field work in the summer of 1959. The aim of the project, which is to continue for three years, is a study of the Pleistocene and Recent evolution of this mountainous and strongly glaciated region. The glaciological work will include glacial meteorology, ice thickness determinations by seismic and gravity methods, and permafrost studies, involving a deep drilling programme to establish depth and temperature profiles. Large-scale glacier maps will be produced using both aerial and terrestrial photogrammetry. Investigations in geology, geomorphology, and allied sciences will also be made.

The reconnaissance party in 1959 consisted of:

F. Muller-Battle	Leader and glaciologist
G. Jacobsen	Permafrost research
E.H. Kranck	Geologist
W.P. Adams	Geographer

The party was flown to Eureka in mid-July by 426 Squadron Air Transport Command, R.C.A.F. and Nordair Ltd. From Eureka the scientists and equipment were ferried across the ice cap of Axel Heiberg Island in a Piper Super Cub piloted by W.W. Phipps of Bradley Air Services to a site on the west coast near Cape Levvel, Strand Fiord (for the first flight of a Piper Cub in these regions see Circular, Vol. 11, pp. 7-9). Fifty-eight landings were made with the "Cub" on varied terrains using large ballon tires of five pounds per square inch pressure.

After many reconnaissance flights the permanent base was established at the head of South Fiord, 79° 25N., 90° 30 W. Here three types of glaciers are found in close proximity:

an outlet glacier from the central ice cap (its tongue in apparent equilibrium); a valley glacier of alpine character (in slight recession), and a high altitude small corrie glacier (this shows relatively strong recession in recent years).

During the season a general reconnaissance was carried out and a theodolite survey of forty fixed points was made using a Wild T2 instrument. To initiate a long-term study of glacier accumulation, ablation and movement, bamboo canes were placed in the ice on all three glaciers and their positions surveyed. These markers, arranged in groups of five, were distributed at different levels between the tongue of the glacier and 1,400 metres above sea level.

In this area the firn line lies between 950 and 1,050 metres above sea level. Studies were made of the annual layering of the firn and ice, and its crystal structures to a depth of 1.8 metres in the accumulation area of both the valley and ice-cap glaciers. Englacial temperatures were measured to a depth of 10 metres in the tongue of the valley glacier.

Meteorological observations were made at six-hourly intervals at the base camp between July 24 and August 26. Detailed comparisons will be made with data from Isachsen and Eureka but the base camp appeared to be a few degrees warmer than either of the weather stations and to have better weather.

The geological reconnaissance by Prof. E.H. Kranck centred in the South Fiord area and extended northwest to Middle Fiord and east across the island to Mokka and Gibs fiords. The magnificent rock exposures available on Axel Heiberg Island offer a unique field for tectonic studies. Studies were made of several of the gypsum piercement domes and of the basic volcanic and intrusive rocks which abound throughout the area. In addition a structural and stratigraphic reconnaissance was made of the South Fiord area and the site for the deep drilling mentioned above in connection with permafrost studies, was chosen. The Piper Super Cub was used extensively during the field season especially by Dr. Kranck and greatly facilitated the geological programme.

Little game was seen but on one occasion wolves broke into the supplies of a survey camp and destroyed much of the food including tinned goods. Tins of corned beef were punctured and squeezed to extract the meat.

Field work ceased on August 26 after a most successful reconnaissance survey of the area. It is proposed that the 1960 party, which will be in the field from April to early October, will consist of fifteen to twenty members. In preparation for this larger group two fiberglas houses, including laboratory facilities, a plywood hut, food, and the bulk of the necessary equipment were shipped to Eureka by C.G.S. d'Iberville during the summer of 1959.

Biological work on Prince of Wales Island in the summer of 1958.

By Andrew Macpherson[1]

The Natural History Branch of the National Museum of Canada and the Canadian Wildlife Service jointly supported a biological investigation of Prince of Wales Island during the summer of 1958. The party consisted of T.H. Manning, leader, who was working as a temporary employee of the Museum, and myself. My wife accompanied us under a grant from the Arctic Institute of North America to study blood parasites.

Our reasons for planning biological work on Prince of Wales Island were as follows. The island lies in the middle of the largest area of biologically unknown country in the Canadian Arctic, and distributional records from it were therefore highly desirable. The island also commands the shortest water-crossing of the Parry Channel, which elsewhere forms an effective barrier to the north-south dispersal of many birds and mammals.

The principal objects of the expedition were to collect adequate specimen samples of the bird and mammal populations for use in taxonomic studies, to contribute to distributional data, to assess the sizes of the bird and mammal populations inhabiting the island, and to assess the potentialities of the island for future Eskimo settlement. Other activities included collecting fish otoliths and scales for population and growth-rate studies by the Fisheries Research Board, collecting

1. Biologist, Canadian Wildlife Service .

plants for the National Herbarium, and making an archaeological reconnaissance of the island for the Human History Branch of the National Museum.

A complete report on our bird and mammal observations and specimens has been prepared. The following is a brief account of our movements and activities.

We arrived at Resolute Bay, Cornwallis Island, on a scheduled R.C.A.F. flight on May 22, and spent the following day examining and preparing specimen material collected by the local Eskimos, and retained for us through the cooperation of Cpl. D.S. Moodie, R.C.M. Police. We left in the afternoon of May 24 with five Eskimos and their dog teams for Prince of Wales Island. On May 26 we spent a few hours collecting on Lowther Island and next day we had a short hunt near Palmerston Point, Russell Island. We reached our proposed base campsite on the west side of Inner Browne Bay about midnight of May 31, and pitched our tents near the top of a series of raised beaches there.

Two of our drivers, Idlaut and Kautak, remained with us until June 7, hunting and helping us to set seal nets in a nearby tidecrack. We secured four dogs from the Eskimos before they left (three of them kindly given to us by Idlaut, and the other bought), and on June 7, Manning hitched them to our small magnesium toboggan and drove down to the mouth of Dolphin River, where he spent two days collecting on the bare slopes under the ridge.

On June 18, Mr. Welland Phipps of Bradley Air Services landed his wheel-equipped Piper Super Cub at our camp. He was on his way to the western Queen Elizabeth Islands, where he was to provide transport for Dr. R. Thorsteinsson and Dr. T.E. Tozer of the Geological Survey of Canada (see <u>Circular</u>, Vol. 11, pp. 59-61), and had been asked to drop in on us. He took me on a flight over the eastern and northern coasts, and made a brief landing at a cliff colony near Arabella Bay in order to collect Thayer's Gulls. Later he flew Manning on what was to be a similar flight around the southern part of the island. A landing was made to collect one of two bull muskoxen en route, but, as it proved impossible to drive the survivor away, it had to be shot in order to prepare the dead one as a specimen. The work of skinning and butchering took the whole of the night, and Mr. Phipps left about noon the next day for Resolute Bay.

We began a trip to Prescott Island, the site of a former Eskimo camp, on June 21, one of us walking on the land and the others accompanying our dogs and the toboggan on the sea ice. That afternoon the bow of the toboggan was irreparably damaged when it struck the side of a meltwater channel a few miles west of Cape Henry Kellett, and the trip had therefore to be curtailed. We returned to our base camp on June 24. Two days later, Manning left for Muskox Hill (where he had taken the muskoxen) with pack-dogs, to collect Arctic Hares. He returned on July 2.

On July 7 we began a trip inland with inflatable rubber boats, called "Dolphins", and pack-dogs. The two aids to transport were combined on the first leg of our journey, the ascent of Dolphin River to Crooked Lake, when we used the dogs to track the boats up this rapid, shallow stream. Leaving our boats, and much of our equipment, on a point near the southern shore of the lake, we began a walk to the eastern and southern portions of the island on July 19. We camped near the head of Young Bay (Manning walked on to Savage Point), then travelled south to Le Feuvre Inlet, west to Fisher Lake and south down Fisher River to Guillemard Bay. On July 31 we reached the temporary Spartan Air Services weather station on the west side of Fisher Lake, where we were generously reprovisioned for the trip back to the boats, which we reached on August 2. We arrived back at our base camp on August 7.

On August 10 I left for a walk to Smith Bay and Scott Bay on the west coast. T.W. Barry, Canadian Wildlife Service Biologist, who was looking for waterfowl on the island from the air, landed near my first camp that evening. He afterwards dropped in at our base camp, and revisited it on August 12, when he kindly took Manning and my wife on a flight. I returned to our main camp on the 18th. Leaving on August 21, Manning went by boat to the neighbourhood of Cape Henry Kellett, then crossed the bay and hunted in the hills north of our camp. He returned on August 27. I made a short packing trip between August 31 and September 4, to look for hares and caribou in the central part of the island. The next few days were spent in collecting, and in packing our specimens and equipment. A Wardair Otter arrived to pick us up on schedule on September 10, and most of the day was spent in hauling our gear up to the pond on which it had landed. After their share in this was over, our four old dogs were shot, and their skulls and long bones removed for specimens. We reached Cambridge Bay before nightfall, where we were hospitably entertained by R.C.M. Police Cpl. and Mrs. R. Milmine. We arrived at Yellowknife next afternoon, where J.P. Kelsall of the Canadian Wildlife Service kindly helped us to take our ton of gear to the airport. We then travelled by scheduled C.P.A. aircraft to Edmonton, and back to Ottawa by train and truck.

Our bird collection from Prince of Wales Island totals 295 skins, 271 long bones (190 humeri, 81 femura) and two complete skeletons. Our mammal collection (excluding muskox and caribou material picked up on walks) totals 311 skins, 354 skulls, and 333 sets of long bones. We also collected the skin, skull, and long bones of a fox, and 11 Rock Ptarmigan wings and skulls on Lowther Island, and skeletal and pickled material from 61 foxes and ten bears taken in the neighbourhood of Resolute Bay by the Eskimos. A collection of 5 birds and 92 mammals was made while travelling by truck between Ottawa and The Pas. We collected specimens representing 54 species of plants, and took scales and otoliths from 124 Arctic Char caught in Inner Browne Bay and in Crooked Lake. We also excavated one old house near our base camp which yielded a small number of Thule culture artifacts.

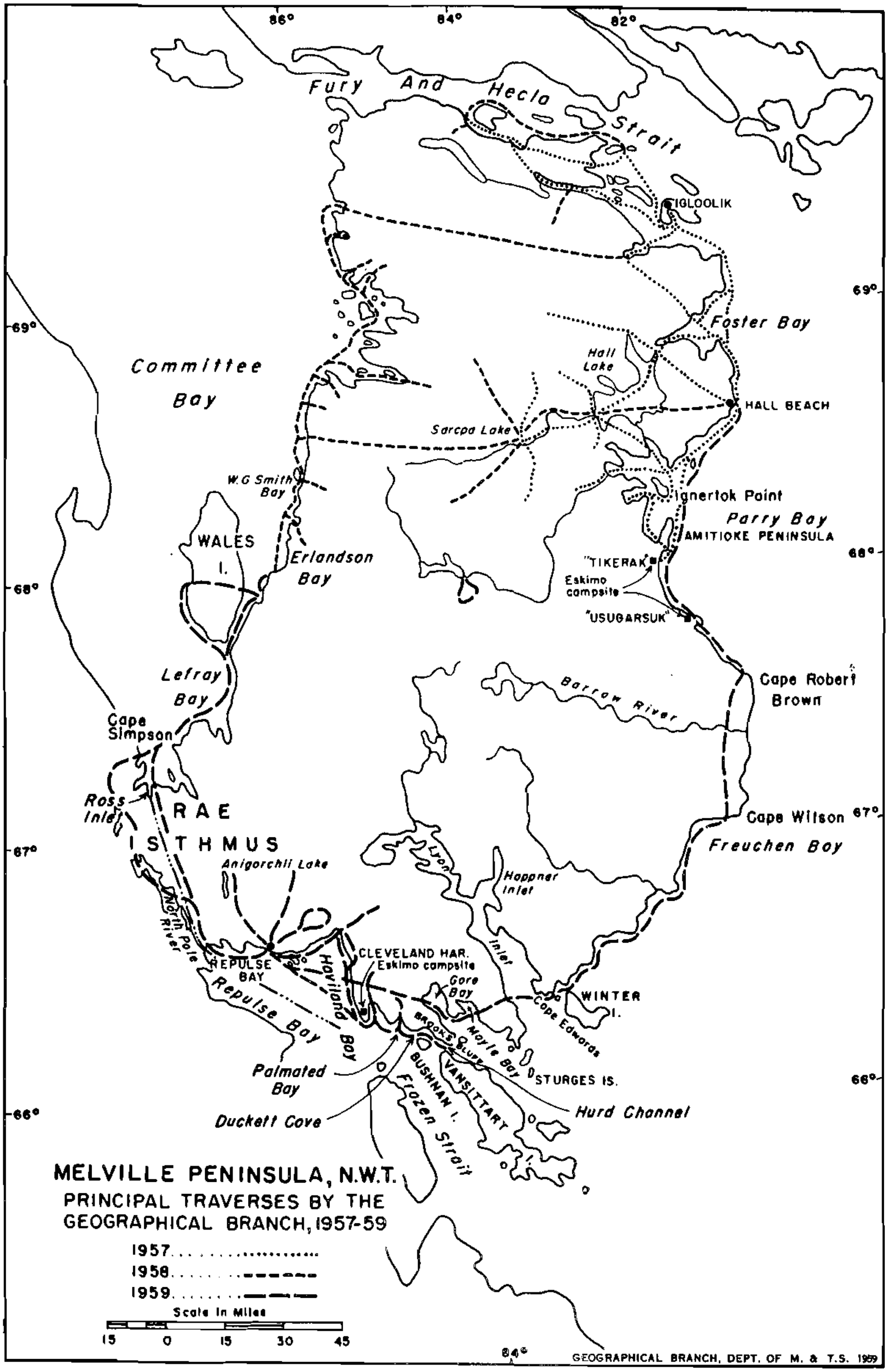
Geographical Branch Survey in southern Melville Peninsula, 1959.[1]

By Victor W. Sim

During the period from May to September of 1959 I completed the reconnaissance geographical study of Melville Peninsula started by the Geographical Branch, Department of Mines and Technical Surveys, in 1957 and continued in 1958 (see Circular, Vol. 11, pp. 27-9 and pp. 71-4).

On May 15, I flew to Hall Beach on the northeast coast of the peninsula and from there proceeded directly to Igloolik by dog team (see sketch-map). At Igloolik, with the assistance of Mr. W.G. Calder, Hudson's Bay Company post manager, arrangements were completed by radio to have an Eskimo and dog team from Repulse Bay meet me in the vicinity of Cape Wilson, 170 miles south of Igloolik on the east coast. On May 19 I returned to Hall

1 Published with the permission of the Director, Geographical Branch, Department of Mines and Technical Surveys, Ottawa.


Fury And Hecla Strait
IGLOOLIK
Committee Bay
Foster Bay
Hall Lake
HALL BEACH
Sarcpa Lake
W.G Smith Bay
Ignertok Point
Parry Bay
AMITIOKE PENINSULA
WALES I.
Erlandson Bay
"TIKERAK"
Eskimo campsite
"USUGARSUK"
Lefray Bay
Cape Robert Brown
Barrow River
Cape Simpson
Ross Inlet
RAE ISTHMUS
Cape Wilson
Freuchen Bay
Anigorchil Lake
Lyon Inlet
Hoppner Inlet
North Pole River
REPULSE BAY
Haviland Bay
CLEVELAND HAR.
Eskimo campsite
Gore Bay
WINTER I.
Cape Edwards
Repulse Bay
Brooks Bluff
Moyle Bay
STURGES IS.
Palmated Bay
Duckett Cove
Bushnan I.
Vansittart I.
Frozen Strait
Hurd Channel
MELVILLE PENINSULA, N.W.T.
PRINCIPAL TRAVERSES BY THE GEOGRAPHICAL BRANCH, 1957-59
1957
1958
1959
Scale in Miles
15 0 15 30 45
86°
84°
82°
69°
68°
67°
66°
GEOGRAPHICAL BRANCH, DEPT. OF M. & T.S. 1959

Beach with Eskimo Pacome Kalaut and on May 21 we left for Cape Wilson. Although the weather was dull and overcast, travelling conditions were generally good and we reached the cape via Ignertok, Amitioke Peninsula, and the overland route from Cape Robert Brown across the Barrow River on May 25. Two families of Eskimo were encamped at Ignertok and two at "Usugarsuk", the most southerly regular camp of the Igloolingmiut. Evidence of marine submergence was found in the vicinity of the lower Barrow River at an elevation of 480 feet.

Eskimo Tagornak from Repulse Bay was encamped near Cape Wilson, having arrived on May 24. We spent May 26 in the vicinity of the cape and on the following day moved to Freüchen Bay where two families of Igloolingmiut, on their way to Repulse Bay, were encamped. Caribou appeared to be relatively numerous in the lowlands north and west of Freuchen Bay.

On May 28 Kalaut returned to Igloolik while Tagornak and I set off for Repulse Bay. The sea ice between Freuchen Bay and Winter Island was smooth and provided excellent travelling. The weather continued poor and it was necessary to halt for a day near Cape Edwards. On May 29 we crossed overland from Lyon Inlet to Moyle Bay and the following day from Gore Bay to Haviland Bay. Deep, newly fallen snow on the crossings slowed progress with the heavily loaded sledge. We arrived at Repulse Bay on the evening of June 2, the trip from Igloolik, a distance of 340 miles, having occupied 12 travelling days.

On June 5, I departed from Repulse Bay by dog team with Eskimo Charlie. We crossed Rae Isthmus via North Pole River, North Pole Lake, Christie Lake, and Miles Lake to Ross Inlet arriving at Committee Bay on June 8. We then proceeded via Cape Simpson and Lefroy Bay to Wales Island, passing up the west coast to latitude 67°55 N., and then crossing eastward over the island to the mainland of Melville Peninsula a few miles south of Erlandson Bay. Driftwood has been reported on the shores of Wales Island but none was seen, perhaps because the island was still completely snow covered. It is so low and the coasts, particularly the southwest, so gently sloping that it is often difficult to tell where the sea ice ends and the land begins. In crossing the island nothing could be seen of the land surface except occasional black lines marking wind-cleared raised strandlines.

Between June 12 and 18 a number of traverses were made inland across the narrow coastal plain which extends from Lefroy Bay to Erlandson Bay and along the lower portions of the valleys which drain to the west coast. It was possible to obtain additional observations on the limit of postglacial marine submergence in the area. The average of these observations indicate that the marine limit is about 500 feet above present sea level. Terrain indicators suggest that during the last glacial advance ice moved across the coast in a roughly west-northwesterly direction. Caribou were relatively numerous around the shores of Lefroy Bay and a small number were seen on Wales Island.

On June 19 we proceeded to Ross Inlet. In general the sea ice on Committee Bay and Lefroy Bay was smooth and unobstructed. Ross Inlet was, however, badly hummocked and travel was extremely difficult. The snow cover had largely melted from the land so that it was necessary to cache the sledge and surplus equipment at the south end of the inlet and return on foot to Repulse Bay. Using the dogs as pack animals we walked in two days to the mouth of North Pole River where we found a number of Eskimo families at a fishing camp. We were fortunately able to borrow a sledge to complete the journey to the settlement at Repulse Bay, arriving on the evening of June 22.

The period from June 23 until July 1 was spent at Repulse Bay. The snow was gone and the weather had improved considerably, but the terrain was yet too wet to make travelling on foot practicable. During July I made a number of foot trips north of Repulse Bay settlement and around the shores of Haviland Bay. These trips were up to one week in duration and were made sometimes alone and sometimes with an Eskimo teen-age boy (Kaunerk) as companion. Visits were made to Anigorchli Lake and to the glaciofluvial lowland at the bottom of Haviland Bay.

Although the weather at the end of July was warm a long period of calm delayed break-up of the sea ice. It was not until the night of July 30 that this ice disappeared from Repulse Bay and travel by boat became possible. On August 5, following several days of windy and rainy weather, I left Repulse Bay aboard a motor trapboat crewed by three local Eskimos. It was my intention to visit Gore and Moyle bays, and,if possible, travel up Lyon Inlet to Hoppner Inlet. Unfortunately Hurd Channel and

Frozen Strait east of Cleveland Harbour were blocked by drifting pack ice as they are in most years. It was only possible, with difficulty, to reach Duckett Cove and Bushnan Island. The ice was in the form of blocky bits and large tabular floes which did not have the characteristic "dirty" appearance of Foxe Basin ice. The concentration increased gradually from zero in Repulse and Haviland bays to ten-tenths between Brooks Bluff Peninsula and Vansittart Island. Gore Bay and Moyle Bay were solidly covered with densely packed floes south of 66°20 N., and this concentration continued to the southeast horizon between the Sturges Islands and Vansittart Island.

On the broad peninsula between Haviland and Gore bays several elevations were determined for the limit of marine submergence in the area. An average value of 547 feet for 7 elevations was obtained. While this figure is almost 100 feet higher than the average in northern and western portions of the peninsula (Sim, 1959, in press) it agrees well with the elevations determined by Bird, Mathiassen, and others in northern Southampton Island and other nearby islands. In several places along this coast, notably near the northeastern corner of Haviland Bay and in Palmated Bay, a horizontal line marking the marine limit is clearly visible from the sea on the sides of the highest hills. I returned to Repulse Bay on August 11. The weather during the first part of the month was extremely poor and appreciable quantities of rain fell on seven of the first fifteen days.

I had made arrangements with TransAir Ltd. to make several flights to interior points in the peninsula as they planned to have a single-engine aircraft operating in the vicinity of Repulse Bay, but unfortunately the aircraft did not visit the area. On August 16, however, a Norseman aircraft operated by Bradley Air Services landed at Repulse Bay and the pilot, Carl Crossley, took me to an unnamed lake (68° 02N., 84° 09W.) in the central interior of the peninsula on August 19. Following two days of field work in an area of well-developed glacial drainage channels near the lake, the aircraft picked me up on August 21 and carried me to Igloolik. On August 28, after a week of field work on Igloolik Island, I returned to Hall Beach by boat.

Pilot of Arctic Canada. By N.G. Gray

Early in the 1950's it was recognized that a new edition of the Arctic Pilot was required for Canadian waters because of the considerably increased shipping which had resulted from the establishment of defence and weather stations in the Arctic and from the need to supply them annually, preferably by sea transport. The Canadian Hydrographic Service, although fully in sympathy with the demand for a new publication and prepared to assist as far as possible, was not in a position to undertake the project as its staff and financial resources were being strained at that time to meet other high priority needs.

As the agencies most concerned were the Navy and, to a lesser degree, the Department of Transport, the matter was referred to the Defence Research Board, who agreed to provide the necessary grant for the work. It was decided it would be easier for administrative reasons to give the grant to some recognized research body rather than to another department of government. The Scott Polar Research Institute, Cambridge, England, was first suggested because it would have easy access to Admiralty sources and because it already had in its possession a considerable amount of information relevant to Canadian Arctic waters. It was soon realized, however, that, apart from the desire to maintain its Canadian identity, the work could be more satisfactorily completed in Canada because of the greater amount of material available from Canadian and Unites States hydrographic sources. Further, the thousands of air photographs to which reference would have to be made, both for original material and for purposes of checking information from other sources, were easily accessible only at the National Air Photo Library in Ottawa. For this reason, the contract was given to the Arctic Institute of North America and the funds and other business were administered from its head office in Montreal. The actual work was done in Ottawa in accommodation provided by the Hydrographic Service.

From the beginning of discussions, the Dominion Hydrographer had expressed his willingness to assist in the task of finding a suitable person to undertake the project, but had insisted that it be someone of recognized hydrographical and navigational experience and not some writer of more general training whose work would probably result in a generalized "Book of Arctic Knowledge" rather than an authoritative reference guide for arctic navigation. The person selected for the work, Captain R.M. Southern, R.N. (Ret'd), proved a most happy choice. Captain Southern had been a specialist in hydrographic surveying during most of his naval career; had served for a period as Assistant Hydrographer to the Admiralty, supervising and coordinating the work of the several branches engaged in producing hydrographic publications; and had recently been employed in the writing and editing of Pilots. Further, he was responsible for the latest edition of the Admiralty's "Manual on Hydrographic Surveying", which serves also as the surveying reference text for the Canadian Hydrographic Service.

Work on the Arctic Pilot was begun in late November of 1955, on the arrival of Captain Southern in Ottawa. More than a year was occupied in the initial collecting of data from sources in Canada, the United States, and Great Britain. Information was gathered, not only from the records of early exploration but also from all available accounts and official reports of recent voyages, surveys, and reconnaissances. In addition, all the available air photographs of the areas covered by the Pilot were examined in detail, spot heights of conspicuous landmarks being determined by parallel bar readings where no other information was available.

In May 1957 the compilation of the Pilot and the personnel engaged on the work were transferred from the Arctic Institute's administration to the Canadian Hydrographic Service of the Department of Mines and Technical Surveys. It was felt that as the Pilot was ultimately to be published and kept up to date by the Hydrographic Service, it should, as soon as possible, come under the authority and responsibility of the department concerned. At the same time it was recognized that the Arctic Institute, by arranging for Captain Southern to undertake the work, and by allowing him such a free hand in the early stages of the project, had materially assisted and speeded up the final compilation of the publication which is expected to be a very vital aid to shipping operations in the Canadian Arctic.

As assistants, Captain Southern had the continuous part-time service of one geographer, Mrs. Margaret Montgomery Larnder; in addition, for both of the two summers he was engaged on the work, he had the full-time service of two University graduates or undergraduates, trained in either geography or geology. These summer assistants worked mainly on the interpretation of air photographs. On certain technical matters, such as Meteorology, Tides, Navigation in Ice, and Magnetic and Auroral disturbances, arrangements were made to have the relevant sections of the Pilot written by experts from the government departments responsible for the study and observations of these phenomena. The remainder of the text was prepared by Captain Southern and his assistants.

The large amount of material necessitated the division of the Pilot into three volumes, two of which have now been published. Both are up to date as of the time of going to press, 1 January 1959, and can be obtained from the Queen's Printer, Price $5.00 each. Volume I includes general information relative to the Canadian Arctic as a whole, and contains a gazetteer which is up to date as of March 1958. Point-to-point sailing directions and local information relative to navigation and facilities in the Eastern Canadian Arctic are contained in Volume II. Volume II is at present in preparation and will deal with sailing directions and local information concerning the Western Canadian Arctic.

Captain Southern returned to England at the beginning of June 1958, at which time the direction of the work was taken over by Captain T.L. Jones, whose wide navigational experience in both the Merchant Navy, where he holds his Master Mariner's Certificate (Foreign Going), and in the Royal Canadian Navy is coupled with experience in preparing and issuing Notices to Mariners for the Canadian Navy.

Subscriptions for 1960

Members are reminded that their subscriptions for 1960 ($2.00 for Ottawa members, or $3.00 for combined membership for husband and wife, and $1.00 for out-of-town members, other than institutions), are payable to the Treasurer, Miss M.C. Murray, 249 Irving Avenue, Ottawa 3.

Owing to currency regulations it is not always convenient for members of the Arctic Circle residing in Europe to pay their subscriptions to the club in Ottawa direct. Through the courtesy of the Director, the Scott Polar Research Institute will now receive the subscriptions of members from the United Kingdom and from the Continent of Europe and will transmit them to Canada from time to time. European members should forward their 1960 subscriptions (5 / -) to the Director, Scott Polar Research Institute, Cambridge, England and mark them "Arctic Circle Subscription".

Change of Address

Members are earnestly requested to advise the Treasurer, Miss M.C. Murray, 249 Irving Avenue, Ottawa 3, promptly of any change of address.

Editorial Note

The Editor would welcome contributions from those who are at present in the Arctic or have information about work in the Arctic. All material for the *Circular* should be sent to:

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Ottawa 2, Ontario.

THE ARCTIC CIRCULAR

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Ninety-fifth Meeting. 12 January 1960. The Annual General Meeting. Mr. T.M. Nicholl showed two films of the Commonwealth Trans-Antarctic Expedition: "Foothold", describing the setting-up of the Shackleton Base, and "Crossing the Antarctic", the main film of the expedition.

Ninety-sixth Meeting. 9 February 1960. "A zoological reconnaissance of Prince of Wales Island, summer 1958" by Mr. A.H. Macpherson.

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Some factors regarding northern oil and gas. By A.T. Davidson

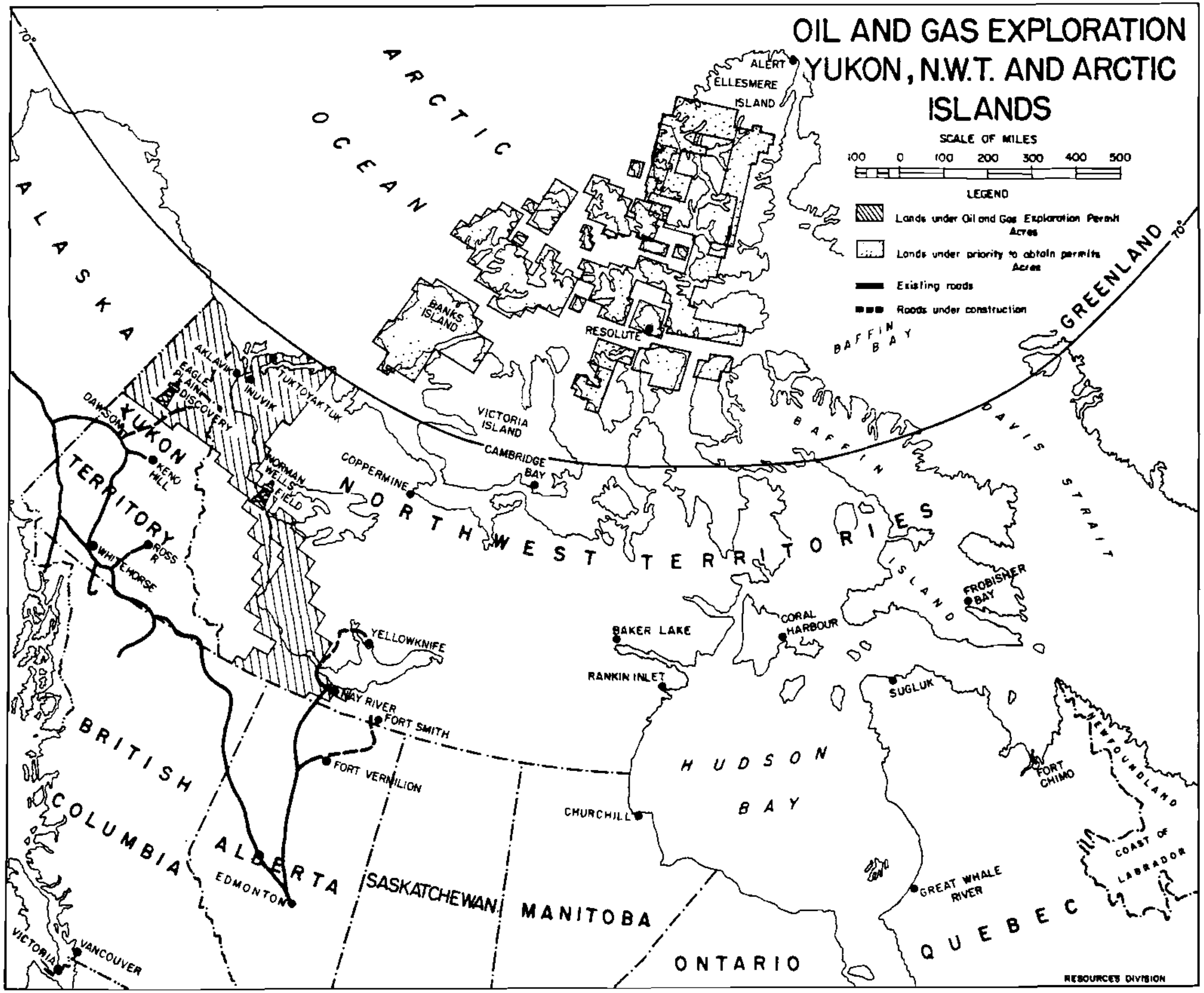
Almost 100 million acres on the mainland of the Northwest Territories and Yukon are under oil and gas exploration permit, and over 130 million acres in the arctic islands are held under priority to obtain permits. Permits on the arctic islands will be issued as soon as the revised Canada Oil and Gas Regulations, now before Cabinet, are passed.[1] In terms of land area, this large acreage represents one of the most widespread oil and gas searches in the world. (see sketch-map)

The north has only one producing oil field, Norman Wells, discovered as long ago as 1920, one of the first in western Canada. Widespread exploration has only been underway however in the past two years. Last summer, over 40 exploration crews with 400 men, took part in the search. A significant discovery of oil and gas was made in the Eagle Plain in the Yukon. About 20 wildcat wells are being drilled this winter and a number of them have had interesting oil and gas shows.

The sedimentary basins of the north are large. They are part of the great interior sedimentary basin of North America that stretches northward from the Gulf of Mexico, through much of the central United States and the Prairie Provinces of Canada, narrows like an hour-glass near Norman Wells in the Territories, and then fans out into the arctic islands. Oil and gas exploration has in general moved northward in this basin in the last half century. The parts of it already explored and developed, from Texas to Alberta, are one of the great oil and gas producing areas of the world. The Sverdrup Basin, the extension of this sedimentary basin, north of 70 degrees north latitude, is roughly similar in basic geology to parts of it farther south. In fact, there are no sedimentary basins in the world of the size of the Sverdrup Basin that do not contain substantial oil and gas resources, although, of course, some are more prolific than others.

It is a common practice to apply rule of thumb estimating techniques to virgin sedimentary basins to attempt to get a rough idea of their oil and gas potential. These rules of thumb are based on volumes of sediments, and known oil and gas reserves per volume in explored similar sedimentary basins. When these are applied to the north estimates run somewhere between 30 to 100 billion barrels of oil and very large volumes of gas. These figures are so large as to be difficult to grasp. They do suggest that oil and gas in the

1. The new regulations were passed on 13 April 1960. For details see pp. 69-70


OIL AND GAS EXPLORATION
YUKON, N.W.T. AND ARCTIC ISLANDS
SCALE OF MILES
100 0 100 200 300 400 500
LEGEND
Lands under Oil and Gas Exploration Permit Acres
Lands under priority to obtain permits Acres
Existing roads
Roads under construction
ARCTIC OCEAN
ALASKA
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
GREENLAND
HUDSON BAY
BAFFIN BAY
BAFFIN ISLAND
DAVIS STRAIT
COAST OF LABRADOR
NEWFOUNDLAND
ALERT
ELLESMERE ISLAND
BANKS ISLAND
RESOLUTE
VICTORIA ISLAND
CAMBRIDGE BAY
COPPERMINE
AKLAVIK
INUVIK
TUKTOYAKTUK
EAGLE PLAIN DISCOVERY
DAWSON
KENO HILL
NORMAN WELLS FIELD
WHITEHORSE
ROSS R.
YELLOWKNIFE
HAY RIVER
FORT SMITH
FORT VERMILION
EDMONTON
VANCOUVER
VICTORIA
BAKER LAKE
RANKIN INLET
CORAL HARBOUR
FROBISHER BAY
SUGLUK
FORT CHIMO
CHURCHILL
GREAT WHALE RIVER
70°
RESOURCES DIVISION

north may be a very substantial resource - perhaps equal in value to the ultimate hard rock mineral potential. At \$2.00 per barrel, the possible value is up to \$200,000,000,000. In brief, one does not have to be an optimist to conclude one may be dealing with a major national resource.

It appears that northern oil and gas is the only northern resource with the early development potential to "open up" many areas of the north on a large scale over the next couple of decades. The development of hard rock minerals will be important but it will probably be slower and more cautious. Large-scale exploration for, and development of, northern oil and gas could result in the expenditure of many hundreds of millions and even billions of dollars in the north. Large expenditures on northern townsites, housing, transportation, and communication facilities would be required and assured. Progress which now can be accomplished only over long periods with relatively small public expenditures, would be forced ahead by pressing requirements of industry for new townsites, pipelines, roads, airfields, harbours, and telecommunications. Oil development elsewhere in the world has brought the most aggressive and advanced technology, backed by large sums of capital, to bear on local development problems. It has been a powerful catalyst in the development of under-developed areas.

It is easy to be carried away by the bright possibilities. There are however many problems and unknowns. There is now, and may well be for decades ahead, a world surplus of oil in spite of soaring world markets. Oil exploration techniques have been developed to the point where, world wide, more oil is being found than can be marketed. There is a restricted domestic market in Canada for large volumes of new oil. Western prairie crudes now discovered, and being discovered, can supply much of Canada's domestic needs for many years. In brief, the market outlook for northern oil and gas is difficult for a number of years ahead.

Yet, companies are taking out large areas of oil lands for exploration. There are a number of reasons for this. Broadly speaking, the physical problems of oil operations in the north have now been solved, although the costs of some operations may be high. The long-term markets justify a start at northern oil exploration with a view to production some years away. From the viewpoint of their world market position most large companies dare not be left out of large basins when others are in. With firmer nationalistic policies, the costs of production in some of the more prolific foreign areas continues to rise as governments take a bigger slice of the profit, and Canada is,politically, a particularly stable area in which to invest.

It is within this general framework and in consideration of a number of other factors which there is no space to discuss here, that the Department of Northern Affairs and National Resources faces the problem of devising government policy for the development of this resource.

The Department's policy rests on two very general bases - first, to encourage early exploration and proving up the resource, and secondly, to protect the public interest in it - for it is all publicly-owned.

It has been evident for some time that if there is to be an economic market for northern oil (and perhaps gas) in the next, say fifteen years, it must be an offshore market or world market - not a protected interior domestic market. This possible market includes the west coast of the United States, Japan, Europe, and Montreal. In these markets it will have to compete with low cost foreign oil and accordingly must be produced more cheaply than high cost western Canadian crude or much United States crude which cannot so compete. Since northern exploration and development costs, because of the facts of northern geography, will be somewhat higher, this appears a difficult objective, but the Department is confident lower cost oil can be produced.

The high cost of United States crude and Canadian crude is basically owing to multiple ownership of oil lands over single pools, permitted or even required drilling by each owner even though wells may be marginal, resultant local overproduction and in turn pro-rationing of each well to market demand. The result is inefficient production - too many wells, most producing at only a fraction of their capacity. The price must be high to make marginal wells with low productivity pay at all. In most foreign areas, because of bold land-holding patterns and unit operation of pools, wells are drilled only to meet market demand, usually produce near their full engineering allowable, and there is no pro-rationing.

The Department is attempting in the north to lay the groundwork for lower cost oil by a policy of bolder land patterns, early unitization (unit operation) of fields, wide well-spacing and avoidance of pro-rationing, and in this way to establish a basis of production more similar to that in the Middle East or South America. This policy of low cost oil through partnership with industry has required considerable new thinking in North American oil law. It appears to form the only basis for early northern oil development but only the years ahead will determine whether this objective can be achieved. If it can be demonstrated that northern oil can be produced competitively, much more active exploration will be encouraged.

Of course one easy way to obtain early northern oil development would be to dispose of it to large corporations at extremely lenient terms. But the other basic policy objective is to protect the public interest in the resource. The two basic objectives - encouragement of development and protection of the public interest must be continually balanced.

The Department's policy requires that permits be vigorously explored. Companies cannot sit on the land. Basic expenditure obligations on permits now held will require over $600,000,000 to be spent on exploration in the next decade - if these permits are retained. Leases on productive or potentially productive lands are granted for a period of 21 years and a royalty of 12 1/2 per cent must be paid to the Crown on the production of all oil and gas. One-half the permit area reverts to the Crown when leases are granted. In this way the Crown will retain a large part of the oil and gas resources to meet its policy objectives at that time - whether these objectives be more revenue, more exploration and development, Canadian participation, or a number of others. In addition, the Crown will obtain through general taxes nearly half the profits from any production on all lands. The oil law assures the Crown substantial returns in revenue and maintains a strong position for it in the disposition of the resource. The Crown, both as landlord and regulator of production, retains the dominant hand in its partnership with private industry. The resource is far from being given away.

However, the balance between encouragement of investment and protection of the public interest in the narrow sense must be constantly reviewed and adjusted in the light of developments and pressures. It is the Department's objective to have large parts of the northern basins evaluated by exploration within the next ten to fifteen years, but this can be achieved only through highly enlightened policy. Such policy can both protect the public interest and serve the broad national interest.

Those interested in the north often ask what the specific implication of such development will be to the north. It is difficult and hazardous to make specific predictions. However, it is clear that when production is under way, government revenues could run in the order of a hundred million dollars annually, and expenditures by oil companies would reach several hundreds of millions. Many of the technical problems of the north would be economically solved because the best technical knowledge of industry and government would be brought to bear on them. While large fields were being developed, hundreds to a few thousands of men would be employed. About 5,000 men are now employed in development of French oil fields in the Sahara. Oil fields under production would be largely automated and manpower use would be small. The direct employment in the oil industry would never be very large although there would certainly be more than enough employment to use all the northern natives who could be technically trained for such work. It is not too early to begin training these people with oil industry needs in mind. Six Eskimos are now employed on a northern drilling rig. This employment could be multiplied very many times. Although service centre towns will not be large, new pipe lines would be built, also oil and gas cleaning plants, tank farms, equipment servicing warehouses, and so on. Development of the resource, barring tremendous unforeseen technological changes which radically affect the value of oil, would go on for a period of 40 to 60 years at least.

To those interested in the development of the far north, the stakes in northern oil and gas resources are high. These undiscovered assets could be the means of opening up the north. Oil and gas development should focus interest on the development of adjacent hard rock mineral resources. In certain areas the exploration of hard rock and sedimentary minerals can complement one another.

If the hopes raised by northern geology are realized and good discoveries are made, if progressive policies can be devised to produce northern oil competitively, this resource will forge the key to development of hundreds of thousands of square miles of the Canadian north within the next fifteen years.

Nauyopee! An Eskimo experiment in market research. By Gavin White

I first heard about Nauyopee from a Scottish fisherman on the Isle of Iona. He was a native of Peterhead and he told me that there had once been an Eskimo visitor there. According to his version this man had been piloting a whaler on the Baffin coast when bad weather had made it impossible to put him ashore. He had sailed to Scotland, lived all winter with the captain, and had been given a free pass to the local cinema. He appeared to be quite happy with this arrangement and had returned to Baffin Island the following summer. Such was the story, but as no one else seemed to have heard of it, I thought the Scot might have been mistaken.

In the winter of 1956 I was travelling on the east coast of Baffin Island and near a spot named Kivitoo I was told of a man named Nauyopee who lived in a white man's house. I promptly concluded that he must be a trader ... the Eskimo word for trader is "neeyavuptay" - and when I had finished my business elsewhere I went to see what sort of a man he might be. He was no trader, rather his name meant "little seagull" and he was an Eskimo with a story worth hearing.

It all seemed to stem from a certain Englishman, Hector J. Pitchforth, who appears to have arrived in Baffin Island in 1920. In a fifty-six page letter to his superiors in the Sabellum Trading Company in London Pitchforth, writing from Kivitoo, mentions that "The ship is taking home Nauyarik, a native of Kivitoo, consult him and take him around Harrod's and Whitely's and show him a great variety of things, he can advise you first hand. I suggest that you give him charge of the station at Kivitoo, he has lived there many years and is a very quiet and respectable fellow, and he is trustworthy".

Sitting in a shack hard by Hector Pitchforth's little house, Nauyopee went through the story as he had done many times before. He told me the name of the ship was the Rosie. She was a motor-ketch out of Bideford and in the Chief Officer's log for Thursday, 4 September 1924, which I saw in the library of Dartmouth College, is the entry, "Shipped Esquimau Nowiyabing as ice pilot".

This fits the story of my Scottish informant, though Nauyopee insists that he was intended to spend the winter in Britain, and Pitchforth's letter bears him out. Nauyopee added that he went every day to the cinema, and that there was sometimes a policeman to keep back the throngs of curious Scots all anxious to view this distinguished visitor to their shores, and that on one occasion he did go down to London. Starting in the Eskimo tongue, but gradually including more English words as they came back to him, he described a tall tower, probably the Monument to the Fire of London. He climbed this tower and was shown the city. To the north were houses, and houses, and houses, as far as the eye could see. To the south were houses, and houses, and houses, and so on around the points of the compass. And through the midst ran the river, and the masts of ships packed almost solidly from shore to shore.

I asked if he had met anyone there who spoke Eskimo, and he said there was one, a Mr. Harley, but his memory seemed confused and I may have been leading him astray. When he had come down the Monument (and he walked half a dozen times round the shack to indicate a spiral staircase, should I be unfamilar with such things) he went to the zoo. He had all the English names for the animals, and he pantomimed each. When he imitated the walk of a camel, I was overcome with laughter. The rest of the Eskimos present were not laughing, they were bored stiff for they had seen this same show at frequent intervals during the past thirty years. His narrative ended with his return to Kivitoo the following summer.

In the log of the Rosie for that season, Nauyopee is not actually mentioned by name, and he might have returned by another ship of the same company - I did not think to ask him about this. But there is an entry for Monday, 31 August 1925, written offshore near Kivitoo, by the master of the Rosie. "If anchors hold, all is well ... Meechiman and his Eskimos unable to get ashore, slept on board ... I am grateful to have got into Signiyak yesterday afternoon with not an hour to spare. This is a wild night ..." Then an entry for Wednesday, September 2, "Eskimo watchman took a bad turn, but could not get him ashore". And on September 4 at 4.00 p.m., "Howling gale from NE with torrential rain" and by 7.00 p.m. the same evening, "Wind eased, natives sent ashore taking Eskimo night-watchman with them sick".

Nauyopee was almost certainly this watchman, but if he had been sick, he was in fine fettle when I met him in 1956. He had performed a fine service to his fellow Eskimos when the D.E.W. line construction began on the coast. To many natives this was most unsettling as they had never dreamed of such colossal piles of supplies, could see no reason for the whole operation, and thought that the end of their world had come. All material and spiritual values seemed imperilled overnight, but the transition was eased by the testimony of old Nauyopee. Whatever new marvel the D.E.W. line might bring, Nauyopee was not impressed. This was nothing to London!

So ended the first experiment in Eskimo market research. The sending of an Eskimo to select trade-goods at Harrod's never seems to have been repeated. The Sabellum Trading Company has disappeared and Hector J. Pitchforth is dead and gone. He died alone and deserted in the dead of winter, and his body was sledged 450 miles to the R.C.M. Police post at Pond Inlet. The ketch Rosie is not to be found in Lloyd's List of Shipping. Even London is not what it once was, but at Kivitoo on the Baffin coast, Nauyopee still lives in the house which Pitchforth built and remains a quiet, trustworthy, and respectable fellow.

Russian-English ice glossary. By Moira Dunbar

The Library of Congress has published a useful reference work entitled "Russian-English glossary and Soviet classification of ice found at sea". It was compiled by Boris N. Mandrovsky and is available from the Card Division, Library of Congress, Washington, D.C., price 30¢.

Part I of the glossary gives the Soviet classification system, in Russian, with English equivalents alongside, and Part II consists of an alphabetical glossary of Russian sea-ice terminology, including a number of local terms, with transliterations and English definitions. There are also comparative tables of ice concentration and floe dimensions according to the Soviet, U.S.N. Hydrographic Office, and World Meteorological Organization systems.

The choice of English equivalents has been made with the assistance of John J. Schule, Jr., and Walter I. Wittmann of the U.S. Navy Hydrographic Office. The author could not have gone to better authorities and the terminology is generally in accordance with current U.S. and Canadian usage. It is a pity, however, that it is not closer to the WMO system, which has been internationally accepted and will before very long, it is hoped, become standard in fact as well as in theory. Perhaps a slightly revised version will be produced when this happens. This would be a good opportunity, too, to correct some of the typographical errors, of which there are quite a few, especially among the Russian script, where they could cause headaches to users.

Even as it stands, however, the glossary is an invaluable aid for all who have to struggle with Russian works on sea ice. Let us hope that Mr. Mandrovsky will now turn his attention to glaciology in general.

Names for birds and mammals from the interior Barrens[1]. By Andrew Macpherson[2]

The names listed below were obtained during the summer of 1959 at Baker Lake, Northwest Territories, where Sanningaiormiut and Utkusiksalingmiut Eskimos are now found living side-by-side with the local Kaingnermiut and Saqvaktormiut. The Sanningaiormiut originate from Garry Lake and upper Back River, the Utkusiksalingmiut from lower Back River, the Saqvaktormiut from lower Kazan River, and the Kaingnermiut from a wide area roughly between the lower Thelon River and the Keewatin coast. Names are usually the same in the two latter groups; the exceptions are specified.

Use has been made of some of the spelling conventions proposed by Lefebvre (1958). His standard orthography, however, ignores differences in pronunciation that appear non-significant between dialects, while this list is assembled as a guide to the pronunciation of names, and to show clearly the differences between these names in the different dialects. It has therefore been

1. Published with the permission of the Director, Parks Branch, Department of Northern Affairs and National Resources.

2. Biologist, Canadian Wildlife Service.

necessary to use the vowels 'o' and 'e' in a less restricted manner than that proposed for the standard orthography, to be more liberal in the use of consonant clusters, and to make occasional use of the letter 'b'. Terminal consonants are written only when they have been definitely heard. According to Lefebvre, the consonnant clusters 'd', 'bl', and 'gl' are merged in the Port Harrison dialect, and he proposes the compound letter 'll' to symbolize all three. In the list, 'll' has been used to represent the sound 'dl', but 'gl' is separate in these dialects, and has been retained. The letter 's' is sibilant only in Kaingnermiut words.

An 'equals' sign (=) replacing a name in the list indicates that it is identical to the name quoted for the foregoing group; a dash means that no name was obtained. The reader interested in comparing these names with those used by Pelly Bay Netsiliks is referred to Macpherson (1958). The Eskimo names listed here were obtained in the same manner as those in the earlier list.

I am grateful to the Rev. Charles Choque, O.M.I., and to Duncan Pryde, Hudson's Bay Company, for assistance, particularly with the spelling, and to Peqiuaq, Pujatak, Itqileq, and Kasarineq, who supplied the names.

Birds

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Yellow-billed Loon	Toollik	=	=
Arctic Loon	Kaglulik	=	=
Red-throated Loon	Qaqsauq	=	=
Whistling Swan	Kogjuk	=	=
Canada Goose (large)	Tingmiaq	Aktoq	=
(small)	Nekleraajuk Saq.: Lerleraajuk	Uluagullik	=

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Brant	-	Karaqjuk	=
Snow Goose	Kango	=	=
Blue Goose	Kango	Qingnedleq	=
Pintail	-	Qongosineqluktok	-
Oldsquaw	Adgieq	=	=
King Eider	Miteq	Mitieq, Qingalik	=
Red-breasted Merganser	Nujaralik	Nujakleq	Nujaralik
Rough-legged Hawk	Kajoq	Qinujaijok	=
Golden Eagle	Naktoralik	=	=
Gyrfalcon	Kitgavik	=	=
Peregrine Falcon	Kitgavik	Kitgaviaqjuk	=
Willow Ptarmigan	Aqitgevik	=	=
Rock Ptarmigan	Aqitgeq. Saq.: Niksaqtuk	Aqitgeq, Niksaqtuk	Aqitgeq
Sandhill Crane	Tatidgak	=	=
Semipalmated Plover	Kolleqkolliaq. Saq.: Kullekulliak	Kollekollik	=
Golden Plover	Tutlik	=	=
Black-bellied Plover	-	Qellijaut	=

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Turnstone	Taleroviaqjuk	Taligvak	-
Pectoral Sand-piper	Sigdjareaqjuak	Nulluaqtujok	Sigdjareaq
Dunlin	Aiviqeak	-	-
Semipalmated Sandpiper	Sigdjareak	Tuituaq	-
Red Phalarope	Saavraq	Saabraq	-
Pomarine Jaeger	Issungaq	Naktoralik	-
Parasitic Jaeger	Issungaq	Issungatkoq	-
Long-tailed Jaeger	Issungaq	-	Issungaqjuk
Glaucous Gull	Naujavak	Naujavik	-
Herring Gull	Nauja, Kottleq Naujatuar	Naujaq, Kottleq	Nauja, Kottle
Sabine's Gull	Aqidgagiaq	Iqidgagiaq	-
Arctic Tern	Imitqotailak	-	-
Snowy Owl	Okpik, Okpittuar	Okpik	-
Short-eared Owl	Unuaqsiut. Saq.: Unuarsiut, Massilik	Massilik	-
Horned Lark	Kopanoaqpajuk	Puttoqtoq, Tullijujoq	Tullijojoq
Raven	Tulugaq, Tulugattuar	Tulugaq	-

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Water Pipit	Iksiktangiaq	Kuttaumeqtaq	=
Redpoll	Oqpingmiutaq	Meqpituneqsaq	-
Savannah Sparrow	Oqpingmiutaq	-	-
Tree Sparrow	Oqpingmiutaq	-	-
Lapland Longspur	Kopanuaq. Saq.: Kopanoaq	Tingmiaqjuk	Nasauligardjuk
Snow Bunting	Amauligaq	=	=

Mammals

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Cinereous Shrew	Ugjugnak	=	=
Arctic Hare	Ukaleq	=	=
Ground Squirrel	Siksik	=	=
Beaver	Kiggiak	-	-
Varying Lemming	Avingak qaqoneksaq	Qilangmiutak	=
Brown Lemming	Avingak	=	=
Red-backed Mouse	Nunivakak	Naulaijok	Oolimakaq
Tundra Wolf	Amarok	=	=
Arctic Fox - White phase	Tiriganiaq	=	=
Blue phase	Tiriganiaq qengaqtok	=	-

English	Kaingnermiut & Saqvaktormiut	Sanningaiormiut	Utkusiksalingmiut
Coloured Fox - Red phase	Tiriganiarjuaq kajoktok	=	Tireaqjuak
Silver phase	Tiriganiarjuaq qengaqtok. Saq.: T. aijadgojak	T. qengaqtok	=
Cross phase	Tiriganiarjuaq siksikujaqtok	T. anulik	Tiriganiarjuaq
Barren-ground Bear	Aklla	=	=
Ermine	Tireaq	=	=
Wolverine	Qabvik. Saq.: Qarpik	Qabvik	=
Otter	Pamiortoq	=	-
Lynx	Peqtokseraq	Peqtokseraq, Kiggiak	-
Barren-ground Caribou	Tuktu	=	=
Muskox	Umingmak. Saq.: Omingmak	Umingmak	Omingmak

N.B. The animal known as 'Tireardjuark' by the Pelly Bay people was believed from the description obtained to be mythical (Macpherson, 1958). Considering the similarity of this name to that of the Utkusiksalingmiut for the Red Fox ('Tireaqjuak'), and the recent origin of the latter group from Netsilingmiut stock, there can be little doubt that the 'Tireardjuark' of the Arviligjuarmiut is in fact the Red Fox.

References

Lefebvre, Gilles R. 1958. "A draft orthography for the Canadian Eskimo, towards a future unification with Greenlandic" (Abstract). Northern Research Coordination Centre, Department of Northern Affairs and National Resources. 18 + ii pp. (Mimeo).

Macpherson, Andrew. 1958. "Arviligjuarmiut names for birds and mammals". Arctic Circular, Vol. 11, No. 2, pp. 30-3.

Polar philately and rare postmarks in the Canadian Arctic

The edition of Linn's Weekly Stamp News for 30 November 1959 is a special polar number. It contains many articles on different aspects of polar philately and can be obtained from Sidney, Ohio (Vol. 32, No. 39, price 10 cents). Perhaps the two articles of most interest to readers of the Circular are: "Bache Peninsula is rare Canadian Arctic cancel" by G.J. Raymond and "Greenland provides fertile philatelic field" by Mrs. D.M. Startin.

According to Mr. Raymond, Bache Peninsula is, "with one exception, the rarest postmark of the Canadian Arctic. Only that of Winter Harbour, N.W.T., used once only, is more elusive." Bache Peninsula post, which was opened on 7 August 1926, was in existence for six years and was at the time the most northerly post office in the world. "The last mail (reportedly some 20 covers) was postmarked 'BACHE PENINSULA, N.W.T., April 12, 1933'. The three Mounties then stationed there - Stallworthy, Hamilton and Monroe - sledged by dog-team the 250 icy miles to the more southerly Ellesmere post of Craig Harbour (unmanned since 1926). To their dismay, they found on arrival that polar bears had destroyed the shacks and reserve supplies, so back again the Mounties went to fetch the few remaining scraps of supplies at the former post. Five months later the relief expedition on board the 'SS Nascopie' found them alive and well at Craig Harbour. Then, finally aboard ship, the last Bache Peninsula mail was backstamped with the interesting large boxed postmark,in violet ink, of the 'EASTERN ARCTIC /MAIL SERVICE/SEP. 7, 1933 / HUDSON'S BAY CO., / S. S. NASCOPIE'".

In 1953, when the R.C.M. Police decided to reopen a post in the Bache Peninsula area, a site was selected at Cape Herschel and the datestamp taken in with the party. "However, on arrival, the site was found to be unsuitable, and the post was actually constructed very close by at Alexandra Fiord, officially opening on August 18, 1953. Permission was granted to utilize the 'CAPE HERSCHEL, N.W.T.' datestamp, and the first mail was postmarked September 3, 1953. It has been reported that only about 15 letters received the Cape Herschel postmark last used December 14, 1954. With its Christmas mail, the post received by airdrop a new datestamp inscribed 'ALEXANDRA FIORD, N.W.T.', first employed February 5, 1955 and now in current (if limited!) use. The strict enforcement of the Canadian Post Office prohibition on the canceling of philatelic covers by the Arctic PO's has permitted few such interesting covers to come through."

Changes in oil and gas regulations for the Northwest Territories and Yukon

The new Canada Oil and Gas Regulations, which were passed on 13 April 1960 by Order-in-Council 1960/474, apply to the Northwest Territories and Yukon. They supersede the former Territorial Oil and Gas Regulations. The changes in the regulations are not numerous, but may have far-reaching consequences. For instance, in the past no special mention was made of land under water. The revised legislation includes provision for the exploration and development of lands underlying the territorial waters of Canada, including the continental shelf, wherever these are within federal jurisdiction.

Two important new clauses have been added to the regulations to ensure Canadian participation at the lease stage. The relevant parts of Sections 32 and 42 are as follows:

32. (3) A lease shall not be granted under this section

(a) to a person unless the Minister is satisfied that he is a Canadian citizen and that he will be the beneficial owner of the interest to be granted;

(b) to a corporation incorporated outside of Canada; or

(c) to a corporation, unless the Minister is satisfied

(i) that at least 50% of the issued shares of the corporation is beneficially owned by persons who are Canadian citizens, or

(ii) that the shares of the corporation are listed on a recognized Canadian stock exchange and that Canadians will have an opportunity of participating in the financing and ownership of the corporation.

42. (5) No lease may be transferred under this section

(a) to a person to whom the grant of a lease is prohibited under paragraph (a) of subsection (3) of section 32; or

(b) to a corporation unless the corporation satisfies the Minister that persons who are Canadian citizens will have an opportunity of participating in the financing and ownership of the corporation.

The other major changes apply to areas north of 70 degrees N. only. The new provisions recognize the extra time and cost involved in work in the arctic islands. The maximum life of exploration permits has been extended from nine to twelve years and the exploration expenditure of $3.00 per acre will also be extended over a twelve-year period. The first three-year permit term has been doubled with no increase in deposit. For the first three-year term of a six-year permit deposits remain at 5 cents an acre rising to 25 cents an acre for the second three years. For each renewal of a six-year permit deposits start at 30 cents an acre; rise to 40 cents for the second renewal; and 50 cents for each added renewal to a limit of six.

North of 70 degrees latitude the permit areas, which are based on a grid, have been doubled. According to the definitions, the "grid area" south of 70 degrees N. is "bounded on the east by a meridian of the series 90° 00' 00", 90° 15' 00", 90° 30' 00" west longitude, on the west by the next successive meridian of the same series"; to the north of 70 degrees, it is "bounded on the east by a meridian of the series 90° 00' 00", 90° 30' 00", 91° 00' 00", west longitude, on the west by the next successive meridian of the same series". The southern and northern boundaries of the grids are drawn at intervals of 10 minutes of latitude, starting at 40° 00' 00"N. Grid widths naturally narrow as they extend north, but with the double grid area exploration land patterns in the arctic islands will, generally, be larger than on the mainland.

Permits already issued are dealt with in Section 156 of the new regulations which provides that:

156. (1) All permits, licences and leases issued or granted under the Territorial Oil and Gas Regulations and in force immediately before the coming into force of these Regulations shall be deemed to have been issued or granted under these Regulations.

(2) Subsection (3) of section 32 of these Regulations does not apply in respect of a permit issued prior to the coming into force of these Regulations.

(3) Subsection (5) of section 42 applies to the transfer of a lease whether granted before or after the coming into force of these Regulations.

Subscriptions for 1960

Members are reminded that their subscriptions for 1960 ($2.00 for Ottawa members, or $3.00 for combined membership for husband and wife, and $1.00 for out-of-town members, other than institutions), are payable to the Treasurer, Miss M.C. Murray, 249 Irving Avenue, Ottawa 3.

Owing to currency regulations it is not always convenient for members of the Arctic Circle residing in Europe to pay their subscriptions to the club in Ottawa direct. Through the courtesy of the Director, the Scott Polar Research Institute will now receive the subscriptions of members from the United Kingdom and from the Continent of Europe and will transmit them to Canada from time to time. European members should forward their 1960 subscriptions (5 / -) to the Director, Scott Polar Research Institute, Cambridge, England and mark them "Arctic Circle Subscription".

Change of Address

Members are earnestly requested to advise the Treasurer, Miss M.C. Murray, 249 Irving Avenue, Ottawa 3, promptly of any change of address.

Contents pages and Indexes

Contents pages and indexes have been distributed for all back numbers of the *Circular* with the exception of contents pages for Volume 8 and the index to Volume 11. Both these have been prepared and will be mailed to members as soon as possible.

Editorial Note

The Editor wishes to thank Dr. R.G. Blackadar for his assistance with the *Circular* and Mr. J. Cantley for preparing the indexes to Volumes 9, 10, and 11.

The Editor would welcome contributions from those who are at present in the Arctic or have information about work in the Arctic. All material for the *Circular* should be sent to:

Mrs. Graham Rowley,
245 Sylvan Road,
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