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The following meetings have been held:

One hundred and twenty-fourth meeting. 8 October 1963. Dr. E.F. Roots showed the film "Science flies north", describing the activities of the Polar Continental Shelf Project.

One hundred and twenty-fifth meeting. 12 November 1963. Dr. R. Slobodin spoke on "The Kutchin Indians and their contacts with the Eskimos".

The Annual Dinner. The Annual Dinner was held at the Eastview Hotel on 10 December 1963. Some 190 members and guests attended the buffet meal, which as usual made a feature of northern foods. Lt. Commander N.S. Norton, R.C.N., spoke on "A cruise to the Antarctic with the Argentine Navy".

The Annual General Meeting. The Annual General Meeting was held in the No. 9 Transport Company Mess, R.C.A.S.C., on 14 January 1964. The President, Miss Moira Dunbar, was in the Chair.

The Treasurer first distributed the financial statement, which was then adopted by the meeting. With the exception of a considerable loss incurred by the Annual Dinner, the club finances were very satisfactory

In accordance with the Constitution the following Committee members retired: Col. J.P. Richards, Mrs. A.G. Sangster, and Dr. A. Taylor. To fill these vacancies the Committee proposed as members: Mr. Harold Serson, Dr. John McGlynn, and Mr. Peter Glynn. These candidates were elected unanimously. Dr. R.G. Blackadar, who had acted as Vice-President for 1963 in the absence of Supt. W.G. Fraser, agreed to serve for one further year. The Officers and Committee members for 1964 are as follows:

Officers

President:	Miss Moira Dunbar
Vice-President:	Dr. R.G. Blackadar (one year)
Secretary:	Dr. R.L. Christie
Treasurer:	Mrs. A.H. Macpherson
Publications Secretary:	Miss Mary Murphy
Editor:	Mrs. G.W. Rowley

Committee members

Mr. K.C. Arnold	Dr. M.J.S. Innes
Dr. R.J.E. Brown	Dr. J. McGlynn
Dr. A.H. Clarke	Dr. D.R. Oliver
Brig. A.B. Connelly	Rev. A. Renaud, O.M.I.
Dr. B.G. Craig	Mr. H. Serson
Mr. P. Glynn	Mr. B.G. Sivertz
Mr. C.R. Harington	Mr. V. Valentine
Dr. G.F. Hattersley-Smith	

Following the election the meeting thanked the auditor, Mr. J. Cantley, and appointed Mr. J. Cantley and Mr. B.G. Sivertz as auditors for 1964.

After an explanation of the loss incurred at the dinner, and some discussion on how this could be avoided in the future, the loss was greatly reduced by a sale of extra food. This included: frozen reindeer meat, shrimps in jars, bake-apple berries in jars, and Labrador tea in bags.

The President then expressed the gratitude of the Club to Major R.A.D. Kelly for the use of the Transport Company Mess and to Captain W.E. Preston for making the arrangements.

At the conclusion of the Club business a colour film on Greenland, "Where mountains float", loaned by the Danish Embassy, was shown.

One hundred and twenty-eight meeting. 12 February 1964. His Excellency John Knox, Ambassador of Denmark, spoke on the expedition of Jens Munk to Hudson Bay.

One hundred and twenty-ninth meeting. Owing to the illness of Dr. Lauge Koch, who had planned to speak, the meeting was cancelled.

One hundred and thirtieth meeting. 14 April 1964. Dr. Arthur Mansfield gave an illustrated talk on walrus.

One hundred and thirty-first meeting. 12 May 1964. Dr. Margaret Lantis spoke on the "Eskimos of the Bethel Triangle, Alaska".

Preliminary account of a 1963 archaeological survey in the Central Arctic. By William E. Taylor, Jr.[1]

During July and August of 1963, Hugh C. Monahan, William T.A. Nicholls, and the writer formed a National Museum of Canada archaeological survey party that travelled from Cape Parry to Cambridge Bay to find and test archaeological sites in the vicinity of D.E.W. line stations. The region was selected primarily because it was largely untested although prehistorians had rummaged with consistent success west and east of it. Further, it seemed, and seems still, to hold answers to several major questions of arctic archaeology. Also, the D.E.W. line provided an excellent transport system: we are very grateful to the Federal Electric Corporation for the use of such transport and for the use of their near-sybaritic station facilities. Members of the staff of each station accorded us every hospitality and assistance. Sites were tested, from west to east, near Cape Parry, at Tysoe Point, Bernard Harbour, Lady Franklin Point, Ekalluk River, Oxford Bay, Cambridge Bay, and Cape Colborne.

At Police Point, near Cape Parry, two Thule sites were tested. In one, R.S. MacNeish had found a sherd of the Barrow Curvilinear pottery type some years ago, leading one to hope that there might be, at Police Point, a Thule culture stage close to the Alaskan Birnirk culture. Sizeable collections were excavated from each site. Despite the more western caste to their collections, however, both sites revealed a developed stage of Thule culture, not the hoped-for proto-Thule form.

Near the Pin 1 station at Tysoe Point, and close to the sea, we briefly examined a Thule winter site. Since it too seemed to contain a developed stage of Thule culture, the party moved on to Bernard Harbour, where, through the aid of Mr. Kenneth Kitchen, we found Dorset culture material, some 450 miles west of its previously recorded western limit on King William Island. The only significant sample came from a tent ring site near the head of the bay forming Bernard Harbour. The Dorset inventory includes one harpoon head whose form vaguely hints at an occupation early in the first millennium A.D.

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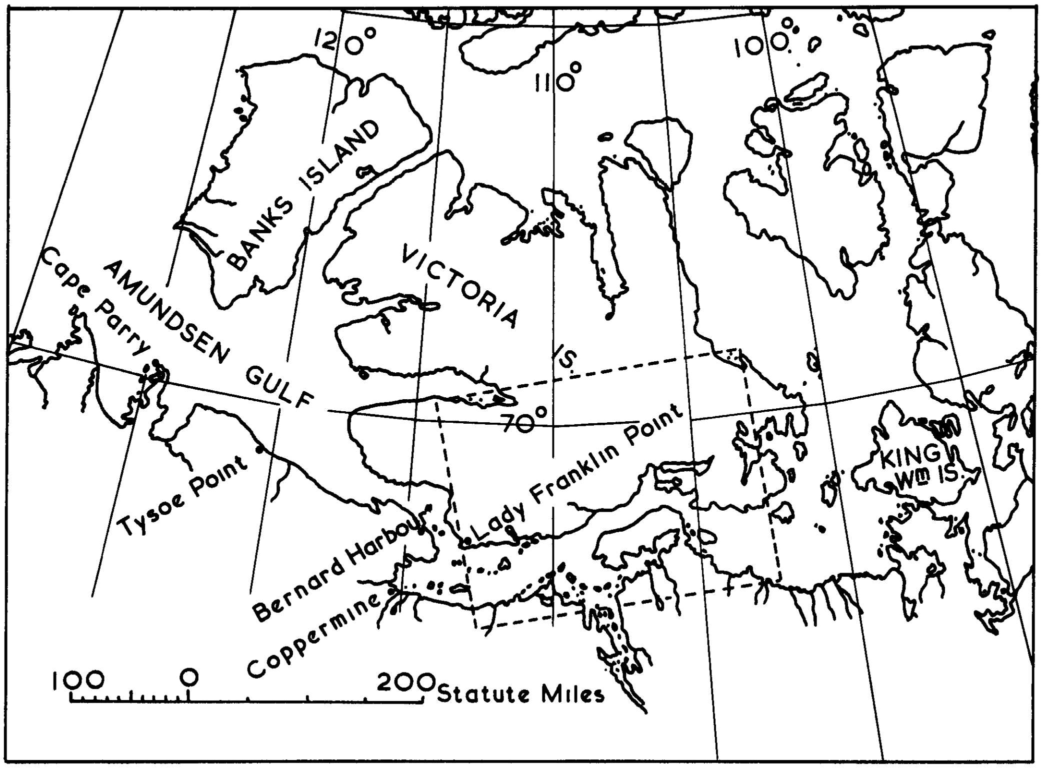
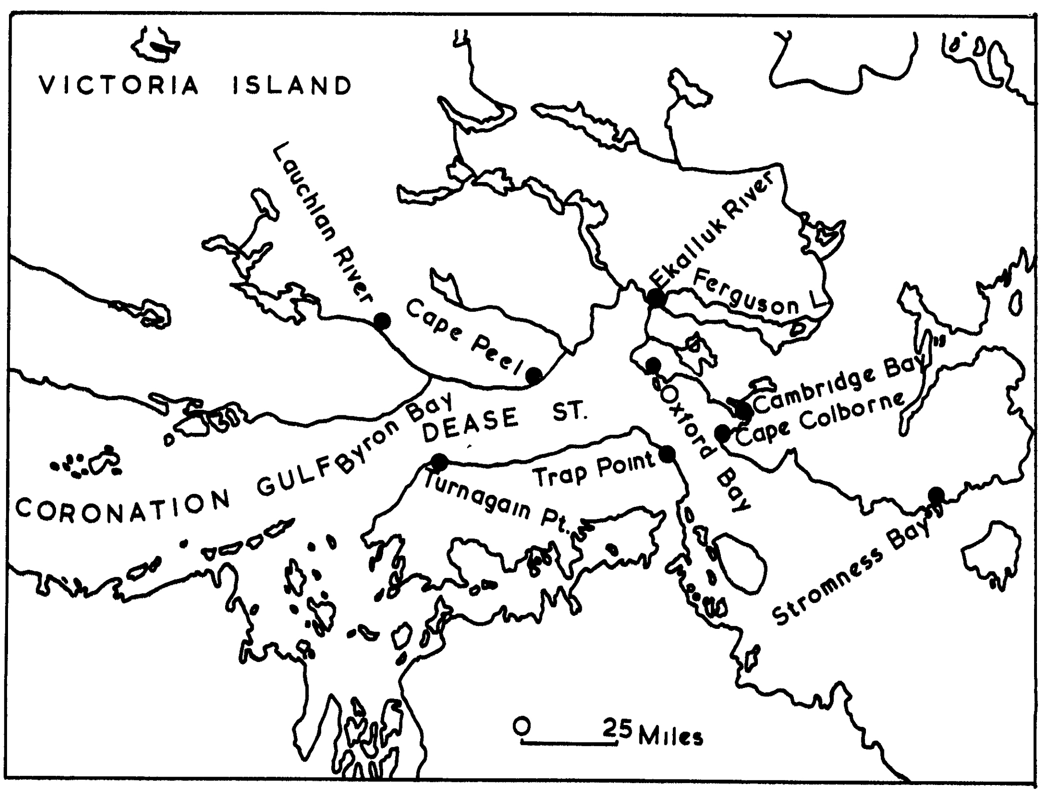
1 National Museum of Canada



120°
110°
100°
BANKS ISLAND
VICTORIA
IS.
AMUNDSEN GULF
Cape Parry
70°
Lady Franklin Point
KING
Wm IS.
Tysoe Point
Bernard Harbour
Coppermine
100
0
200
Statute Miles



VICTORIA ISLAND
Lauchlan River
Ekalluk River
Ferguson L.
Cape Peel
Cambridge Bay
Cape Colborne
Oxford Bay
DEASE ST.
Byron Bay
CORONATION GULF
Trap Point
Turnagain Pt.
Stromness Bay
0
25
Miles

At Lady Franklin Point, we returned to the Thule period; south of the station lie twenty-one winter house mounds where test trenches yielded a Thule sample. As interesting as the artifacts are the animal bones; here in a winter site of the usually sea-mammal oriented, whale-devoted Thule culture, a count of 5,900 bones showed 82 per cent caribou, 17 per cent seal, and 1 per cent others.

We by-passed the promising Richardson Islands area for an unnamed point west of Byron Bay; in that region we found nothing. Better luck rejoined the party at Cambridge Bay where we found five sites called after Cambridge colleges: Clare, Downing, Pembroke, Newnham, and Girton. As there are other sites seen but untested one may eventually add to that list of borrowed names. The Clare site, of seven tent rings and a midden area, yielded a few recent non-Eskimo fragments, some customary Thule material, and, from a small knoll near the main part of the site, a few Dorset artifacts. The Downing site, which was assigned a name through premature optimism, produced only a few Dorset artifacts. The Pembroke site, of thirteen very strong tent rings and stone huts provided a bone count very heavily of caribou remains as did the nearby Clare site. Its small artifact sample hints at a fairly early Thule occupation. A rather large surface collection from the Newnham site, whose area is clearly marked by several tent rings and caches, indicates an early Dorset occupation, probably before A.D. 1. The Girton site of two tent rings and associated caches provided a small surface collection suggesting a Copper Eskimo occupation.

Ekalluk River, about thirty-five miles northwest of Cambridge Bay, drains Ferguson Lake, to the eastern coast of Wellington Bay. We first examined this place during an aerial survey of the Dease Strait region, for Mr. D. Hamilton, of F.W.A., had already seen old tent rings there and Mr. J.K. Fraser, of the Geographical Branch, had earlier described to me old houses he had seen at the head of the river. Eventually we managed to fit in a week's work there, testing three sites given the spirited names, Bell, Ballantine, and Buchanan, a dour aside on the state of our supplies. These sites lie on the south bank of the river. Tent rings and caches dot the north bank as well and, a few hundred yards back from the river and the sea, a line of inukshuks extends for several hundred yards, interrupted at intervals by concealed shooting pits.

Eleven of the sixteen Bell site houses are faint subrectangular depressions, the kind of thing more often thought of as Dorset than as Thule. The other houses there are marked by large lichen-encrusted boulders and limestone slabs. There are also several tumbled stone food caches, and nearby about a dozen old tent rings. Most of the animal bone recovered was of caribou, although muskox, seal, bearded seal, fox, and bird bones did occur. The small artifact sample excavated from the Bell site reflects both a developed stage of Thule culture, and a Dorset occupation very roughly dated to the first part of the first millennium A.D.

The Ballantine site consists of a small midden area on a knoll and perhaps the scattered remnants of three tent rings. Again the bones were nearly all of caribou. The artifacts are all of Dorset culture and the nine harpoon heads suggest an occupation near 500 B.C.

The Buchanan site contains three components. First, the remains of a midden with its contents scattered down an eroding stream bank provided a Dorset collection of an occupation slightly younger than the nearby Ballantine site and a little older likely than the Dorset stage of the Bell site. Second, a little hillock, two hundred yards southwest of the eroding bank, yielded a few nondescript Dorset objects. Third, about seventy yards southeast and uphill from the eroding bank, we found an early Dorset harpoon head, a burin spall, and a harpoon head of the middle to late Dorset period on the surface. The latter was particularly interesting as all the other Dorset material found on the survey represents the earlier part of the Dorset time span or remains undated within that continuum. Test trenches in this component revealed a buried turf layer which produced a small, typical Pre-Dorset artifact sample and a number of large, coarsely chipped biface ovate blades or choppers. The age of this Pre-Dorset midden leads to indulgent speculation; my speculation that it was occupied about the period 2500 B.C. to 3000 B.C. may well be a very bad guess.

During the aerial survey already mentioned, a large Dorset camp was found on the coast twenty-seven miles west of Cambridge Bay. This we called the Oxford site and the bay it overlooks has been officially named Oxford Bay. The site contains some forty tent rings, most are oval or subrectangular, although one has a bilobate plan. The site rests in a very barren area of well-defined beach ridges. Discovered late in the day, we managed to find only eleven artifacts despite a diligent surface examination. The single harpoon head recovered leads me to suggest very timidly that the site is roughly two thousand years old.

The aerial survey on August 15 carried us around Dease Strait in a chartered P.W.A. Otter piloted by Mr. D. Hamilton. On this trip we found the Ekalluk River sites, the Oxford site, a rather recent summer site in the southwest corner of Ferguson Lake, and the Cape Colborne site described to us by Mr. D. O'Brien of Cambridge Bay. From Ekalluk River we flew to a point a few miles up the coast from Cape Peel then followed the coast at low elevation to Byron Bay and Lauchlan River. We then crossed Dease Strait to Turnagain Point but failed to locate the ruins that Simpson reported seeing there in 1845. The flight then followed the coast to Trap Point where we turned north over the Finlayson Islands to Oxford Bay and Cambridge Bay. Except for the sites previously mentioned, nothing of archaeological concern was seen except an occasional small cluster of untempting tent rings.

A boat trip later in the season to Cape Colborne led to the recovery of a few artifacts that seem reasonably identified as nineteenth or early twentieth century Copper Eskimo items. Mr. O'Brien gave us a small artifact collection gathered by an Eskimo at Stromness Bay. Here, again, a Copper Eskimo site is indicated; four iron rivets in one of the objects suggest a rather recent occupation if one assumes a single period of occupation for these specimens.

Further field work is planned for the area using both Coppermine and Cambridge Bay as bases for transportation.

Unusual ice conditions in the Canadian Arctic, summer 1963.

By Moira Dunbar.

The summer of 1963 was one of strange contrasts in ice conditions. In the Western Arctic it was on the whole an open season. In Foxe Basin and northeast Baffin Island and Pond Inlet it was normal to good. On the route to Eureka conditions were severe but not unusually so. But the Smith Sound channel, owing to very special circumstances, was abnormally open, while on the southeast coast of Baffin Island and in Lancaster Sound conditions were quite unusually severe, the latter the worst that have ever been recorded. The following is a brief discussion of the causes of these anomalies.

Southeast Baffin Island

Baffin Bay and Davis Strait have been subject to a period of regular ice observation that now passes ten years, and it is becoming possible to talk of mean conditions with some slight degree of assurance. Development of open water is in two directions; northward up the Greenland coast, owing to the influence of the warm West Greenland Current, and southward from Smith Sound, by the spring extension of the North Water, which forms an open, or partially open, area in Smith Sound and the head of Baffin Bay throughout the winter. Last to open up is the so-called Middle Pack area, which forms a sort of tongue running north from the southern part of the east Baffin coast. Thus the area to which most of the east Baffin resupply is directed in in fact the last part to become clear of ice. Usually however by early August the ice has dissipated to a point where access to the coast is fairly easy and at the latest this has been about August 20. From 1952 to 1962 the entire area of Baffin Bay and Davis Strait has become ice free by September in every year except 1958, when as in 1963, a little ice remained through to freeze-up.

In 1963 the pattern of break-up was normal but the timing about three to four weeks later than the mean. From Pond Inlet south to about Cape Christian a narrow strip of ice persisted until about August 20, while from this point south to Cape Dyer a much wider band remained until a full month later. At the end of August there were ice concentrations of 6-to 9-tenths from south of Cape Dyer up to Cape Raper. By September 5 this area had shrunk to from Padloping Island to Cape Henry Kater, clearing gradually until by September 22 the coast was clear almost down to Cape Dyer. Much of the same ice however had now worked south and was lying round and to the south of Cape Dyer, where some remained until freeze-up.

The first ships carrying supplies for points from Cape Dyer to Broughton Island arrived on August 5. Thereafter the resupply continued more or less according to schedule, but at the cost of considerable damage to ships, until August 21, when the operation was interrupted owing to the poor conditions, continuing on September 18 after the resupply of the Foxe Basin area. The last vessels left the east coast at the end of September.

A relatively tough season had been predicted in the long-range ice forecast issued by the Meteorological Branch at the beginning of the season, but the magnitude of the anomaly had been underestimated. The main reason for the exceptional conditions, according to W.E. Markham, chief of Ice Central, Meteorological Branch (personal communication), was the very open conditions which existed in 1962 and which allowed large quantities of polar ice to enter Baffin Bay late in the fall by way of Smith Sound. It was this ice which hung on so stubbornly throughout the summer of 1963, aided by below normal summer temperatures and onshore winds in southeastern Baffin Island. This illustrates a long-known fact that good ice conditions in one area very frequently lead to bad ones in another.

Lancaster

Conditions on the sea route to Cornwallis Island, consisting of Lancaster Sound and western Barrow Strait, have been recorded with reasonable completeness since 1953, and less completely in a number of other years. This route is normally easily navigable sometime in the first half of August. The resupply convoy is usually scheduled to reach Resolute about August 10 and does so without too much difficulty except sometimes in Barrow Strait close to Resolute itself. Lancaster Sound (that is the part of the Parry Channel east of Wellington Channel) is in fact normally open by mid or late July.

In 1963, by contrast, the resupply vessels did not reach Resolute until August 21, and that after a very difficult passage through heavy ice all the way from Croker Bay, which resulted in heavy damage to ships. It should be pointed out that while this was the latest date on record for the arrival of the convoy, it was only a week to ten days later than usual. What made the season so abnormal was the amount of ice remaining at this late date in the eastern part of the channel, i.e. Lancaster Sound, and the difficulties which it caused to the ships. The latest dates at which over 5-tenths ice concentration has been recorded in this area up to this year are as follows: Lancaster Sound east of Beechey Island, fourth week in July (in 1958); off Beechey Island, third week in July (in 1957); off Resolute, fourth week in August (in 1953, 54, and 56). In 1963 the corresponding dates were Lancaster Sound, beginning of fourth week in August; Beechey Island, end of August; Resolute, first week in September. In the second area conditions never got any better than this owing to a continuous stream of ice from Wellington Channel, which continued to block Barrow Strait all season. This too is unusual, as Wellington Channel commonly becomes ice free by mid August.

Thus in summary we may say that for the access to Resolute as a whole the season was about a week behind the worst previously recorded season, whereas in Lancaster Sound it was a full four weeks behind, a very considerable anomaly.

The following data on 1963 conditions and assessment of causes is summarized from Markham (1963).

The ice causing the blockage of the route to Resolute, unlike that off the east coast of Baffin Island, was not polar ice but almost exclusively of the previous winter's formation. The open season of 1962 did bring polar ice in large quantities into western Barrow Strait and Viscount Melville Sound, causing severe conditions in that area, but east of Resolute this was not the case. Accumulation of freezing degree-days at Resolute over the winter of 1962-3 was the third lowest in the past eleven years; melting degree-days up to August 1, on the other hand, were the fourth lowest for the same period and only just over half the figure for 1962. However the low summer temperatures are not considered to be an important factor, as greater departures from normal in the past have not been followed by congested ice conditions. More significant was the winter wind pattern, which more than compensated for the low freezing degree-day accumulation by causing greater than normal ridging in the ice. This raised the total volume of the ice, which thus required more energy input to break or to melt it. The combination of this factor with an anomalous pressure distribution in the summer months is considered to be the main cause of the severe conditions.

Two aspects of the pressure pattern and resultant wind regime are important. In the early part of the summer the wind flow patterns were not significantly different from normal, but there were fewer travelling depressions. Only one weak frontal low passed through the area in July and none in June, compared with a normal one to four in June and two to three in July. Thus the strong westerly winds which normally follow these lows and which at this season break up the ice were lacking, and the ice remained in very large floes, exposing less open water to solar radiation and thus retarding melting.

Secondly a low pressure area persisted northwest of Mould Bay from July 23 to August 20. This is an unusual occurrence, the longest period such a low has persisted at this time of year since 1953 being ten days in 1954. The result was that instead of the normal northerly and northwesterly winds a predominance of moderate southwesterly winds was experienced in the Resolute area, keeping the ice pressed close to the coasts of Devon and Cornwallis islands. Towards the end of the period some strong southeasterlies were experienced, which made matters even worse.

This supports an earlier statement of Markham's (1962) to the effect that break-up in this area appears to depend mainly on wind speed and direction, and that temperature trends do not exert much influence. This means that long-range forecasting of ice conditions for the area will tend to continue to be difficult and will depend largely on the accuracy of long-range weather predictions.

Smith Sound - Kennedy Channel

The extraordinarily open conditions in this area were due to an ice island, known as WH-5, which became lodged between Ellesmere Island and Hans Island in Kennedy Channel between February 25 and 28, 1963, completely blocking the channel to the normal southward passage of ice (see Arctic Circular, Vol. 15 (1963) pp. 20-1). Almost immediately open water began to appear to the south of it. On March 29 it extended south to the head of Kane Basin, and by May 23 (or possibly sooner as I have no records between these dates) it had joined up with the North Water and there was not more than 3-tenths ice all the way to Baffin Bay except in the wider eastern bay of Kane Basin, where there was fast ice.

The ice island broke loose on July 22 and subsequently broke up and drifted south, providing valuable drift data. Contrary to what might have been expected the removal of the ice island did not cause any worsening in the conditions in the waters to the south. Oceanographic measurements made by the United States Coast Guard revealed that as a result of the absence of ice in Kane Basin, which normally remains ice-covered throughout all or most of the summer, the surface water temperatures were as high as 5 and 6°C, so that the ice drifting south very quickly melted and open water persisted till mid September (Nutt and Coachman, 1963). Thus the entrance of large amounts of polar ice into Baffin Bay experienced in 1962 was not repeated.

Another interesting point is that the ice island moved down into Kennedy Channel in February, in defiance of the commonly held theory that there is little or no movement of ice in the channel between Robeson Channel and Smith Sound in winter. Not only this, but south of the barrier the rapid clearing of the ice quickly formed what amounted to a second North Water, raising interesting questions as to the reasons for this well-known but still not fully explained feature. It tends to support the theory that the cause is not failure of ice to form so much as transport southward by current and more especially by winds funnelling through the narrow passage of Smith Sound. A Russian paper, of which I have seen only an abstract (Kupetskiy, 1962), makes this suggestion, and calculates that the constant removal of ice from the North Water area leads to the formation in the course of the winter of 4.5 times as much ice as would otherwise form. This results in increased salinity of the surface water, which in turn leads to intensification of vertical mixing and transport of heat to the surface.

Whether or not this represents the true mechanism of the North Water formation, it would appear likely that normally some transport of ice down the channel continues through at least part of the winter and at least as far as Kane Basin, dying out before reaching the ice bridge at the head of Smith Sound. This might account for the extremely heavy ridging often observed in Kane Basin, particularly on the west side. Wide cross-channel leads at the heads of Kennedy and Robeson channels have frequently been observed, and would be explained by temporary ice bridges at the points of narrowing of those channels, comparable to the more or less permanent one that forms the head of the North Water. It is possible that if these barriers became permanent there would be considerable open water in both these narrow channels (Robeson and Kennedy), with areas of ice accumulation in Hall and Kane basins.

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Russian plans to transplant snow geese (*Anser caerulescens*).

By F.G. Cooch.

In 1830 snow geese (*Anser caerulescens*) bred on the mainland of Siberia from the mouth of the Yenisey River and Taymyr Peninsula east to the Anadyr Peninsula. In winter, sizeable concentrations were recorded on the Caspian Sea south of Baku, at Lake Baykal near Irkutsk, and in Yokohama Bay, Japan.

By 1900 the European and Asiatic wintering populations had been extirpated, and by 1936 the last mainland breeding colonies (from the area between the Indigirka River and the Kolyma delta, including the Tundra Alazeya) had disappeared.

Snow geese still breed in Siberia at three colonies on Wrangel Island. One of these on the Tundrovaya River is probably the largest single colony in the world. These birds winter in California and thus contribute little to the Russian economy.

In 1964 S. M. Uspenski, Zoological Museum, University of Moscow, had planned to direct a pilot transplant of eggs and goslings from Wrangel Island to the Pyasina River, a westward shift of over 1,500 miles. Due to unfavourable weather on the breeding grounds, sufficient birds were not available, and the plan has been transferred to 1965. At the Pyasina River, Dr. Uspenski hopes to imprint the goslings to white-fronted geese (Anser albifrons) which winter in the vicinity of Caspian Sea. If successful it is to be anticipated that other transplants will be made in areas which historically supported breeding populations of snow geese. A natural re-colonization has recently occurred in the delta of the Indigirka.

If these experiments are successful, the results will indicate a method of bringing into use certain areas in North America, such as the Arctic Slope of Alaska, the lower Firth River, Yukon, and the Kovik Bay area of Ungava, which do not at present support snow goose populations.

Numbering of the Circular and Subscriptions

In order to bring the Circular more up to date in publication it has been decided to refer to Volume 16 as 1963-4 rather than as 1963. Ottawa members will pay their annual subscriptions as usual. Out-of-town members will automatically be credited with an extra year's subscription. It is hoped that this numbering change will not cause any inconvenience to members.

Change of Address

Members are earnestly requested to advise the Treasurer, Mrs. A.H. Macpherson, 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. G.W. Rowley,
245 Sylvan Road, Rockcliffe,
Ottawa 2, Ontario.

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A SYMPOSIUM ON FACTORS AFFECTING THE DISTRIBUTION OF PLANTS AND ANIMALS IN NORTHERN CANADA

A symposium on biotic distributions in northern Canada, organized by a committee of local biologists, was held in Ottawa on 14 May 1964, in the National Museum auditorium. The five papers presented appeared to be of sufficient interest to those working in the north to justify devoting a number of the Circular to a summary of the proceedings. The account which follows was compiled by Mr. A.H. Macpherson, of the Canadian Wildlife Service, from summaries of the papers and discussions contributed by the participants. Dr. J.F. Bendell of the University of British Columbia, then with the Canadian Wildlife Service, was in the Chair.

Introductory remarks. By Dr. E.G. Munroe, Entomology Research Institute, Central Experimental Farm.

I will very briefly mention some of the questions that must be answered before we have a satisfactory understanding of arctic and subarctic biotic distributions. The arctic biota is comparatively simple in structure owing to its paucity, yet its component species may be highly specialized to cope with the extreme environment. These unique or exaggerated features of the northern faunas and floras have not yet been studied systematically. The ecological interactions of the plants and animals are also poorly known. Again, there are questions of historical biogeography, relating to the unravelling of the effects of the glacial stages and associated changes in the extent of habitable land on the biota of the modern Arctic.

The subarctic biota is better known, and the problems posed by its distribution patterns more familiar to biologists of the temperate zone, and hence more conventional. An important field of study concerns the interactions of climate and geography, and their relationships to the biota. The frequent meeting in the Subarctic of stocks that diverged in separate refugia during the Pleistocene is a subject of great interest and a potentially rewarding field for research. Climatic change, and its effects on biotic distributions, differentiations, and extinction, lead naturally into the vast and challenging problem of the future, and to what course evolution is likely to take.

I Ecological peculiarities of the Canadian North. By Dr. W.R.M. Mason, Entomology Research Institute, Central Experimental Farm.

Proceeding northward from boreal forests, the first change usually noted is a thinning of the forest cover and a reduction in the size of individual trees. The habitat changes drastically from a shaded forest to an open bush area in which sunlight reaches the ground almost everywhere and the trees cannot be said to dominate the flora and fauna as they do in a truly forested region. Sphagnum bogs reach their maximum extent in this area.

Proceeding farther northward, it is noted that the trees become confined to the most sheltered and favourable areas such as river banks and lake shores. This type of country is called wooded tundra in the Russian literature, and, together with the preceding region, it is equivalent to the Hudsonian Zone or Subarctic Zone of North American literature. The species of trees appearing farthest north, the timber-line species, vary in different parts of the world. In Canada, spruce and larch are the northernmost trees; in Greenland, Iceland, and Scandinavia, birch; in European Russia, spruce; in most of Siberia, two species of larch, but in the easternmost part, poplar. Poplar is also the northernmost tree in western and northern Alaska. Thus we see that, in general, coniferous trees form the timber-line in continental areas, and broad-leaved trees in oceanic areas.

Passing still farther to the north, we usually encounter a zone of shrubs with a variable mixture of conifers, often crippled or prostrate. The coniferous species are absent from much of this zone of shrubs, especially in oceanic areas. This zone is referred to as shrub tundra or typical tundra in Russian literature, regio alpina inferior in Scandinavian literature, and in common parlance as buckbrush or krumholz. The sphagnum bogs are less dominant here than farther south.

Farther north the shrubs become confined to the warmest and most sheltered areas and the landscape is dominated by a kind of turf formed of various mixtures of grasses, sedges, and heaths. Sphagnum bogs become quite rare. This is the arctic tundra of Russian literature; called true Arctic or Low Arctic in Canadian literature, and regio alpina media in Scandinavian literature. Its fauna and flora is remarkably uniform throughout the world. In fact, there can be said to be only one arctic fauna, since a great majority of species have a circumpolar distribution.

Finally, the northernmost lands are covered with scattered plants only, have no shrubs at all, and even small patches of continuous sod are rare. This is the rock desert zone or regio alpina superior, usually referred to as High Arctic in Canadian literature.

In Canada east of the Mackenzie valley, the middle zone, that of the shrub tundra, appears to be missing, or so restricted as virtually to disappear except in the Labrador Peninsula. At the same time the timber-line, which throughout most of the world lies between the Arctic Circle and latitute 70°N., is depressed to the south almost a thousand miles. Associated with the abrupt change from thin forest to arctic tundra is an equally abrupt change in the fauna, such as occurs nowhere else in the world. In Alaska and that small part of Canada lying west of Great Bear Lake, there is a broad zone of shrub tundra varying from fifty to several hundred miles in width. This Alaska and Yukon sector is unusual in that the conifers are young, vigorous trees growing erectly in the middle of miles of shrub-covered country, not crippled and prostrate as elsewhere. It has been indicated by the work of Griggs (1946) that the timber-line is advancing rapidly in Alaska. The associated subarctic or Hudsonian Zone fauna shows no change at the timber-line, except for those phytophagous species associated with coniferous trees, and extends far into the shrub tundra zone. In Alaska the coniferous timber-line is quite clearly not a fundamental biological barrier.

In Eurasia the shrub tundra zone is so universally present as to have been given the name typical tundra in Russian literature. Unfortunately, I am not sufficiently acquainted with this literature to know the relationship of the Russian fauna to timber-line, but there appears to be a gradual transition of much the same nature as that found in northern Scandinavia. The fauna of Scandinavia, which is very well documented, exhibits only a gradual change from boreal to arctic species on passing from the zone of conifers into the arctic tundra. At Abisko in northern Sweden, for instance, arctic and more southern species of both plants and animals intermingle over a broad span of intermediate zones between subarctic birch "forest" and arctic or alpine tundra. A gradual change from one floral or faunal region to another is, of course, the typical condition throughout the world.

The situation in Iceland is similar to that in northern Sweden. Arctic species occur throughout the island, being equally at home in the mountains or at sea level. A subarctic fauna is found in the birch woods and elsewhere at lower altitudes around the coast.

Finally, in the Labrador Peninsula conditions contrast markedly with those found in Alaska. Shrub tundra is abundant, but the hilltops are barren and exposed as far south as the fifty-fifth parallel, and they carry an arctic flora and fauna far south of timber-line.

What is the reason for the unusual situation in most of the Canadian North, that is, the extreme southerly displacement of timber-line and the very abrupt transition from northern thin forests to arctic tundra? It is as if the whole zone of shrub tundra had been removed from across most of Canada. Several factors, none sufficient in itself, seem implicated. One is the combination of very severe glaciation with granitic bedrock resulting in an almost total lack of soil. The southerly trend of timber-line centres on Hudson Bay, and it is evident that the presence of such a huge, cold body of water far inland must be a most important factor. Other factors probably increasing the severity of the climate, at least locally, are the Greenland ice cap and that great outflow of arctic water, the Labrador Current.

The southerly deflection of tree-line around the Bering Sea and across the North Atlantic is superficially similar, but both the latter areas are influenced by warm ocean currents which cause mild winters and maritime climates thoroughly unlike any found in northern Canada. Thus boreal species can exist in these areas (i.e., the Aleutian Islands and the islands north of Scotland), probably in large measure due to the comparatively long growing season and the mild winters.

We in Canada have a unique opportunity to study two very different types of arctic habitat within our own borders. One is in the far west and is rather similar to that of arctic regions in the rest of the world; the other comprises by far the greater part of northern Canada, and is unique.

Remarks of invited commentators

1. Dr. A.E. Porsild, National Museum of Canada.

Dr. Mason has drawn a very fair picture of the physical aspects and the geographical distribution of tundra and taiga. It has long been recognized that a great many of the plants and animals inhabiting arctic and boreal lands are circumpolar, and that the physiognomy and general aspects of tundra and taiga in the Old and New Worlds are remarkably alike, so much so that a Finnish botanist would feel perfectly at home in forested parts of Ungava or the Hudson Bay country, whereas a botanist at home in the forested parts of temperate Europe or Asia could easily be "lost in the woods" of temperate North America. To early plant geographers, Siberia, Scandinavia, Greenland, and boreal North America were just so many spots on a circumpolar map. In North America our knowledge of plant distribution has at last reached the point where the mapping of plant distribution is yielding useful results. Some very peculiar and significant patterns of distribution have emerged from our mapping of the ranges, thus far, of some 3,000 boreal North American plants. Although perhaps half of all arctic vascular plants have circumpolar ranges, the remainder can be divided into groups having narrower but well-defined and distinct geographical ranges. These distribution patterns are, of course, due to historical causes, *i.e.*, the physical factors that controlled plant survival and plant migration in Pleistocene time; from them we can learn much about the history of floras and vegetation, and no doubt also about the history of animal species and their populations.

2. Dr. D.B.O. Savile, Plant Research Institute, Central Experimental Farm.

The virtual absence of a shrub tundra zone east and west of Hudson Bay is correlated with the unusually severe climate, for its latitude, of this region. Hudson Bay depresses vegetational zones southward in several ways: it delays spring, cools summer, and greatly increases wind-sweep, especially from November to June when it is largely ice-covered. The most important single cause of elimination of the shrub tundra, as distinct from southward depression, may well be the severe wind-sweep and winter snow abrasion that occurs across eastern Mackenzie, Keewatin, and northern Ungava, where ground relief is low and strong WNW winds are general. Where trees or shrubs grow densely they cause eddying and thus give mutual protection from abrasion. But let the density fall below a critical point, and the reduced protection may cause the remaining tall plants to be eliminated or rendered prostrate. Thus winter snow abrasion in this zone may well be the cause of the abrupt transition from forest to arctic tundra.

II Freshwater molluscs of the Hudson Bay watershed. By Dr. A.H. Clarke, Jr., National Museum of Canada.

The Hudson Bay watershed is a vast area of partially interconnected river systems, the southern portion of which is confluent with the upper St. Lawrence system through Lake Nipigon and Long Lac. The most recent general reports on its freshwater molluscan fauna, which includes about a hundred species and subspecies, are those of Dall (1905) and Mozley (1938). The distribution of the molluscs is still poorly known, but from studies of approximately 400 collections made by the writer and others over the past four years, and also of older material in the National Museum of Canada, patterns are beginning to emerge.

The molluscs studied fall into three general categories: 1) species and subspecies which are endemic to portions of the area, 2) widespread species of northern affinities, many of which are pan-boreal, and 3) widespread species of southern affinities, most of which reach their northern limits within the Hudson Bay watershed. The third group is by far the largest.

Approximately ten species and subspecies have been described as endemic in this region. At least three of these, Valvata lewisi ontariensis Baker, Helisoma antrosa royalensis Walker (both occurring in northwestern Ontario, the latter also in northern Lake Superior) and Stagnicola arctica (Lea) (occurring around the rim of Hudson and James bays and in the country northwest of Hudson Bay) merit separate taxonomic status. They appear either to have evolved since the Pleistocene, or to be survivors of species that invaded the region from the south and are elsewhere extinct.

Widespread species of northern affinities, of which there are approximately 15, include many which are pan-boreal (Lymnaea stagnalis Linn., Stagnicola palustris (Müller), Sphaerium nitidum Clessin, Pisidum casertanum (Poli), P. conventus Clessin, P. henslowanum (Sheppard), P. lilljeborgi Clessin, P. nitidum Jenyns, etc.), and some which are strictly North American (Valvata lewisi Currier, Amnicola limnosa Say, etc.). The species ranging farthest north, to Baffin and Victoria islands, are in this group. Most occur in the St. Lawrence system also, and some extend even farther south.

All major North American freshwater mollusc families, except the Pleuroceridae, are represented among the approximately 75 species and subspecies of southern affinities. Some show disjunct distribution patterns within the Hudson Bay watershed. For example, the unionid Lasmigona compressa (Lea) is known only from north-central Ontario and from west of Lake Winnipegosis near the Manitoba-Saskatchewan boundary, a distribution that may indicate a dual invasion from the south.

Distribution maps of the better-known groups, the freshwater mussels and larger gastropods, reveal interesting correlations. Many mussel species have invaded the Hudson Bay watershed from the upper Mississippi-Missouri system via the Red River. Some of these (Fusconaia flava (Raf.), Quadrula quadrula (Raf.), Crenodonta plicata (Say), Lasmigona costata (Say), and Proptera alata (Say), have not penetrated beyond the vicinity of the Red River in southern Manitoba. Both Ligumia recta (Lam.) and Lampsilis ovata ventricosa (Barnes) have ascended the Assiniboine River to western Manitoba, and the latter species also occurs in Lake Winnipeg and its outlet, the Nelson River. Strophitus undulatus (Say) has dispersed even more widely, and occurs in tributaries of Lake Winnipegosis, while Lasmigona complanata (Barnes) has spread far westward through central Saskatchewan and Alberta, as far as the Lake Athabasca drainage. All these species are calciphiles, and are absent from the soft waters of the Precambrian Shield. Their varying success in penetrating colder areas may be related to their respective spawning temperature requirements. In only two cases, Ligumia recta (Lam.) and Strophitus undulatus (Say), does the distribution of the fish hosts of the larva appear to be the main factor limiting their northwestward spread.

At least one unionid, Elliptio complanatus (Solander), is restricted to the portion of the region east of Lake Nipigon and south of James Bay. It apparently entered the watershed from the St. Lawrence system, possibly by way of the Ottawa River during postglacial time. The range of its only known fish host, Perca fluviatalis flavescens (Mitchill), is much more extensive, reaching west to Alberta. Continued expansion of the range of E. complanatus may be expected, unless halted by, for example, such a factor as competition with the abundant and widespread Lampsilis radiata siliquoidea (Barnes). Other molluscan invaders from the St. Lawrence system

(Lake Superior) are Bulimnea megasoma (Say) and Campeloma decisum (Say). The former occurs north to Lake St. Joseph and the latter as far as the vicinity of Red Lake, both in northwestern Ontario.

The two remaining mussel species found in the Hudson Bay watershed, Anodonta grandis (Say) and Lampsilis radiata siliquoidea (Barnes), are widespread and dominant. Both occur in suitable lake and river habitats throughout the boreal forest region, and A. grandis as far north as 63°N. on the Mackenzie River. They also occur in the vicinity of Moosonee, in the Moose River and its tributaries. Summer water temperatures for the northern parts of their ranges are unavailable. The northern limits of both however fall between the 55° and 60°F average daily July air temperature isotherms, which are probably related to the summer water temperature limits.

Remarks of invited commentators

1. Dr. E.L. Bousfield, National Museum of Canada

The distribution patterns of molluscs within the Hudson Bay watershed present a number of problems of zoogeography and ecology. How do they, and in particular those of the unionid bivalves, fit the zoogeographic groupings of van der Schalie and van der Schalie (1950)? I have noticed a marked similarity in ecological requirements and distributional patterns between unionid molluscs and some of the other invertebrates, such as crayfish. For instance, both unionids and crayfish tend to be warm, shallow-water animals. They tend to inhabit the larger rivers, and are rare in the smaller, faster-flowing, colder streams. Though there are, of course, differences between the distributions of the two groups, some of the crayfish are reported to penetrate from the Pacific drainage into that of the Missouri. Their status in the Hudson Bay watershed is under examination.

Recent studies of shallow-water marine molluscs on the North Atlantic coast have indicated that, in general, the ratio of bivalves to gastropods is higher in the northern latitudes, and lower farther south. Would Dr. Clarke agree that the trend is reversed in fresh water, and, if so, what might be responsible for this apparent paradox?

Dr. A.H. Clarke, Jr.: The freshwater mussel fauna of the Hudson Bay watershed is composed principally of Mississippi Basin species. It also contains a few Atlantic drainage species, but no Pacific drainage species are known to be included.

It is true that in North America the ratio of freshwater bivalve species to freshwater gastropod species is lower in northern localities than in southern ones. If the entire freshwater molluscan faunas of the north and south are compared the contrast is less apparent, but it is impossible to make a precise comparison because the groups have not all been revised.

It is safe to state, however, that among the five largest North American families, species of the Lymnaeidae, Planorbidae, and Sphaeriidae are much the more abundant in the north, while species of the Pleuroceridae and Unionidae are much the more abundant in the south. The species of the three former families are monoecious and capable of self-fertilization; they are also characteristically thin-shelled and light in weight. With few exceptions the Pleuroceridae and Unionidae are dioecious, and many are also rather thick and heavy. The Lymnaeidae, Planorbidae, and Sphaeriidae are therefore better adapted for successful invasion of newly deglaciated regions by passive transport. The dioecious gastropods are obviously less well adapted, for even if an egg mass is transported into an unoccupied habitat, upon attaining sexual maturity the surviving individuals might well be so dispersed that they were unable to reproduce. Among the Unionidae, with their unique mechanism for transportation on fish, the few species which are hermaphroditic (e.g. Lasmigona compressa and Anodonta grandis) exhibit outstanding ability to invade isolated habitats.

The southern United States has not been greatly disturbed by glaciation, and hundreds of species of Pleuroceridae and Unionidae have evolved there. The relative scarcity of pulmonate gastropods in that region cannot be satisfactorily explained, but the comparative rarity of lakes may be a factor.

2. Dr. J.R. Vockeroth. Entomology Research Insitute, Central Experimental Farm.

I must congratulate Dr. Clarke on having chosen a group whose distribution patterns show some correlation with fairly obvious physical factors. In the insects, I am afraid, we are not quite so fortunate. Almost all insects, even the aquatic forms, have an aerial stage. Thus drainage patterns, theoretically at least, should have no effect on distribution, for there are no apparent obstacles to insects moving from one drainage system to another. Therefore, we must look for other explanations for the distribution patterns we observe. Dr. Mason has already remarked on the importance of the tree-line as a faunal boundary, and its effect on insect distribution in the north is most striking. Virtually without exception, the Diptera with aquatic immature stages are almost as sharply limited by tree-line as are those which are strictly terrestrial or phytophagous. In the mosquitoes, at least, the three species that occur on arctic tundra are rare or absent within the tree-line. The subarctic species, on the other hand, especially mosquitoes, are found in waters up to the limit of trees, and there stop very suddenly. Is there any information on the distribution of molluscs that cross tree-line?

Dr. A.H. Clarke, Jr.: Most of the freshwater molluscs, especially the Unionidae, are confined to the boreal forest zone. Of course, our freshwater mollusc distributions are not really related to the terrestrial vegetation type, but are affected by the same physical factors, of which the most important is temperature.

III. Distribution of freshwater fish in northern Canada. By Dr. D.E. McAllister, National Museum of Canada.

The breadth of the Canadian arctic drainage, including that of Hudson Bay, and its close approach to several other major drainage systems, provide a challenge to the ichthyologist interested in determining the sources of its freshwater fishes. The following review leans heavily on the studies of McPhail (1963), Walters (1955), and Radforth (1944).

A striking feature of the fauna as a whole is the decrease in number of species northward in North America. The Mississippi drainage has about 260 primary freshwater species (those unable to live in the sea), the Great Lakes 112, the arctic mainland 52, and the arctic archipelago 0. The number of primary freshwater families also decreases northward, from 13 to 12, 10, and 0 respectively.

A major factor affecting the distribution of northern Canadian freshwater fishes was the Wisconsin glaciation. Present distributions result from the dispersal from glacial refugia, with the interaction of other physical and biotic factors on dispersal rates and barriers. Dispersal rates of fish may be as high as over 400 miles in 28 years (rainbow smelt, *Osmerus eperlanus mordax*) (Dymond, 1944) and over 300 miles in 26 years (white perch, *Roccus americanus*) (Scott and Christie, 1963); other species may be far less quick to spread into confluent waters, but even so it seems that factors other than dispersal rate usually limit the distribution of fish. One such factor may be temperature. For example, the northern limit of the creek chub (*Semotilus atromaulatus*) has been found to be correlated with the 65° July air isotherm.

Examples of the species believed to have inhabited the various refugia are as follows:-

Bering refugium. Portions of Alaska and Yukon, connected to Eurasia in Wisconsin time, provided a refuge for freshwater fishes. About 18 species survived there, most of which have extended their ranges eastward. One of these is the inconnu, *Stenodus leucichthys*, which ranges along the arctic coast to just past the Mackenzie River and up it to the rapids on the Slave River at Fort Smith.

Pacific refugium. The squawfish (Ptychocheilus oregonensis) ranges north from the Columbia River in the Pacific drainage to the upper Fraser River, then crosses into the Parsnip River and via the upper Peace River into Alberta, indicating probable survival in the Pacific refugium. The prickly sculpin (Cottus asper) ranges in the Pacific drainages from California to Prince William Sound, and just enters the Parsnip River of the Peace-Mackenzie system. The broadness of its southern distribution and the lack of northern and southern races suggest survival in the Pacific refugium with rapid northward dispersal in saline coastal waters.

Mississippi refugium. The occurrence of the goldeye (Hiodon alosoides), the fathead minnow (Pimephales promelas), the flathead chub (Platygobio gracilis), and the walleye (Stizostedion vitreum) in the upper Mississippi system and to the northwest to the Northwest Territories, marks them as survivors from the Mississippi refugium. This view is bolstered by their geographic uniformity, and in the case of the fathead minnow by a fossil dated to 10,000 B.P. from southern Saskatchewan. The northward flow of warm water in the Mackenzie permits the flathead chub and walleye to reach higher latitudes there than they do farther east. The lake trout, or, more properly, char [1] (Salvelinus namaycush) ranges from the Great Lakes into Alaska. Its distribution has led some scientists to the conclusion that it survived glaciation in the Bering refugium. However, its absence from suitable coastal habitats in Alaska and Siberia, and the presence of a fossil dating to 12,500 - 16,000 B.P. in Wisconsin, suggests that it survived glaciation in the Mississippi but died out there as the climate warmed. It perhaps used pro-glacial lakes in spreading northwestward.

Atlantic refugium. The fallfish (Semotilus corporalis) is distributed from Atlantic drainages across the St. Lawrence River and into rivers draining into James Bay. It probably survived in the Atlantic Refugium and was able to cross headwaters because of its liking for rapid current.

Multiple refugia. Some fishes survived glaciation in two or more refugia. This may be indicated by the occurrence of two or more races, differing consistently over broad geographical ranges, and extending outward from the sites of refugia. Thus the round whitefish (Prosopium cylindraceum) probably survived in the Bering and Mississippi refugia, the pygmy whitefish (Prosopium coulteri) in the Pacific and Mississippi, and perhaps Bering, refugia, the northern pike (Esox lucius) in the Bering and Mississippi refugia, and the arctic char (Salvelinus alpinus) in the Kodiak Island, Bering, and Atlantic refugia, and perhaps in an arctic one as well.

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1. This author and several other modern ichthyologists prefer the usage "charr" for the genus Salvelinus (sensu lato).

Some of the dispersal routes used by northern Canadian freshwater fishes to invade glaciated territory run as follows: eastward along the arctic coast from the Bering refugium; eastward and southward in fresh water from the Bering refugium; northward and eastward via the Fraser and Peace systems to the Saskatchewan systems from the Pacific refugium; northward from the Mississippi refugium; northward via fresh water from the Atlantic refugium; and northward via the sea from the Atlantic refugium.

Remarks of invited commentators

1. Dr. V.D. Vladykov, University of Ottawa.

In the paper, strong emphasis was given to physico-chemical factors while biological factors, competition for example, were understated. Dispersal rates were exemplified by recent introductions of smelt and white perch into new habitats, and these cannot represent natural dispersal rates. When native pike-perch, or walleye, were tagged at Montreal, they travelled no more than 50 or 60 miles from their release points. Specimens brought from Lake Champlain and released at Montreal, on the other hand, travelled five or even six times as far as the native fish. Again, anadromous species, coregonids and salmonids, were emphasized, while typical freshwater species, such as cyprinids, were mentioned sparingly.

The paper would have been improved by some holarctic comparisons. Many cyprinid genera (e.g., Rutilus, Leuciscus, Phoximus, Gobio, and Carassius) reach the northern parts of the Asiatic continent, while in North America only three genera range into the Arctic (Rhinichthys, Platygobio, and Couesius).

The nomenclature for Salmonidae, especially for the lake trout, is the Ann Arbor, Michigan, "neo-Linnaean" type. For the arctic char, I would prefer the true Linnaean name used by many Scandinavian authors, Salmo alpinus. The Scandinavians no doubt know the differences between salmon and char, but do not consider them important enough to merit generic distinction.

Dr. D.E. McAllister: Competition is an important factor which might have been mentioned had adequate studies of range limitation by competition in freshwater fishes been available. The examples given merely illustrate potential dispersal rates of fishes into new habitats, as would be the case in the occupation of new habitats following glaciation. The dispersal rate given by Dr. Vladykov is in agreement with those cited, though the area was already inhabited by the species of his example. The Coregonidae, or more properly, Salmonidae, were discussed, as well as typically freshwater groups such as the Cyprinidae, Esocidae, and Hiodontidae. Except through Beringia, the Asiatic continent has contributed little to the nearctic freshwater fish fauna. In other than this, a comparison between the American and Eurasian faunas is outside the scope of the paper. Dr. Vladykov's views on arctic char nomenclature are well known. North American ichthyologists appear divided between "neo-Linnaean" lumpers and "pro-Jordan" splitters.

2. Dr. Lionel Johnson, Fisheries Research Board of Canada, Montreal.

I must disagree with Dr. McAllister's estimate of the dispersal rate of fishes, for the rates that he quotes are for the spread of exotic species and therefore probably have little in common with those of indigenous species. It seems likely that the lake trout is still undergoing expansion of its range. It is found on Southampton Island, and in Hall Lake at the north end of Melville Peninsula, but has not to our present knowledge reached Baffin Island; it extends northward on Boothia Peninsula to Bellot Strait, but again has not reached Somerset Island. In the west it is found throughout Victoria and Banks islands. Its spread does not seem to be hindered by salt water, and it may be possible for it to cross straits in the spring when melting ice provides a layer of water of low salinity on the surface. The lake trout is also absent from Newfoundland as an indigenous species. The sea may form an obstacle which takes a long time to cross but is by no means insuperable, and perhaps the recent recession of the ice in the Eastern Arctic has not provided sufficient time for the spread of the species to all the areas which it could conceivably occupy. Similar circumstances may attend the distribution of whitefish (Coregonus clupeaformis) and lake herring (Coregonus sardinella and C. autumnalis), which are present on Victoria Island and probably Banks Island, but do not appear to have reached any of the other islands.

Dr. D.E. McAllister: The rainbow smelt and the white perch are indigenous to eastern North America. Scott and Christie (1963) have recorded other similar range extensions. I agree that some species have recently spread or are now spreading, but these changes are possibly the results of recent climatic changes, and not indicative of slow dispersal rates.

IV Distribution of Canadian arctic tundra mammals. By A.H. Macpherson, Canadian Wildlife Service.

Well-marked patterns of distribution and variation in Canadian arctic mammals strongly suggest, by their nature, that the modern mammal fauna has occupied the region rather recently. Many of the distinctive species and races appear to have arrived from the northwest, and others evidently spread into the area from the region of north Greenland, the central Cordillera, and the woodlands. Such a finding is not surprising, in view of the shortness of the period since most of the modern tundra region emerged from beneath continental ice sheets and shallow postglacial seas, nor is it unexpected to find that the regions from which the mammals appear to have come correspond to those that are believed on other grounds to have been ice-free during the last, or Wisconsin, glacial stage. It is possible to frame a hypothesis that accounts for much of the evident taxonomic variation in Canadian arctic tundra mammals, and for their differing distribution patterns, and tentatively to list the mammals on the basis of their hypothetical origin and relative antiquity on the North American tundra.

As the continental ice sheets spread outward from centres on the northern mainland, populations of widespread tundra species were split apart, and finally, at the glacial maximum, their remnants became confined to small ice-free areas, called refugia. The most important of these, in the development of the modern mammal fauna, were Beringia in the Alaska-Yukon area, including land now covered by the Bering Sea, and Pearyland, in north Greenland. A narrow strip of tundra habitat also existed south of the ice, but it was interrupted, unstable, and subject to flooding by proglacial lakes, and appears to have supported only a small fauna. Arctic tundra mammal species that were evidently widespread in North America before the Wisconsin glacial stage, and of which separate populations survived the period in scattered refugia, include the arctic and mountain hares, the varying lemming, and the muskox. The hares have well-marked species or races derived from Beringia, Pearyland, and possibly from other refugia. The varying lemming shows a dual origin from Beringia and Pearyland, while its close relative, the Ungava varying lemming, may have survived the Wisconsin either south of the ice or in a refugium on the Labrador-Ungava peninsula. The muskox appears to have spread from both Pearyland and the southern tundra fringe.

Other tundra species were evidently less widespread before the Wisconsin stage. The brown lemming and the ground squirrel occurred only west of the Great Plains, and became broken into populations confined to Beringia and to the central Cordillera. The Cordilleran populations produced alpine tundra forms, the Columbian ground squirrel and the brown lemming race helvolus; the Beringian ones gave rise to arctic tundra forms, the arctic ground squirrel and the several northern brown lemming races.

Species that were probably occupants of the Hudsonian Zone and tree-line habitat were also broken into separate populations by the advancing ice. Those that were trapped in cooling refugia became adapted to tundra life, while those south of the ice sheets became woodland-oriented. This group includes the caribou, the gray wolf, the ermine, the red-backed mice and the masked shrew. The first three were evidently the more widespread, occurring in both main arctic refugia; all are alike in that the tundra form (or forms) does not occur east of Hudson Bay on the mainland.

Three species were confined to Beringia by the Wisconsin ice, and spread beyond it only upon deglaciation. These are the brown (and grizzly) bear, the tundra mouse, and man.

Two species now widespread on the mainland tundra evidently did not maintain populations in arctic refugia, but invaded the area after deglaciation, from the woodlands. They are the red fox and the wolverine.

Finally, there are two species, the arctic fox and the polar bear, that are not amenable to the kind of analysis here attempted. They are able to support themselves for long periods on sea ice, the bear on seals, and the fox perhaps largely on the leavings of the bear, and their resulting mobility has allowed them to interbreed through their whole range. Only certain arctic fox populations, isolated from the drifting ice on islands in the North Pacific Ocean, or in the mountains of Scandinavia, are markedly differentiated from the rest and from each other.

Remarks of invited commentators

1. Mr. P.M. Youngman, National Museum of Canada.

Early mammalogists were necessarily rather provincial in their outlook, and many of the species that they described as new from North America in fact had holarctic distributions. As examples I might mention the singing vole, brown bear, some mustelids, caribou, red-backed vole, pikas, varying lemming, and brown lemming.

Few of the mammals that have been discussed are restricted to the tundra, and many have a wide distribution. I would, therefore, have preferred a broader title. Tundra species without close forest relations I suggest are late migrants.

The division given is an interesting example of the kind of grouping that can be made, though I question some of the individual cases. In the category of species capable of free dispersal over sea ice, the wolverine and caribou can be added to the polar bear and arctic fox.

Mr. A.H. Macpherson: Certainly a number of northern North American forms are being recognized as conspecific with Eurasian ones. My purpose here is to examine patterns of variation within the North American representatives of these species and species complexes. The evidence for the existence of two species of the varying lemming in North America seems convincing: it has recently been reviewed by Guilday (1963). The arctic hares similarly do not seem very homogeneous. *Lepus othus* has been synonymized with *timidus*, but *arcticus*, and in particular the Pearyland complex *L. a. monstrabilis* and its allies, may be another matter. The taiga mammals noted were brought into the discussion because they are believed to throw light on the origin of their tundra relations. The polar bear and the arctic fox are unlike other species in that they are able to maintain themselves routinely for long periods on sea ice, the first by hunting seals and the second by following the more powerful predator and eating the remains of its prey. In this way, both species have been able to live long enough on sea ice to visit even the most remote of the arctic islands, such as Jan Mayen and Wrangel. This is not the case with such species as wolverine and caribou, though ice may, of course, be important in their dispersal.

2. Dr. A.W.F. Banfield, National Museum of Canada.

I agree with Mr. Macpherson's analysis of the survival of certain tundra mammals in northern North America and Greenland. Recent taxonomic studies have indicated that many of our northern mammals were only subspecifically distinct from northern Eurasian forms, and constituted holarctic species. The deglaciation of North America lasted from a Wisconsin maximum of approximately 18,000 B.P. to the "Last Ice" of approximately 7,000 B.P. Maps of this deglaciation, based on numerous data from recent investigations, particularly the research of the Pleistocene Geology Section of the Geological Survey of Canada, show that the pattern of recession gave rise to three main corridors: the Cordilleran-Laurentide, the Arctic Coast, and the Pearyland, which separated the main ice sheets and permitted terrestrial mammals to move from the refugia, colonizing new areas and meeting previously isolated relations.

Other comments and questions

Dr. Lionel Johnson: In your analysis, you have dwelt on the historical aspects of distribution and not on the ecological ones. Do you consider the latter relatively unimportant in the development of present distribution patterns?

Mr. A.H. Macpherson: Ecological factors are obviously implicated in the mutual exclusion at tree-line which several tundra and boreal forms display. They are clearly involved in the delimiting of northern range boundaries. The ground squirrel, for example, has never succeeded in establishing itself north of the mainland, though individuals have been recorded on both Baffin and King William islands. Nor, in the absence of geographic barriers, does it inhabit Boothia Peninsula north of Thom Bay. Ecological factors are undoubtedly important in the development of patterns both of distribution and of variation. The patterns exhibited by the tundra mammals are, however, explicable in general terms largely on the basis of historical zoogeography.

V. Distribution of the beetles of the Eastern Canadian Arctic. By W.J. Brown, Entomology Research Institute, Central Experimental Farm.

The Canadian Eastern Arctic is here defined as the region east of 100° W. and north or east of the limit of trees. It extends farther south, and is more abruptly limited to the south, than any other arctic region in the world. The entire region, or at least those parts in which beetles are likely to occur was, probably, covered by Wisconsin ice. Therefore all species of the region are presumably recent immigrants.

The beetle fauna of the Eastern Arctic is small; so far, it is known to include only 62, or perhaps 65, species, belonging to 9 families. By contrast, more than 260 species belonging to 28 families occur at Churchill, a tree-line locality at which strictly arctic species meet species of the forested Hudsonian Zone. Only one family that includes strictly arctic species, the Chrysomelidae, is lacking in the Eastern Arctic. None of the genera and subgenera of the region is restricted to the Arctic, except one genus of the Hydrophilidae which includes only one species. Thus the few arctic species are similar to their numerous relatives of the Hudsonian and Canadian zones. The Lepidoptera, Hymenoptera, and, especially, the Diptera are much more successful than the Coleoptera in arctic regions. Nevertheless, arctic species of beetles are well adapted to their way of life. Most of them are abundant, and many have spread widely in regions in which habitable areas are often small and scattered.

What are the habits of the beetles that occur in the Arctic? Like other arctic insects, they tend to restrict themselves to habitats in which extremes of weather and climate are more or less buffered and moderated. Nearly all arctic beetles live in still, shallow water or under cover in moss, peat, or soil. Of the Eastern Arctic species, 18, or nearly one-third, are aquatic. All of the others live on or in the ground except two weevils; adults and larvae of one of these feed on the leaves of willow, and those of the other on the leaves of dock. These are the only beetles of our region that depend on dicotyledons. Two weevils breed in the crowns of sedges, the two byrrhids feed on mosses, and the haliplid feeds on aquatic algae. Only these seven species are surely phytophagous. The food of two species is unknown, but all of the other species are predators. Thus the Coleoptera fail to utilize all available habitats and food sources in the Eastern Arctic.

Very little is known of the factors that govern the distribution of arctic beetles. Climate, especially summer temperatures, is certainly important. The July mean of 40°F evidently approximates the limit of the Coleoptera. Thompson Glacier Base Camp, Axel Heiberg Island, with 3 species of beetles, is very near that isotherm, as is Hazen Camp, northern Ellesmere Island, with the 3 species of Axel Heiberg Island and 2 others. But Hazen Camp is a well-sheltered place with a July mean of 43°F and with more than 200 species of insects. J.F. McAlpine spent a season collecting insects at

Isachsen, Ellef Ringnes Island. He found no beetles and only 30 species of other insects. Here the July mean is only about 38°F, and the cloud cover is approximately 80 per cent during the summer. Northern soil temperatures are much higher than air temperatures during sunny summer days; amount of overcast may well be a limiting factor in the arctic distribution of beetles.

The most puzzling fact in the distribution of our beetles is the relatively abrupt transition from an arctic to a Hudsonian fauna at timber-line in the east. Of the 62 to 65 species, probably all except 4 occur at timber-line. Seventeen extend farther south and are widespread in the Hudsonian Zone. Little can be said of the distribution of several species, but at least 30 find their southern limits at timber-line in the east, relict populations to the south excepted. Why should this be so, when some arctic species extend well into more southern regions? The situation changes to the west. At Bathurst Inlet, about 150 miles beyond the ill-defined timber-line, and at Umiat, Alaska, which is more than 100 miles north of the conifers, the majority of the species are primarily Hudsonian; these are extreme cases, but the fauna at these and other localities of the Central and Western Arctic approximates that of tree-line localities. We do not know why so many Hudsonian species enter the Arctic in these regions. The beetle fauna changes again and greatly in western Alaska. The region bordering the Bering Sea lacks conifers but otherwise has little biological similarity to the Arctic.

Lack of time since the Wisconsin appears to be important to distribution, especially in relation to barriers such as Hudson Strait and Hudson Bay. Sixteen species are known from Baffin Island, and all but one of these occurs south of Hudson Strait. Seventeen species that are lacking on Baffin Island occur on the southern shores of the strait; some of these represent Hudsonian intrusions, but at least 5 live there at such bleak localities as Port Burwell and could surely survive on Baffin Island. Twenty species, one-third of those known from our region, occur on or very near the western shores of Hudson Bay but have not been found east of the bay.

Some of the most interesting species of the Eastern Arctic are those with greatly restricted distributions. These are the staphylinid *Gnypeta* sp., which is known only from Hazen Camp, northern Ellesmere Island, and the staphylinid *Atheta* "sp. A" and the willow-feeding weevil *Rhynchaenus* n. sp., which are known only from Hazen Camp and Axel Heiberg Island. All are abundant and have not been overlooked in the southern Arctic. Their distribution, and that of certain plants and other insects, is indicative of a Wisconsin refugium in the High Arctic, probably in Pearyland.

None of the 20 species that are unknown east of Hudson Bay occurs in relict populations south of the principal range. Of the 26 that occur from the eastern parts of our region to Alaska, 12 occur in more southern, relict populations, and 3 extend on to the Queen Elizabeth Islands. The southern relicts, of course, indicate survival south of the ice during Wisconsin times. Five of our species occur in Greenland; 26 are known from Eurasia, and more will be found there when the Siberian fauna is studied.

Remarks of invited commentators

1. Dr. E.G. Munroe, Entomology Research Institute, Central Experimental Farm.

Mr. Brown has given an extremely good and comprehensive account. It must be remembered that our beetle collections come from very few localities as compared with those on which plant and mammal distributions are based, and that little, if any, fossil evidence has so far been analysed.

One striking feature of northern beetle distributions is the poverty of the Greenland fauna. Mr. Brown said that Greenland is a poorly collected territory, especially the northern or arctic part, and some of the poverty may therefore be only apparent. The composition of the northern beetle fauna is also unusual. When Mr. Brown returned from Sondre Strømfjord he brought back the only regional collection of insects I have ever seen in which there were more species of caddis flies than of beetles. Another feature is the concentration of species in the Low Arctic, and the fact that many of them are found as relicts to the south is indicative of where they came from.

It was emphasized that the Coleoptera do very poorly in the Arctic, compared with the Hymenoptera, Diptera, and Lepidoptera. Curiously, Hymenoptera do poorly in the Subantarctic, though one cannot speak of the Antarctic, where there are almost no representatives of these major orders.

An interesting correlation brought out in the Symposium is that between the tree-line of the Central Arctic, where the shrub tundra zone is absent, and the division between arctic and subarctic beetle faunas. The concept of the treeless Hudsonian Zone mentioned earlier by Dr. Mason would seem to relate well to the features of Western Arctic beetle distribution described by Mr. Brown. From this viewpoint, the occurrence of 2 or 3 species of conifer up to the border of the Hudsonian Zone in some places may be seen as a sort of vegetational accident.

It is well known that beetle fragments frequently turn up in early post-glacial peat, and I would be interested to hear whether this subfossil material sheds any light on the development of the present distribution patterns of arctic insects. I was surprised earlier to hear no mention of ice-free land around the Gulf of St. Lawrence, for it would seem that the huge eustatic lowering of sea level at successive glacial stages would have exposed tremendous areas of the Grand Banks. I would be interested in hearing whether the mammalogists believe there was no refugium here, or whether they think that it was unimportant to mammal distribution.

2. Dr. H.F. Howden, Entomology Research Institute, Central Experimental Farm.

Since I lack personal knowledge of the Eastern Arctic, I should like to indicate some of the general factors that may be of importance in governing beetle distributions and, possibly to some extent, at least, in the development of the arctic biota.

A striking feature of the arctic beetle fauna, and of the arctic biota as a whole, is its poverty. Modern distribution patterns may well result from a combination of habitat size and the ability of the species to disperse. Dispersal rates of beetles are lower than those of certain other groups mentioned today, and, as a consequence, the distribution patterns of beetles are often comparatively complex and difficult to interpret.

For example, the coastal sand-hill habitats of the southeastern United States have been dissected and combined repeatedly by events of the Pleistocene. Certain beetles which are peculiar to sand-hill regions may be widely distributed from the sand bars of New Jersey through Florida and across the southern sandy belt of Alabama. Other species may be limited to one or two small areas of sand-hill habitat which are separated from other seemingly suitable areas by minor barriers, such as rivers or swamps (Howden, 1963). In the Arctic, suitable habitats for beetles are often similarly fragmented, and may exist only as pockets. If we consider this disjunct nature of suitable habitats, then, we might be tempted to apply the observation on insular ant faunas of Wilson (1961), that the smaller the island, the fewer the genera and the species found on it. However, considering the comparatively slow dispersal rates of beetles, it may be that all of the species capable of living in the Arctic have simply not yet invaded the area.

Concluding discussion

Dr. A.H. Clarke, Jr.: Are there differences between the ratios of flighted to flightless beetles in the Arctic and Subarctic?

Mr. W.J. Brown: None that we have detected.

Dr. D.B.O. Savile: Dispersal of both flighted and flightless beetles across barriers is by wind. Neither can cross water barriers.

Mr. W.K.W. Baldwin, National Museum of Canada: We have discussed invasion by various species of the Arctic. What about retreat out?

Dr. E.G. Munroe: Very little work has been done on this interesting question, which merits more attention from North American biologists.

Anonymous: Is there any evidence of retreat in the marine fauna since the hypsithermal warm period?

Dr. E.L. Bousfield: Yes, among the littoral marine animals of the Canadian Atlantic coast.

Dr. W.R.M. Mason: Dr. Sherman Bleakney has shown that Blanding's turtle is a post-hypsithermal isolate in Nova Scotia.

Dr. J.G. Fyles, Geological Survey of Canada: I am interested in the possibility of using the hard parts of beetles found in cores as paleoclimatic indicators. Also, I think that some speakers have oversimplified the problems of present biotic distribution by considering mainly glacial events. The hypsithermal warm period almost certainly had an effect on recent distributions.

Mr. W.J. Brown: I think your suggestion of using beetle parts as climatic indicators may well be feasible. Paleontological work on the Eastern Arctic beetle fauna might provide valuable zoogeographic evidence.

Dr. H.F. Howden: It has been suggested that seeds may be dispersed great distances in the Arctic by being blown across snow-covered ice in winter. Could some beetles also be dispersed in this manner? Or would they necessarily be frozen and become fractured and abraded?

Dr. D.B.O. Savile: It seems possible that beetles might be distributed in this fashion, perhaps in lumps of vegetation such as blow off the feeding places of large ungulates.

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

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The following meetings have been held:

One hundred and thirty-second meeting. 13 October 1964. Dr. D. Dineley spoke on "The Ottawa University expedition to Somerset Island, 1964".

One hundred and thirty-third meeting. 10 November 1964. Air Vice Marshall J.B. Harvey described "The Boy Scout Movement in the Arctic".

The Annual Dinner was held at the Eastview Hotel on 8 December 1964. Mr. Frank Scott gave the after-dinner speech.

The Annual General Meeting was held in the No. 9 Transport Company Mess, R.C.A.S.C. on 12 January 1965. The President, Miss Moira Dunbar, was in the Chair. The Officers and Committee members elected for 1965 were as follows:

Officers

President:	Dr. R.G. Blackadar
Vice-President:	Dr. W.E. Taylor
Secretary:	Dr. R.L. Christie
Treasurer:	Mrs. A.H. Macpherson
Publications Secretary:	Miss Mary Murphy
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Mr. K.C. Arnold
Dr. R.J.E. Brown
Dr. A.H. Clarke
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Mr. F.R. Crawley
Mr. Peter Glynn
Mr. C.R. Harington
Dr. M.J.S. Innes
Mr. S.A. Kanik
Dr. J.C. McGlynn
Capt. T.C. Pullen
Mr. Harold Serson
Mr. V. Valentine

Following the completion of club business the film "High Arctic" made by Mr. Lewis Cotlow was shown.

One hundred and thirty-sixth meeting. 9 February 1965. Mr. Murray Watts spoke on "The Mary River iron deposit, north Baffin Island".

One hundred and thirty-seventh meeting. 9 March 1965. Dr. Weston Blake Jr. spoke on "North East Land, Spitsbergen".

One hundred and thirty-eighth meeting. 13 April 1965. Four films were shown. Three of these were made by the National Film Board: "Arctic Outpost", "Up North", and "Fur Country", and "Kumak the Sleepy Hunter" was made by Dunclaren Productions.

One hundred and thirty-ninth meeting. 15 April 1965. A special meeting was put on to hear Mr. Eske Brun from Denmark speak on "The History of administration of Greenland".

One hundred and fortieth meeting. 11 May 1965. Dr. Frank Vallee discussed "Special problems of the north".

One hundred and forty-first meeting. 12 October 1965. Mr. A.H. Macpherson gave a commentary on the film "Fishing at the stone weir" made near Pelly Bay by Education Services. The film, the first of a series of eight on the life of the Netsilik Eskimos, was produced under the supervision of Dr. A. Balikci and the Rev. G.-M. Rousselière, O.M.I.

One hundred and forty-second meeting. 9 November 1965. Dr. David Damas spoke on "Eskimo ethnology: the ethnological approach in the field".

Superintendent Henry A. Larsen, R.C.M.P.

We do not normally publish obituaries, but it was felt that the Circle would wish to record its sorrow at the death of Henry Larsen on 29 October 1964 in Vancouver at the age of sixty-five. Henry Larsen will always be remembered with the St. Roch, the small ship which he skippered through the Northwest Passage from east to west and west to east. He practically never missed a meeting of the Arctic Circle when in Ottawa and was President for the years 1952 and 1953. He will be sadly missed by the Circle as well as by Eskimos and others throughout the north.

Report on the First International Scientific Meeting on the Polar Bear.
By C.R. Harington *

The first international conference on polar bears took place from September 6-10 at the University of Alaska, near Fairbanks. The conference was organized to permit scientists and conservationists from interested arctic nations to meet to discuss the future of the polar bear, which roams widely throughout the Arctic Basin. Delegates to the meeting were: Canada - J.S. Tener (Technical Secretary), C.R. Harington; Denmark - C. Vibe; Norway - T. Oritsland, M. Norderhaug; U.S.S.R. - I. Maksimov, V. Sokolov; U.S.A. - C.E. Carlson (Chairman), S.E. Jorgensen, J.W. Brooks, J.J. Craighead, K.W. Kenyon, J.W. Lentfer, R.C. Hagan. Delegates representing the International Union for the Conservation of Nature and Natural Resources, and the Arctic Institute of North America also took part in the meeting. J.A. Slater of the United States acted as Secretary General.

After formal introductions, welcoming addresses were given by Governor William A. Egan of Alaska, and Dr. William Wood, President of the University of Alaska. Senator E.L. Bartlett opened the meeting, and as personal representative of President Johnson, wished it success. Delegates then began their discussions on research and management of polar bears throughout their circumpolar range, with special reference to their conservation.

Mr. C.R. Harington, Canada, spoke first, and gave a summary of present scientific knowledge on the polar bear, emphasizing life history, denning habits, and the status of research and management in Canada. Dr. C. Vibe, Denmark, then discussed conservation regulations in Greenland; in addition, using remarkably detailed game harvest records covering the period 1793-1950, he outlined how changing climate had caused variations in pack ice conditions near Greenland, which, in turn, influenced polar bear numbers and distribution in that region. The Norwegian delegates gave a detailed analysis of that country's polar bear harvest (which extends from the Barents Sea to Davis Strait), reviewed Norwegian hunting regulations, and outlined preliminary plans for studies of polar bear biology and physiology on Kong Karls Land (Svalbard). Dr. I. Maksimov, U.S.S.R., gave an account of the status of polar bears in the Soviet Union, and mentioned the research being conducted by Dr. S.M. Uspenskiy on the denning ecology of polar bears on Wrangel Island. Mr. J.W. Brooks, U.S.A., in his review of polar bear management and research activities in Alaska, stated that increasing harvests of polar bears in the seas adjacent to Alaska have not resulted in an apparent reduction in numbers. He also mentioned that polar bears do not regularly den or forage on the Alaskan mainland, although they are common on the ice adjacent to Alaska north of the Bering Straits.

* Canadian Wildlife Service

Subsequent discussions dealt with techniques of marking polar bears in order to find out more about their movements. This subject necessarily led to talks on methods of capturing and immobilizing polar bears. Research methods for better assessment of the influence of environmental factors on polar bear numbers were examined. Aerial polar bear survey techniques were also considered.

At the conclusion of the conference the national delegates, in a statement of accord, confirmed that scientific knowledge of the polar bear is far from being sufficient as a foundation for sound management policies. There was general agreement that polar bears be considered an international circumpolar resource, and that each nation concerned should take the action it deems necessary to conserve the species adequately until more precise management, based on research findings, can be applied. Furthermore, it was mutually recognized that each nation should determine the character of its polar bear research, according to its particular problems and abilities. It was agreed that all cubs, and females accompanied by cubs, require protection throughout the year. It is encouraging that consideration is being given to the prompt exchange of research and management information on polar bears by means of an international polar bear data sheet. Conference delegates suggested that the International Union for the Conservation of Nature and Natural Resources, or a similar international organization, be invited to receive and distribute the polar bear information submitted to it. There was mutual agreement that future international scientific meetings on the polar bear be called when urgent problems, or new scientific data, warrant international consideration. It was decided that a comprehensive report on the meeting would be printed.

The Chairman of the Conference, C. Edward Carlson, felt that the meeting had been a complete success. Intensive discussions were held in a spirit of full international cooperation. The delegates were unanimous in praise of their hosts in the City of Fairbanks and the University of Alaska, and they expressed their deep appreciation for the splendid hospitality furnished them by so many people.

The Advisory Commission on the Development of Government in the Northwest Territories

On 11 May 1965 the Honourable Arthur Laing, Minister of Northern Affairs and National Resources, announced the establishment of an Advisory Commission on the Development of Government in the Northwest Territories to report to him on matters relating to the political development of the Northwest Territories. The Commission has been directed to give special study to:

"The views of residents of the Northwest Territories and other Canadians with northern experience;

"The nature of the federal responsibility for the Territories;

"Consideration of the political development of the Territories contingent on the size, nature and distribution of population and its ability to pay a significant share of the costs involved having regard to the present and prospective level of social and economic development;

"Existing forms of government as defined by the Northwest Territories and Northern Affairs and National Resources Acts;

"Previous proposals affecting constitutional structure."

Dean A.W.R. Carrothers, Professor and Dean of Law at the University of Western Ontario, is Chairman of the Commission and the two other members are John H. Parker, Mayor of Yellowknife, and Jean Beetz, Professor of Constitutional Law, of the University of Montreal. The Secretary of the Commission is Dr. Walter O. Kupsch, Professor of Geology at the University of Saskatchewan and Director of the Institute for Northern Studies.

In June the three Commission Members attended the 30th Session of the Council of the Northwest Territories in Yellowknife and afterwards travelled to nearby settlements, including Fort Resolution and Snowdrift, to become familiar with the country and to find the most effective way in which future hearings could be held.

In August and the early part of September the Commissioners and their staff visited thirty-seven communities throughout the Northwest Territories to secure the views of residents on the most appropriate form of government in the Northwest Territories in the light of the political, economic, fiscal, and social prospects.

Travel was by chartered aircraft and a total of nearly 7,000 miles was flown within the boundaries of the Northwest Territories. Extensive publicity concerning the trip and the hearings was given by a reporter from the Canadian Press and by a representative of the Northern Service C.B.C. who both accompanied the Commission. Verbatim minutes of all hearings were kept by a court reporter and several persons were involved in the required translation services. The hearings were held in schools, community halls, warehouses, and even out of doors. The attendance ranged from as many as one hundred seated in the school at Rankin Inlet to as few as eight lying in the grass along the banks of the Mackenzie River at Fort Wrigley.

Early in November Mayor Parker and the Secretary of the Commission were in the Yukon Territory to observe the operations of the Territorial Government there and to discuss related problems with the Commissioner of the Yukon.

Public hearings of the Commission were held in Ottawa from November 15 to 19 and a further visit to settlements in the Northwest Territories is planned for the beginning of March, 1966. The Commission is expected to report its findings during the summer of 1966.

Notes on a canoe journey from Aylmer Lake to Rae via the Lockhart and Snare rivers, July 1964. By Eric W. Morse

(The following notes were compiled at the request of the R.C.M. Police to assist other travellers in small craft. With the increasing interest in canoeing in the Barrens, details of portages become essential. This account is a full record of portages on the trip made by Mr. and Mrs. Eric W. Morse, Mr. G.H. Bayly, and Mr. Angus Scott in the summer of 1964. They do not recommend that the Lockhart River be travelled upstream if it can be travelled in reverse - Mr. Morse did it upstream merely to connect with a previous trip. The portages on the Snare River are of particular interest as this is virtually an untravelled route. Ed. A.C.)

This 400-mile canoe trip from Aylmer Lake to Rae was part of a project aimed to establish the existence of a feasible freshwater "Northwest Passage" from Hudson Bay to Bering Sea. The 1,500 miles from Chesterfield Inlet to Norman Wells have now been covered in three three-week canoe trips (1959, 1962, and 1964).* The 1964 summer trip, undertaken by four of us as an alleged vacation, was the key link in the whole 3,000 miles; the remaining parts - including the lower Mackenzie, the Rat-Bell route over McDougall Pass,** and the Yukon River - are familiar canoe routes.

We failed to find record of anyone who had gone through on the Snare River, though the odd section of it had, of course, been covered by prospectors, the Geological Survey, mapping crews, and the Wildlife Service. Preliminary contacts in the area all advised against travelling this route by canoe - particularly over the divide between the Lockhart and Snare rivers, and the escarpment east of Indin Lake. Apparently the local Indians forsake the Snare below Snare Lake for an alternate route via Wecho River.

I would suggest that this is a route for thoroughly experienced canoeists and wilderness travellers only. The main hazards are the big lakes, dangerous rapids, canyons, and the absence of portage paths except below Indin Lake. Also, the published maps provide very inadequate information on rapids. The latest (1960-61) maps actually show only about half the rapids. Despite running many marginal rapids, and poling or tracking up others, we made a total of 62 portages.

A specific hazard to canoe travel in this latitude is late ice on the biggest lakes. To get through by arctic autumn (which begins in mid-August)

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* See "Fresh water Northwest Passage" by E.W. Morse (Can. Geogr. J. Vol. 70, No. 6, 1965, pp. 182-91) for an account of the three trips and Arctic Circular, Vol. 15, No. 3, 1962, pp. 47-51, for details of the 1962 trip.

** This section was completed in the summer of 1965. We hope to publish an account in a forthcoming number of the Circular. Ed. A.C.

it is necessary to start a canoe trip as early as ice will allow. Records of early travellers and the advice of local pilots would indicate mid-July as a reasonably safe date for starting. However, it should be noted that in 1964 Clinton-Colden and Aylmer lakes were covered with pack ice for all but their extreme windward portions, as late as July 11.

(Parenthetically, it might be added that, provided a party could allow a week to be kept in hand against delay by ice, a delightful trip across the Barren Lands would be from Jolly Lake near the source of the Lockhart River through Clinton-Colden Lake, across the Hanbury Portage to the source of the Hanbury River, and thence down the Thelon River. This trip would be about 700 miles. I paddled this going partly upstream in 4 1/2 weeks, but had reasonably good luck with wind and feel it would be safer to allow 5 weeks, or more. It is all downstream; the rapids are mostly runnable, involving no more than about 12 miles of portaging in the whole 700 miles. The scenery, fishing, and big game make this, I think, one of the best canoe trips on the continent.)

Wildlife

Isolated caribou were encountered, and there was evidence of the regular passage of fairly small herds throughout the Barrens portion of our trip, east of Fort Enterprise and Winter Lake.

Considerable evidence of Barren-ground grizzlies existed everywhere, in the form of droppings and demolished ground squirrel colonies. We surprised one large grizzly asleep at a portage; when it saw an aluminum canoe walking on two legs, it was two hills away in thirty seconds.

Moose seemed plentiful when we got into birch country.

No wolves or smaller mammals (except otters) were actually seen, but tracks and droppings indicated their normal incidence.

Eagles, jaegers, various hawks, Pacific, red-throated, and common loons, plus the usual numbers of golden-eye and other ducks, plovers, terns, longspurs, and ptarmigan were seen. No Canada geese or swans were encountered.

Canoe navigation notes
(Aylmer Lake to Rae)

The following notes describe an east-west progression; they take no note of rapids which can be easily run or merely paddled up. East of Jolly Lake, most rapids can be run in part or whole, if going downstream, the opposite direction to our course. It is important to bear in mind that the notes are based on high-water level, and that any rapids sounding dangerous should be scouted before running. The mention of a particular side for portaging merely indicates the side we used, but does not necessarily preclude portaging on the other side. Because of the inadequacy of marking of rapids on the government 1:250,000 maps, it is not always easy to designate the rapids. Air photos for the more critical sections are useful. The following 1:250,000 sheets of the Topographical Survey were used: 76C Aylmer Lake, 76D Lac de Gras, 86A Winter Lake, 86B Indin Lake, and 85O Wecho River, and for the last section to Rae, 85J Yellowknife, and 85K Rae.

Aylmer Lake

In scheduling canoe travel on lakes this size in this latitude, our rule of thumb is to plan on making no more than 10 to 15 miles a day, even during the summer months. When the wind is adverse, one sits; when it is favourable or absent, one paddles practically around the clock. (It remains light enough for navigating all "night" during June and July).

Lockhart River below MacKay Lake

First rapid: portage south side, 1/4 mile.

First rapid between Outram Lakes: portage west side, 200 yards, near upper elbow.

Second rapid between Outram Lakes: portage north side, 1/3 mile.

First rapid above upper Outram Lake: portage westward across a point for a mile, thus passing all the rough water above the falls.

Second rapid above upper Outram Lake: portage west side, 1/2 mile. (We met a grizzly here).

Third rapid above upper Outram Lake: portage west side, 1 mile.

Fourth rapid above upper Outram Lake (just below deep, pointed bay on east side): portage east side, 1/2 mile.

Third rapid below MacKay Lake: portage across small isthmus on west side, by-passing four riffles (coming downstream these may all be run).

Second rapid below MacKay Lake: portage east side, 1 mile.

Rapid at exit of MacKay Lake: portage south side, 300 yards (travelling downstream run this).

MacKay Lake to Courageous Lake (via the Snake River)

First rapid: portage south side, 200 yards.

Second rapid: portage south side, 1/2 mile.

Third rapid: portage west side, 1/2 mile.

Courageous Lake to Jolly Lake

S-turn rapid emptying into Courageous Lake: portage west side, 200 yards.

Falls above cut esker: portage south side, 200 yards.

Rapids below Jolly Lake: portage south side, 1/2 mile.

Snare source lakes (Jolly Lake to Winter Lake)

Detailed notes on this section are perhaps not necessary; there is always more than one way to play it, and there is no chance of getting off the route. A map, air photos, plenty of stamina, and common sense are required.

(1) Portage over the divide (1 1/4 miles), starting from a smooth granite area 200 yards southwest of the creek which enters the northwest corner of Jolly Lake. Climb the hill to get a line (to the northwest) which passes over the left shoulder of a long low hill half a mile away. Follow this line, first bending to the right to cross the creek at a favourable point. Keep two small ponds on the left, and end the portage in a bay of the first lake, in a large boulder patch.

(2) Of the first 13 miles of this route, about 4 miles must be portaged. In general, avoid streams between lakes because they are mostly boulder-strewn, without enough water to bear the canoe. It sometimes pays even to portage past small lakes in this section.

(3) After the first 13 miles, some rapids may be waded, and some run. The lakes become deeper.

(4) Below the longest lake in this chain, only three portages are necessary, and there are some good rapids for running, with occasional wading sections between runs.

(5) The whole of the Snare source lakes down to Winter Lake can be done in three days: a day of toil, a day of mostly paddling, and a day of fun running and wading rapids.

Rapids between Winter and Roundrock lakes:

First rapid: portage from head of small sandy bay just south of the outlet, across a saddle; from the crest of the saddle, the foot of the rapid will be seen in a straight line ahead.

Second rapid: looks easily navigable from the top, but has a very bad, rocky "apron" at its foot which did not look good at high water; there is a short portage on the north side, from the lip of the rapid.

Third rapid (island in middle): ran at high water, near south shore.

Snare Lake to Indin Lake

Keep to the south shore of Snare Lake nearing its western end, to avoid being led down the main river when it turns north, and follow a smaller branch of the river heading west. The map is misleading, since it shows the same level (1164) for the extreme west end of Snare Lake as for the main body of the lake; actually a series of rocky rapids (which can be run or waded) drops down a good ten feet into the extreme west end.

The section of the Snare below Snare Lake is the most difficult of all; the river drops 270 feet in 4 miles as the crow flies. At this steep escarpment, we broke the party into two teams and spent an afternoon scouting. We found the main course of the river to be a canyon in sections and practically unnavigable. However, a chain of lakes by-passing the canyon to the south is a feasible route. Next day we got through without trouble in seven hours.

The by-pass route of small lakes totals only 5 or 6 miles and ten portages in all. The sketch-map makes clear where this route lies: start from a small bay just west of the westernmost outlet of the Snare, which leaves Snare Lake near its western extremity; instead of following the current, go straight north from the little bay by two portages and a small lake and enter a second small lake which is a widening of the west branch of the Snare; but do not proceed down any rapids. At the foot of the little lake and the head of a rapid, leave the Snare River and cut due west over a low rise to a small lake about 1/2 mile away. An obvious chain of five little lakes connected by short portages leads to the north end of a long narrow lake which lies 1 1/2 miles due east of the big south bend of the Snare, below all its rapids. There are no set portages between these little lakes; but the woods are open and the footing dry. A climb here and there to the crest of a knoll will show the line to take. The final portage is 1 1/2 miles long. From the northwest corner of a little lake, separated from the long narrow lake by a portage of 20 feet, follow an old trapping line cut due west through the birches in the direction of the Snare and ending in a large bog. Continue across this bog almost due westward to a low sandy ridge and the crest of the escarpment, whence a way down can be worked out. The river is reached in a bay at the bottom of its southward swing, a mile or two back from the rapid lying at the entrance to Indin Lake.

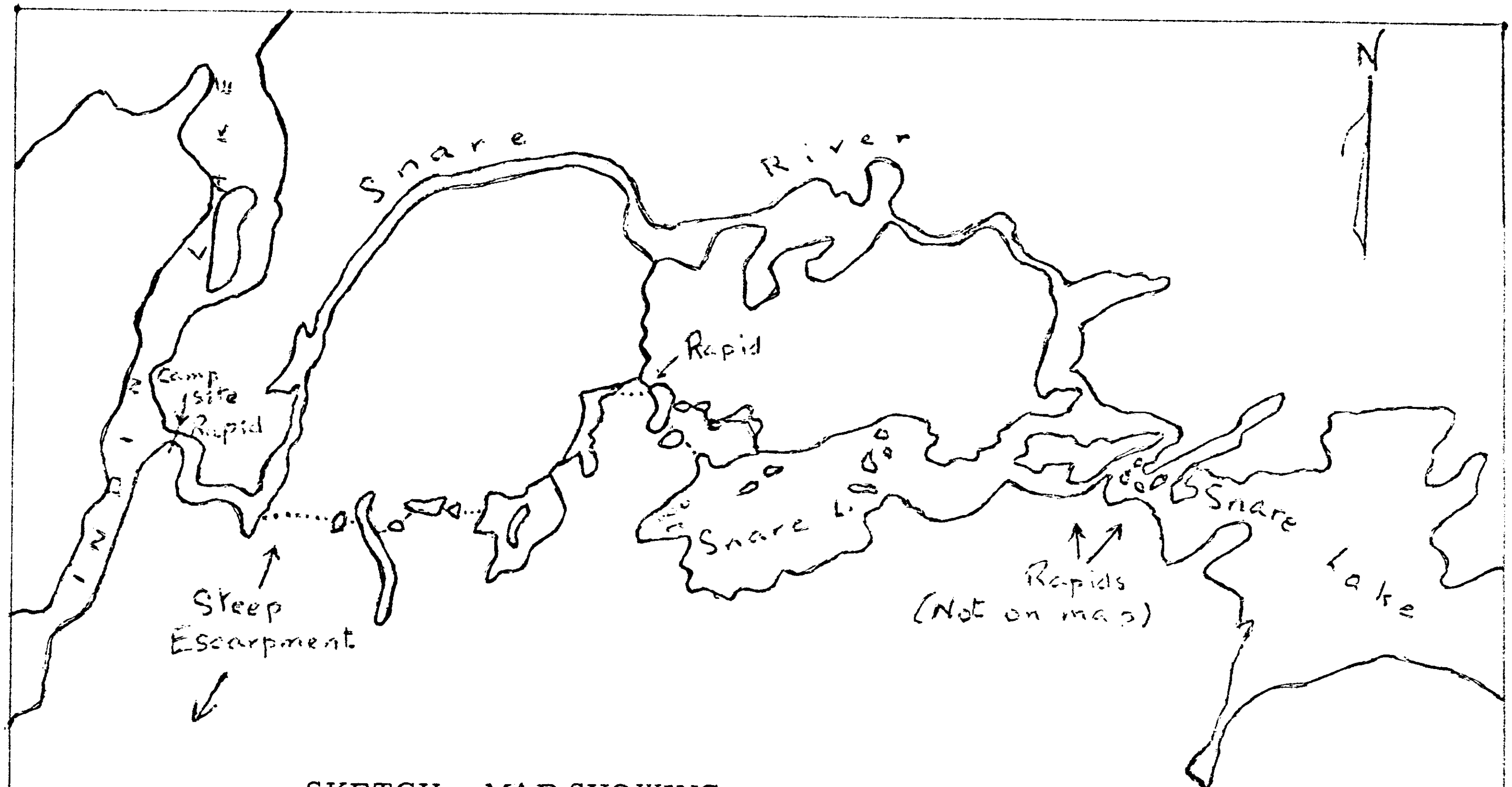
At the entrance to Indin Lake, the portage is on the north side, 200 yards.

Indin Lake to Kwejinne Lake

At the outlet of Indin Lake a set of six bad rapids drop 80 feet in a couple of miles. Portage past the first one on the east side, then put in again and paddle to the next. The next five rapids should be portaged all in one long, 1 1/2-mile, portage on the east side, coming out in a bay a little to the east of the foot of the lowest rapid. In 1964, a set of old blaze marks was still visible, but the path was obscure at its lower end. The portage path starts to climb at once, then drops down to the river again, finally leaving the river where it takes a more westerly trend.

Between this set of rapids and the beginning of the headpond for the upper Snare dam a couple of falls and some rapids are marked on the map.

First falls: portage east side, 100 yards. (Below this are several riffles and a rapid which are runnable at high water). Just above the Bigspruce - Kwejinne headpond (labelled as 740 feet) is a cluster of three rapids and one falls.



SKETCH - MAP SHOWING

Little-lakes route to by-pass Snare Canyons and falls

Scale: 1 inch = 2 miles

First two rapids: portage together on the east, 1/3 mile.

Falls: portage east side, 1/4 mile.

Rapids just below falls: portage east, 200 yards. (The rest of the rapids down to the flat water are all easily runnable at high water).

Snare River below upper dam

Below the upper dam, the Snare is reported to have bad canyons and falls. Other unattractive features are a flanking road between the two dams, and departure off the Precambrian Shield. The Indian canoe route to Slemon Lake follows a charming chain of lakes stretching due south from the long south bay of Bigspruce Lake. The portages are clearly marked, since this is also a winter tractor trail. However the "cat" route does not follow the exact portage route designated on the map for all the way. Ask about this at the dam. The final portage, a mile long, into Slemon Lake, goes over a saddle of a ridge. Slemon and Russell lakes are the same level as Great Slave Lake and the route to Rae is straightforward.

Scheduled helicopter service in Greenland

Regular passenger helicopter service along the west coast of Greenland was begun in the spring of 1965 by Grønlandsfly A/S. This company, which is now registered in Greenland, was formed by Scandinavian Airlines System, the Royal Greenland Trade Department, the Greenland Provincial Council, and the Øresund Cryolite Company, and has in the past operated the service with Catalina and Otter aircraft. The three helicopters replacing them are Sikorsky S-61N, fitted with long-range fuel tanks, more powerful heating equipment, and a special de-icing device.

The Greenland service connects at Søndre Strømfjord with SAS flights to Los Angeles and Copenhagen. The company has its main base at Godthaab. Other places served by scheduled flights are Sukkertoppen, Holtsteinsborg, and Egedesminde to the north of Godthaab and Frederikshaab and Julianehaab to the south. Flights to other settlements will be provided as necessary. Later the scheduled service will be extended to Nanortalik, Narrsaq, Godhavn, and Jakobshavn, and perhaps to Umanak and Upernavik. The helicopters will be used also for medical and other needs.

Change of Address

Members are earnestly requested to advise the Treasurer, Mrs. A.H. Macpherson, 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. G.W. Rowley,
245 Sylvan Road, Rockcliffe,
Ottawa 2, Ontario.

THE ARCTIC CIRCULAR

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The Annual Dinner was held at the Eastview Hotel on 26 November 1965. Capt. T.C. Pullen, R.C.N. gave the after-dinner speech.

One hundred and forty-fourth meeting. 14 December 1965. Mr. Graham Rowley spoke on "A trip to northern Scandinavia and Siberia".

The 1961 Census in the north

In 1953 the *Circular* (Vol. 6, pp. 37-42) published a short account of the taking of the 1951 Census. It had been hoped to treat the 1961 Census in the same simple fashion, but to improve the account by providing a sketch-map giving a reasonably accurate indication of the population of the Northwest Territories and by including some detailed figures for the arctic islands. The surprising difficulties encountered have impeded completion of this note and there are still some small figures in doubt. Although the time taken has been so great it still seems to be worth publishing the following account even if not absolutely complete. The problems involved related mainly to the handling of the DEW Line figures. The DEW Line is a very considerable influence in the north, and had even more effect in 1961 than today, and it therefore seemed essential to understand how its personnel had been recorded before publishing any census figures.

In the past, the Dominion Bureau of Statistics did not record DEW Line or military personnel at their stations, but lumped them in a general figure, and instructed their enumerators accordingly. These instructions seem to have been interpreted very differently in the east from the west. In the Eastern Arctic instructions seem to have been followed carefully with the result that no DEW Line stations as such appeared on a map drawn up from the official figures (a few stations on the coast with indigenous native populations were shown), but two large towns were indicated in uninhabited parts of Baffin Island - obviously a draughtsman's attempt to handle the DEW Line personnel. In the Western Arctic the families of the Eskimos working for the DEW Line, and perhaps the Eskimo workers, were shown as living at the sites, but the white personnel were lumped at the main stations and elsewhere. Therefore all DEW Line sites in the west appeared on the map drawn up from the official figures.

In the following account most of the figures given in the tables are those of the Dominion Bureau of Statistics. We wish to thank Mr. R.J. Davy and Miss M.L. Pendleton for their assistance with the 1961 figures. The 1951 figures for the Northwest Territories have been taken from the *Circular* account. In the tables the white DEW Line personnel have mostly been omitted. The population given for Axel Heiberg and Devon islands has been deleted as it related to scientific expeditions and was only temporary. The figures given for the joint weather stations appear rather low as they do not include United States citizens or temporary Canadian employees.

The sketch-map of the Northwest Territories (p. 51) is based on the work of Mrs. Isabel Jost of the Geographical Branch, and we would like to thank Mrs. Jost and Dr. R.T. Gajda for their help. In this map the choice of a simple division between those places with a population of 0-49 and those of 50-199 has made it possible to include the DEW Line sites. We hope that the map does, therefore, give a good, if very general, impression of the real distribution of population in 1961. Since that time the intermediate sites of the DEW Line have been closed, but this does not affect the general picture very much.

The following comments on the 1961 Census figures are based on some notes written by Mr. J.R. Lotz, now of St. Paul University, Ottawa, when working with the Northern Research Co-ordination Centre of the Department of Northern Affairs.

The account of the 1951 Census in the Circular included a brief description of the history of census taking in the north and of the methods of handling the 1951 Census. The 1961 Census was handled in much the same fashion. The official enumeration date is always June 1, but as in previous years returns from outlying parts were made any time up to about the end of July. In the Northwest Territories and the Yukon Territory, census enumerators were employed in the larger settlements, and in the smaller settlements and outlying areas members of the Royal Canadian Mounted Police counted the population. The accurate enumeration of a large area containing semi-nomadic peoples is an extremely difficult undertaking, but all indications are that the figures derived from the 1961 Census are the most accurate to date.

The main features of the population change in the territories between 1951 and 1961 are as follows:

1. The total population increased from 25,100 in 1951 to 37,626 in 1961. The population of the Northwest Territories rose from 16,004 to 22,998, an increase of nearly 44 per cent, and that of the Yukon Territory from 9,096 to 14,628, an increase of approximately 61 per cent. The census enumeration in 1961 included a large number of summer transients. No accurate estimate is available of the number of such transients, but they may account for as much as 10 per cent of the population in some of the larger settlements in the territories.

2. There was a considerable increase in the numbers of native peoples. The native population of the Northwest Territories rose from 10,660 to 13,233, and that of the Yukon Territory from 1,563 to 2,207 in the ten years. This increase in numbers of native peoples is shown in the following table

taken from Abrahamson (1964, p. 22),* which compares the vital statistics of the Copper Eskimos and all Canadian Eskimos with those for the rest of Canada.

	Copper Eskimos (1962)	All Canadian Eskimos (1962)	All Canada (1962)
Birth rate per 1000 population	61	61	26
Death rate per 1000 population	25	23	8
Infant mortality per 1000 live births	186	194	27
Natural increase per 1000 population	36	38	18

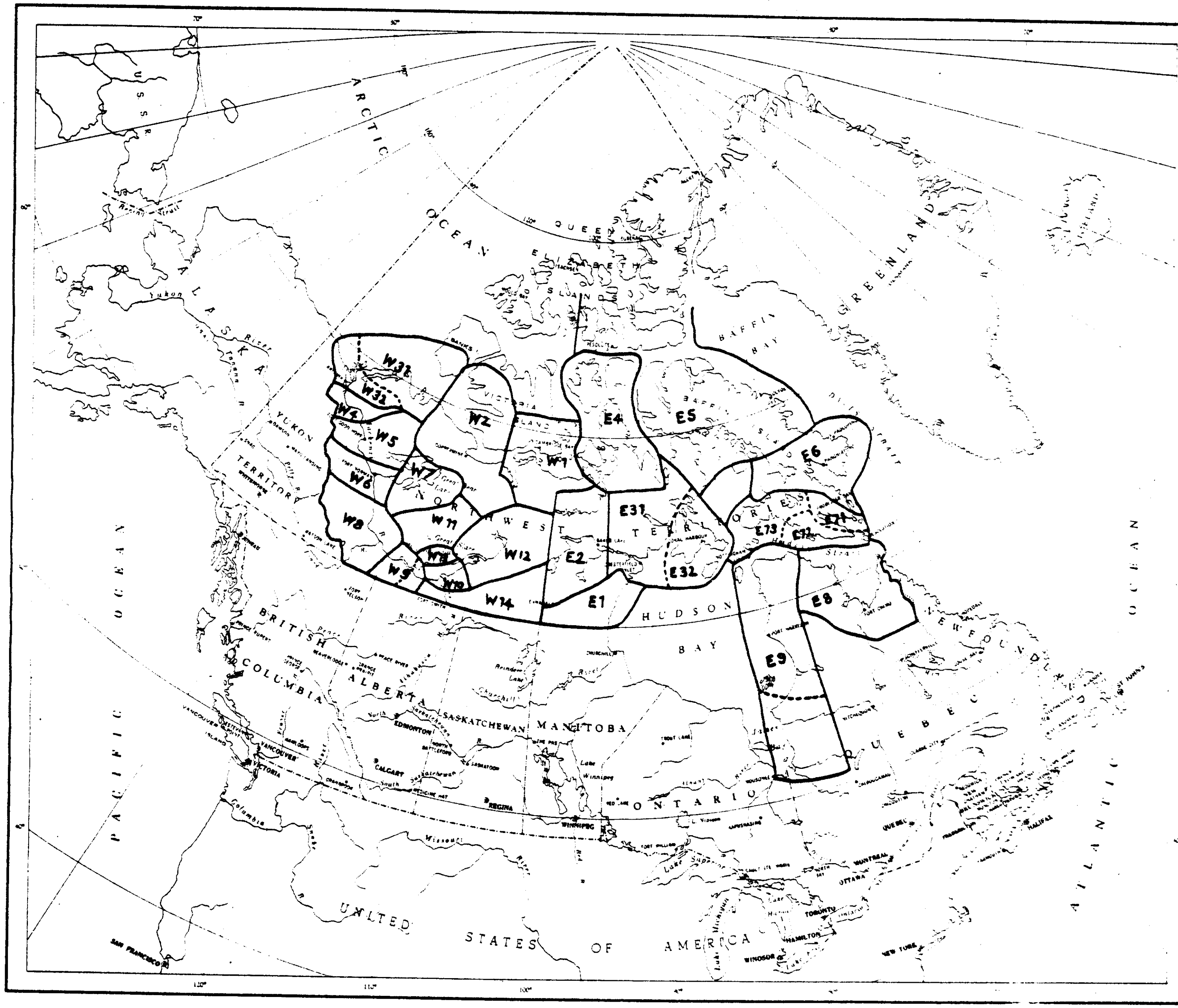
3. There has been a noticeable movement of native peoples into the settlements, and many southern people moving into the north have gone to the larger settlements. This movement is not easy to assess. In the Yukon Territory in 1961 although the population of Whitehorse numbered 5,031, at least 8,000 people, more than half the whole population of the territory, lived within ten miles of the city. Rogers (1962, p. 9)** gives comparable figures for Alaska. In 1960, 82,833 people, or about one-third of the population of the state, lived in and around Anchorage.

The census definition of an urban population as that living in settlements of 1,000 or more does not appear to be a very useful definition of "urban" in the area north of 60 degrees. In the Yukon, for instance, only Whitehorse can be classified as "urban", but Dawson, with a population of 881 in 1961, was certainly urban in form and function.

The following maps and tables have been prepared for this note. Map 1 shows the health or registration districts. Map 2 the population of the Northwest Territories. Tables 1 to 3 give the total population for the Northwest Territories and Yukon Territory and their major settlements. Table 4 lists the distribution of the Eskimo population in Canada. Tables 5 and 6 record the figures for the separate health districts broken down into Eskimo, Indian, and "Other" for the Northwest Territories. Table 7 gives an ethnic breakdown for separate settlements for New Quebec. It was felt that figures for this area would be of particular interest, and this one table is an example of

* G. Abrahamson. 1964. 'The Copper Eskimos: an area economic survey 1963'. Industrial Division, Department of Northern Affairs, Ottawa, 194 pp.

**G.W. Rogers. 1962. 'The future of Alaska', Baltimore, 380 pp.



Map 1. Registration Districts.

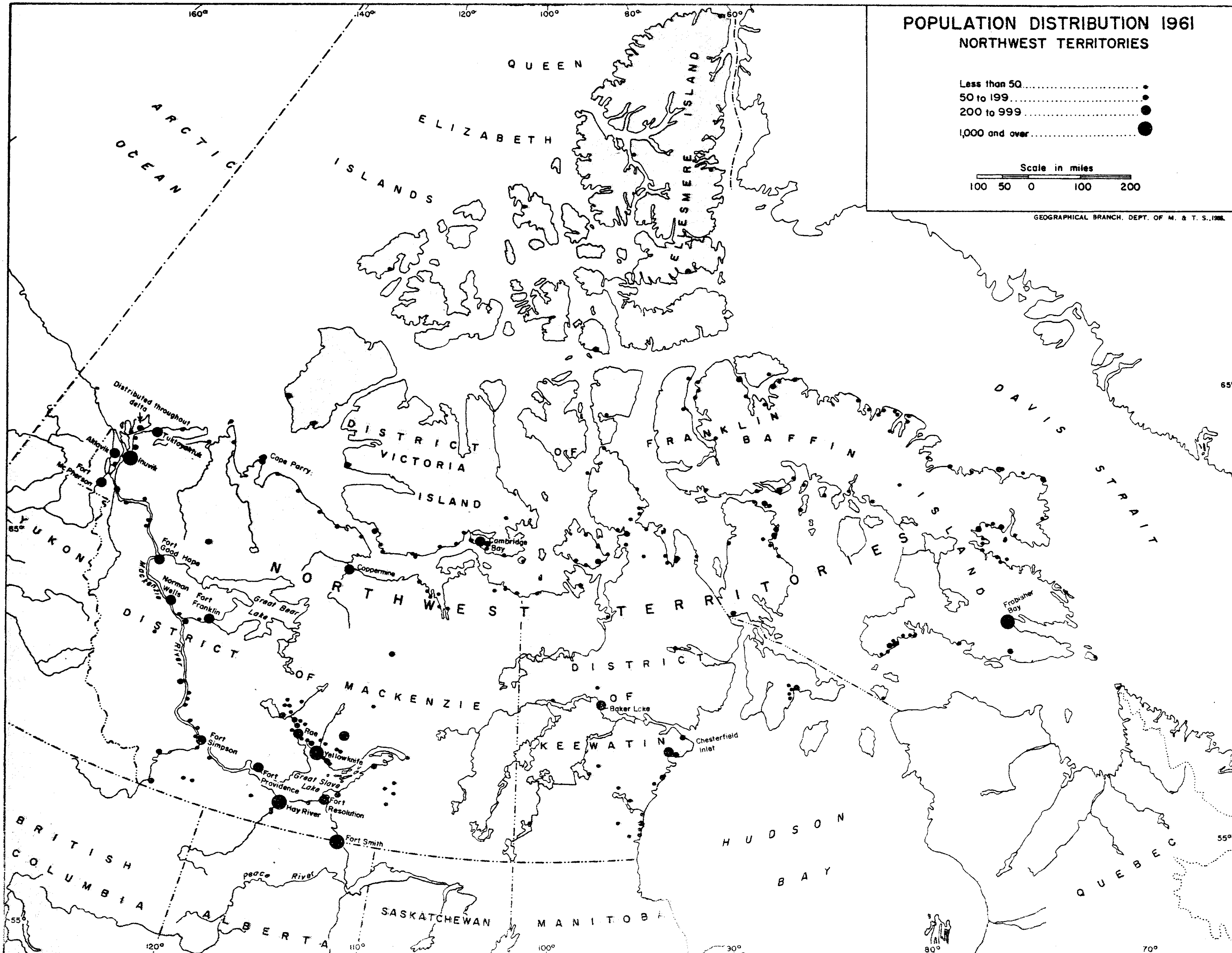

POPULATION DISTRIBUTION 1961
NORTHWEST TERRITORIES
Less than 50
50 to 199
200 to 999
1,000 and over
Scale in miles
100 50 0 100 200
GEOGRAPHICAL BRANCH, DEPT. OF M. & T. S., 1961
QUEEN ELIZABETH ISLANDS
ARCTIC OCEAN
ELLESMERE ISLAND
DAVIS STRAIT
BAFFIN ISLAND
DISTRICT OF FRANKLIN
VICTORIA ISLAND
NORTHWEST TERRITORIES
DISTRICT OF MACKENZIE
DISTRICT OF KEEWATIN
HUDSON BAY
YUKON
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
QUEBEC
Distributed throughout delta
Aklavik
Fort McPherson
Inuvik
Tuktoyaktuk
Cape Parry
Fort Good Hope
Norman Wells
Fort Franklin
Great Bear Lake
Mackenzie River
Coppermine
Cambridge Bay
Rae
Yellowknife
Fort Simpson
Fort Providence
Great Slave Lake
Hay River
Fort Resolution
Fort Smith
Peace River
Baker Lake
Chesterfield Inlet
Frobisher Bay
160°
140°
120°
100°
80°
60°
65°
55°
110°
90°
70°

TABLE 1

NORTHWEST TERRITORIES

	1951	1956	1961
Total	16,004	19,313	22,998 *
Indian and Eskimo	10,660	--	13,233
Census Districts			
Franklin	3,424	4,408	5,758 *
Keewatin	2,301	2,413	2,345 *
Mackenzie River	10,279	12,492	14,895 *
Major settlements			
Fort Simpson	--	--	563
Fort Smith	--	--	1,681
Hay River	792 **	942	1,338
Inuvik	--	--	1,248
Yellowknife	2,724 **	3,100	3,245
Total in major settlements	3,516	--	8,075
Unorganized	6,536	8,450	6,820

* Includes some white DEW Line workers.

** Population of the area, not of the settlement alone.

TABLE 2

YUKON TERRITORY

	1951	1956	1961
Total	9,096	12,190	14,628
Eskimos and Indians	1,533	--	2,207
Major settlements			
Dawson	783	851	881
Whitehorse	2,594	2,570	5,031
Mayo	241	249	342
Total in major settlements	3,618	3,670	6,254

TABLE 3

TOTAL POPULATION: N.W.T. AND YUKON TERRITORY 1941-1961

1941	1951	1956	1961 *
16,942	25,100	31,503	37,626

TABLE 4

THE DISTRIBUTION OF CANADA'S ESKIMO POPULATION 1961

Total Population	11,835
Male	6,068
Female	5,767

Newfoundland	Nova Scotia	Quebec	Ontario	Manitoba
815	4	2,467	212	208
Saskatchewan	**Yukon**	**Alberta**	**British Columbia**	**Northwest Territories**
2	40	85	25	7,977

* Includes some white DEW Line workers

TABLE 5

WESTERN ARCTIC **

Health District	Total Pop. 1951	Total Pop. 1961	Increase or Decrease	Eskimo 1951	Eskimo 1961	Indian 1951	Indian 1961	Other 1951	Other 1961
W 1 Cambridge Bay	306	554	+248 *	295	476	-	1	11	77
W 2 Coppermine	655	514	-141*	624	485	-	-	31	29
W 31 and 32 Tuktoyaktuk, Inuvik-Aklavik	1,516	2,729	+1,213	1,080	1,202	175	329	261	1,198
W 4 Fort McPherson-Arctic Red River	499	605	+106	-	10	463	442	36	153
W 5 Fort Good Hope	285	349	+64	-		257	307	28	42
W 6 Fort Norman	445	774	+329	-	2	270	428	175	344
W 7 Port Radium	346	0	-346	-	-	35	0	311	0
W 8 Fort Simpson	865	1,089	+224	-	-	668	823	197	266
W 91, 92, 93 Hay River-Enterprise Fort Providence	1,158	1,804	+646	-	-	470	671	688	1,133
W 10 Fort Resolution	613	544	-69	-	-	277	367	336	177
W 11 Rae (includes Discovery and Snare in 1961)	831	1,143	+312	-	5	680	857	151	281
W 12 Fort Reliance	70	209	+139	-	-	62	146	8	63
W 131, 132 Yellowknife and Yellowknife area	2,724	3,414	+690	-	12	345	426	2,379	2,976
W 14 Fort Smith	442	1,681	+1,239	-	-	101	455	341	1,226

* Bathurst Inlet enumerated in Coppermine district in 1951 and in Cambridge Bay district in 1961.

** White DEW Line workers omitted.

TABLE 6

EASTERN AND CENTRAL ARCTIC *

Health District	Total Pop. 1951	Total Pop. 1961	Increase or Decrease	Eskimo		Indian		Other	
				1951	1961	1951	1961	1951	1961
E 1 Eskimo Point	484	382	-102	446	312	-	-	38	70
E 2 Baker Lake	433	520	+87	413	458	-	-	20	62
E 31 and 32 Chesterfield Inlet, Coral Harbour	772	1,103	+331	647	862	-	-	125	241
E 4 Spence Bay	481	577	+96	462	549	-	-	19	28
E 5 Pond Inlet-Resolute (Queen Elizabeth Islands)	940	1,490	+550	908	1,363	-	-	32	127
E 6 Pangnirtung	608	781	+173	591	763	-	-	17	18
E 7 Frobisher Bay-Lake Harbour-Cape Dorset	1,089	1,904	+815	1,014	1,273	.	4	75	627
E 8 (pt) Port Burwell	--	36	--	--	36	-	-	-	0
E 9 (pt) Belcher Islands	--	169	--	--	169	-	-	-	0

* White DEW Line workers omitted.

TABLE 7

NEW QUEBEC, 1961

District	Total Population	Eskimo	Indian	White	Other
New Quebec	8,121	2,388	1,989	3,725	19
Health District E 8 (pt)	965	883	--	81	1
Fort Chimo	468	397	--	70	1
George River	144	144	--	--	--
Wakeham Bay	112	109	--	3	--
Payne Bay	83	82	--	1	--
Payne River	25	25	--	--	--
Koartak Bay	7	7	--	--	--
Koartak	68	65	--	3	--
Diana Bay	12	12	--	--	--
Cape Hopes Advance	8	4	--	4	--
Leaf Bay	18	18	--	--	--
Hopes Advance Bay	8	8	--	--	--
False River	12	12	--	--	--
Health District E 9 (pt)	3,358	1,505	1,513	337	3
Fort George	1,074	--	952	122	--
Paint Hill	378	--	368	10	--
Great Whale River	718	387	193	137	1
Ivugivik	98	95	--	3	--
Port Harrison	115	78	--	36	1
Povungnituk	443	429	--	13	1
Sugluk	255	246	--	9	--
Other parts	277	270	--	7	--
Other parts	620	--	474	140	6
Knob Lake	128	--	--	122	6
Indian Village	492	--	474	18	--
Schefferville Town	3,178	--	2	3,167	9

TABLE 8

ESKIMO POPULATION FOR SPECIFIED ARCTIC ISLANDS, NORTHWEST TERRITORIES, 1961 **

Island	Total Population	Eskimo	Other (1)
Ellesmere Island	98	79	19
Alert	5	--	5
Alexandra Fiord	15	11	4
Grise Fiord	70	68	2
Eureka	8	--	8
Ellef Ringnes Island	4		4
Isachsen	4	--	4
Prince Patrick Island	2		2
Mould Bay	2	--	2
Cornwallis Island	153	84	69
Resolute Bay	153	84	69
Baffin Island	3,083	2,426	657
Cape Thalbitzer	15	15	--
Nosuardjuak	27	27	--
Agu Bay	22	22	--
Pudlatauyok	7	7	--
Eietidlirk	28	28	--
Imak	37	37	--
Khikartaukanee	29	29	--
Arctic Bay	49	45	4
Abvartok	26	26	--
Nedloa	50	50	--
Alfred Point	43	43	--
Tay Sound	19	19	--
Pond Inlet	53	46	7
Mount Herodier	45	45	--
Guys Bight	22	22	--
Scott Inlet	30	30	--
Sam Ford Fiord	12	12	--
Eglinton Fiord	25	25	--
Cape Christian	12	10	2
Clyde Inlet	6	6	--
Clyde River	40	32	8
Inugsuin Fiord	16	16	--
Ekalugad Fiord	9	9	--
Home Bay	14	14	--
Cape Hooper	15	15	--
Kivitoo	22	22	--
Cape Dyer	25	25	--
Tuakjuak	25	25	--
Sukpeeveesuktoo	32	32	--
Pangnirtung	114	96	18
Bon Accord	66	66	--

** White DEW Line workers omitted.

(1) Other includes Indian.

TABLE 8 (cont'd.)

Island	Total Population	Eskimo	Other (1)
Baffin Island (cont'd.)			
Avatuktoo	44	44	--
Imigen	46	46	--
Ikaloolik	41	41	--
Nouyaklik	28	28	--
Iglootalik	30	30	--
Keepeeshaw	46	46	--
Frobisher Bay	1,426	843	583
Lake Harbour	90	79	11
Aberdeen Bay	27	27	--
Shukbuk West	20	20	--
Ikerasak	13	13	--
Kangiak	11	11	--
Etiliakjuk	23	22	1
Shartovitok	25	25	--
Kiaktok	30	30	--
Cape Dorset	161	138	23
Tessiuyakjuak	17	17	--
Tikerak	24	24	--
Dewar Lakes	12	12	--
West Baffin	3	3	--
Longstaff Bluff	7	7	--
Bylot Island	27	27	--
Broughton Island	70	70	--
Padloping Island	43	43	--
Kikastan Islands	31	31	--
Twapine	31	31	--
Nunatak Island	38	38	--
Noonata	38	38	--
Nimigen Island	42	42	--
Kingmiksoon	42	42	--
Maneetok Islands	24	24	--
Jens Munk Island	66	66	--
Cape Elwyn	66	66	--
Igloolik Island	172	163	9
Igloolik	133	124	9
Kikitardjuak	39	39	--

(1) Other includes Indian.

TABLE 8 (cont'd)

Island	Total Population	Eskimo	Other (1)
Southampton Island	240	204	36
Kirchoffer	36	36	--
Munn Bay	25	25	--
Airport	22	4	18
Snafu	40	40	--
Coral Harbour	117	99	18
Nottingham Island	16	16	--
Resolution Island	21	8	13
Killinek Island	36	36	--
Port Burwell	36	36	--
Belcher Islands	169	169	--
Somerset Island	8	8	--
Cresswell Bay	8	8	--
Tasmania Islands	9	9	--
King William Island	175	174	1
Humboldt Channel	17	17	--
Iglooglig alook	9	9	--
Matheson Point	5	5	--
Gjoa Haven	98	97	1
Douglas Bay	38	38	--
Gladman Point	8	8	--
Victoria Island	472	409	63
Sturt Point	5	5	--
Cambridge Bay	297	237	60 (2)
Anderson Bay	3	3	--
Starvation Cove	3	3	--
Wellington Bay	9	9	--
Cape Peel	4	4	--
Byron Bay	20	20	--
Ross Point	5	5	--
Lady Franklin Point	24	24	--
Cache Point	4	4	--
Holman Island post	98	95	3
Richardson Islands	7	7	--
Read Island	75	72	3
Banks Island	81	67	14
De Salis Bay	5	5	--
Sachs Harbour	76	62	14
Baillie Island	10	--	10

(1) Other includes Indian.
(2) Approx. figure excluding DEW Line employees.

the information readily available for all of the Northwest Territories.* Table 8 lists population for most of the arctic islands. As far as we are aware this is the first time that this kind of information has been published. It might assist the reader to know that the settlements are listed clockwise around the major islands and the small nearby islands are listed separately. For instance, Bylot Island is given immediately after Baffin Island.

It does not seem worth going into the small discrepancies in different sets of population figures for the Northwest Territories at this date, but it is necessary to caution the reader that they do exist. They are mostly of the order of 4 or 5 people, such as 4 given for Sheppard Bay in health district W1, which in fact relates to the Shepherd Bay on Boothia Peninsula in E4, or confusion with white DEW Line employees. The latter can introduce quite large errors, for instance Cape Parry, which had 2 white inhabitants in 1961, appears on some lists allegedly without DEW Line personnel as having 111 white inhabitants. Tables 5 and 6, however, do escape most of these difficulties as the white DEW Line personnel has been removed as far as can be ascertained. It is hoped that the population map will be of use as indicating the pattern of settlements in 1961 including the DEW Line sites.

<u>Operation Wager, 1964.</u> By W.W. Heywood

Operation Wager was a continuation of the Geological Survey of Canada's reconnaissance mapping in the western Canadian Shield. Approximately 55,000 square miles in the northeastern District of Keewatin and in the adjoining District of Franklin were examined during the 1964 field season. The boundary of the area mapped runs from the arctic coast at Pelly Bay south on the 90th meridan to latitude 66°, thence west to 91°30', thence south to latitude 64° and east to the coast at Winchester Inlet. Roes Welcome Sound forms the eastern boundary as far north as 65°30', thence east on this latitude to Foxe Basin, which forms the remainder of the eastern boundary. The northern boundary is the arctic coast from Pelly Bay easterly to cross Melville Peninsula at 68°30'N.

W. W. Heywood (geologist-in-charge), W. R.A. Baragar, J.A. Donaldson, and G.D. Jackson were responsible for the bedrock geology and were assisted by C.I. Godwin and H.R. Jordan. B.G. Craig examined the Quaternary deposits and glacial features of the area. W.R. Warren operated and maintained the radio equipment. The supporting party included two cooks, two helicopter pilots and one helicopter pilot-engineer, one Otter pilot and engineer, and one Cessna pilot.

Two Bell 47G2A helicopters were chartered from Dominion Helicopters Ltd. for geological traversing. A de Havilland Otter was supplied by MacMurray Air Services, and a Lamb Airways Cessna 180 was used from July 15 to August 22.

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* The Editor has this information and can make it available to members if required.

Gasoline and oil supplies for the project were sent to the settlements of Repulse Bay, Chesterfield Inlet, and Baker Lake by ship in 1963. Equipment, food, and most of the personnel were flown from Churchill by a Canso aircraft which landed on smooth, snow-free ice at the first camp site. Three flights were required to complete this phase of the operation. The remainder of the personnel and some of the supplies were transported to the field in the Otter and in the helicopters.

The helicopter reconnaissance traverses were flown at 75 to 400 feet above the ground. Continuous geological observations were recorded during the flights and landings were made at about 6-mile intervals to examine and sample the rocks. Flight lines were spaced 6 miles apart and about 240 line miles of geology were mapped each day. Additional flights were made in areas where more information was required. The Cessna 180 was used for high level reconnaissance flights, for spot landings to collect large samples, and for transportation of personnel and supplies. The bulk of the supplies were moved within the project area by the ski-wheel equipped Otter before breakup, and the same Otter on floats after breakup.

The first field camp was established about 90 miles north of Chesterfield Inlet on June 1 and by June 6 all personnel and equipment were in camp. Routine helicopter traverses were started on June 7, but heavy snow cover in the upland areas restricted work to the coastal areas. Some flooding of the lake ice at Camp 1 occurred by June 12 and although this camp area was only 35 per cent completed a move to Camp 2 was considered advisable. Camp 2 was established on June 16 on the shore of a lake along the Snowbank River about 45 miles southwest of the main supply base at the Repulse Bay settlement. The position of this camp would permit four to five weeks work should a late breakup occur. The Otter left camp on ski-wheels on June 16 and returned on July 16 when open water permitted float operations. A new camp (3) was set up northeast of Repulse Bay and from there the mapping of Melville Peninsula was completed. A fly camp was occupied near Pelly Bay to survey Simpson Peninsula. Mapping was completed on August 20 from Camp 5 located a few miles east of Camp 1. The return to Churchill commenced immediately and all equipment and personnel were out of the field area by August 25.

The ruins of three large Eskimo villages were found by Donaldson and Jackson on the west side of Roes Welcome Sound. Circular and square houses, with walls 2 to 4 feet high were common in one area. At a second site houses were as much as 20 feet in diameter and some of these, with floors as much as 3 feet deep, were lined with stones. Hundreds of graves are present near these sites. A few pieces of bone and a small carved wooden figure were collected and forwarded to the National Museum.

The site of Fort Hope located near the mouth of the North Pole River was visited. Parts of the walls are all that remain of this house built by Rae in 1846. The location, as shown on the maps of the area, is about two miles east of the actual site; this has been brought to the attention of the Geographical Branch of the Department of Mines and Technical Surveys.

Metamorphosed volcanic and sedimentary rocks, forming discontinuous belts, are probably the oldest in the area. Iron formations are associated with them on Melville Peninsula. Gneiss, migmatite, and massive to foliated granitoid rocks with amphibolite and paragneiss underlie most of the area west of Committee Bay, Rae Isthmus, and Roes Welcome Sound.

Massive porphyritic granite forms much of the upland area around Wager Bay. Gneiss and paragneiss are the common rock types in central and southwestern Melville Peninsula. Granulite and gneiss are the characteristic rocks east and west of Lyon Inlet. A concentric pluton consisting of a massive anorthosite core surrounded by moderate to steeply dipping anorthositic and mafic rocks occurs in the Daly Bay area.

Younger intensely folded Proterozoic crystalline limestone, quartzite, and paragneiss outcrop extensively on Melville Peninsula in an east to northeasterly trending belt that is about 50 miles wide on the west side of Foxe Basin.

Ordovician and Silurian sandstone, dolomite, and dolomitic limestone occur on Simpson Peninsula, Wales Island, the east side of Melville Peninsula at Parry Bay, on Southampton Island and on the western side of White Island. Outliers are present in Hoppner Inlet and on the shores of the large lake in the middle of White Island.

The geological report will be published in the Geological Survey of Canada Paper series.

Field activities of the Geological Survey of Canada in the Arctic, 1965. By R.G. Blackadar.

Thirteen parties of the Geological Survey of Canada carried out studies in the Canadian Arctic in 1965, four in the District of Franklin, two in the District of Keewatin, and seven in the District of Mackenzie.

The following note, abstracted from Paper 66-1, of the Geological Survey of Canada 'Report of activities, May to October, 1965', is intended to indicate where the Survey operated in 1965 thus enabling those interested in specific areas to make contact with others who have been there before. More complete, though still preliminary, geological results are given in Paper 66-1.

Operation Amadjuak, southern Baffin Island. This project, directed by R.G. Blackadar, completed the geological reconnaissance of Baffin Island south of latitude 66 degrees north. Persistent fog prevented the party from reaching Resolution Island and adjacent islands but most others parts of southern Baffin Island were examined despite generally unfavourable weather conditions. Aircraft under contract included two helicopters and an amphibious Cessna 180; aircraft based at Frobisher Bay were used for casual charter to assist camp moves and in fuel caching.

Both Precambrian and Palaeozoic rocks outcrop in southern Baffin Island. Mapping of these was done by R.G. Blackadar and F.C. Taylor assisted by two graduate students. South of a line extending northwest from Frobisher Bay towards Amadjuak Lake the gneissic rocks are lithologically varied and structurally complex. Crystalline limestones, bands of rusty schist and paragneiss, and some metavolcanic rocks are interbedded with granite gneiss. Garnet, graphite, and mica were mined near Lake Harbour early in this century from the former assemblage and low grade iron deposits in the structurally complex gneisses were prospected from 1956 to 1959 between Chorkbak Inlet and Amadjuak Bay. Fossil collections were made from thin, nearly horizontal Palaeozoic strata that extend southeast from Koukdjuak River through Amadjuak Lake to within a few miles of Frobisher Bay. These will aid greatly in the understanding of the northward extension of Lower Ordovician rocks in North America.

A study of the glacial geology of southern Baffin Island by W. Blake Jr. assisted by F.M. Synge indicates that in a general way ice-flow was from the uplands towards Hudson Strait, Frobisher Bay, and Cumberland Sound although at times it appears that the ice-flow down Hudson Strait was strong enough to counteract the movement towards the strait and tills containing limestone fragments and shells were deposited. A remnant ice mass lay east of Amadjuak Lake for some time after much of the rest of the area had been deglaciated. Marine submergence was confined to a narrow coastal strip along Hudson Strait, Frobisher Bay, and Cumberland Sound but on the lowlands facing Foxe Basin marine deposits are found as much as 60 miles inland.

During postglacial marine submergence arms of the sea joined Foxe Basin and Cumberland Sound by way of Nettilling Lake and joined Foxe Basin and Hudson Strait in the vicinity of Chorkbak Inlet thus rendering western Foxe Peninsula an island. The elevation of the limit of marine submergence varies from 500 feet along Foxe Peninsula to less than 100 feet near the southeastern tip of Baffin Island. Along Frobisher Bay the limit appears to be 400 feet; it is 300 feet on Putnam Highland and west of Nettilling Lake, and less than 300 feet along the length of Cumberland Sound.

Northern Baffin Island. Mapping on a scale of one inch to one mile was carried out by G.D. Jackson in an area of about 750 square miles near Baffinland Iron Mines property at Mary River. It is not clear as to how much if any of the high grade magnetite-hematite ore is primary but most of it probably predates the last period of regional metamorphism (about 1.7 billion years ago). Some hematite ore has formed from magnetite ore, some is a product of post-metamorphic leaching and enrichment, and some may possibly derive from relatively recent leaching and enrichment.

Several new occurrences of iron formation, small pods of high grade magnetite-hematite and areas of iron formation and high grade float, were located and it is possible that these may represent one or possibly two formations formerly more continuous and extensive.

Operation Grant Land. R.L. Christie directed the first year of a proposed two-year helicopter- and Piper Super Cub-supported reconnaissance investigation of northeastern Ellesmere Island. The project involved four separate studies: H.P. Trettin studied the Palaeozoic eugeosynclinal rocks; T. Frisch, a graduate student, the metamorphic terrain of the north coast; A.E. Petryk, a graduate student, the Permo-Carboniferous to Tertiary stratigraphy; and J.H. Allart of the Greenland Geological Survey, the stratigraphy of Hall Land in northwestern Greenland. The latter project is part of a cooperative programme between the Canadian and Greenland Surveys to relate the geology of the adjacent regions. R.L. Christie examined Permo-Carboniferous sections on Feilden Peninsula, Tertiary beds at Lincoln Bay, and Palaeozoic rocks at Carl Ritter Bay. Studies were also made in connection with a proposed triangulation net between Hall Land, Nyeboes Land, and Ellesmere Island.

The studies carried out by J.H. Allart indicate a close similarity between the Late Ordovician and Silurian strata in Greenland and those in eastern Ellesmere Island. Open folds of medium and large scale are common in Hall Land in contrast to the steep, isoclinal folds characteristic of Nyeboes Land and northeastern Ellesmere Island.

Along the north coast of Ellesmere Island T. Frisch found that the Mount Disraeli Group is the low grade metamorphic equivalent of the Cape Columbia Group, a gneissic complex.

A.E. Petryk examined Mesozoic and Tertiary rocks southeast of the Garfield Range. These beds are extremely friable, terrestrial sediments ranging from almost pure quartz sand to fine carbonaceous or white clays. Cyclical coal sequences are common in the Upper Cretaceous and Tertiary beds.

Seven weeks were spent by H.P. Trettin in stratigraphic and structural studies in the M'Clintock Inlet region. There the lowest strata, a volcanic and sedimentary assemblage, contain chert-hematite deposits which although possibly widespread are probably localized, low-grade, and structurally complex. This assemblage, Precambrian (?) and Lower Cambrian in age, is overlain by a nearly complete, composite section of the Middle Ordovician to Middle Silurian systems. Late Palaeozoic rocks are also present in the area studied.

Cornwallis Island. The first year of a two-year programme of field studies on Cornwallis and adjacent islands was completed by R. Thorsteinsson and J.W. Kerr. The area is of considerable interest in petroleum exploration and presents a variety of stratigraphic and structural complexities some of which were solved during the past field season.

Central Hudson Bay. A detailed aeromagnetic survey was carried out in an area about halfway between Churchill and Port Harrison (see report by P.J. Hood, P. Sawatzky, and Margaret E. Bower, Geol. Surv. Can. Paper 66-1). About 7,000 line miles of aeromagnetic data with values about every 150 feet were obtained. During earlier work in northern Manitoba a striking pattern of northeast-trending, relatively high amplitude anomalies was obtained but the results of the 1965 survey indicate that it is reasonable to conclude that this magnetic zone does not pass through the area surveyed. Intense magnetic anomalies were recorded about 60 miles north-northeast of Cape Churchill across an area about 14 miles by 5 miles. There is little doubt that these anomalies are produced by a magnetic iron formation.

K.E. Eade spent a week using a helicopter, and completed the mapping of Kognak River (65 G, H, parts)* map-area, an area containing late Precambrian sedimentary strata as well as early Precambrian volcanic, sedimentary, and gneissic rocks. Minor amounts of iron formation are present in both ages of rocks.

J.A. Donaldson continued his study of the Dubawnt Group, an assemblage of unmetamorphosed sedimentary rocks. Field work was confined mainly to outcrops of the group on the Schultz Lake (66 A) map-area. Small amounts of galena were found on the west flank of a granite plug about 20 miles north-northeast of Baker Lake settlement. Palaeocurrent studies indicate that the cobbles and pebbles of specularite iron formation that are abundant in the Thelon conglomerates bordering Schultz Lake came from the southeast.

In the District of Mackenzie projects of the Geological Survey of Canada comprised more detailed studies than those carried out in the districts of Keewatin and Franklin.

H.H. Bostock carried out studies in Contwoyto Lake (76 E, west half) map-area where gold has been reported in garnet amphibolite gossan bands associated with knotted schist, impure quartzite, phyllite, quartzite, and chlorite schist. More detailed studies were made in this area by L.P. Tremblay who carried out detailed mapping in map-area 75 E/14.

J.A. Fraser commenced a study of the relatively unmetamorphosed strata of the Precambrian Epworth Group as exposed in Rocknest Lake area (86 G/NE, H/NW, I/SW, J/SE). Little direct evidence of mineralization was found in the area.

J.G. Fyles carried out a preliminary study of the Quaternary sediments of the Arctic Coastal Plain between Cape Bathurst and the Alaska boundary. Stratigraphic sections were measured at a number of localities in order to assess the usefulness of surface stratigraphy in unravelling the Quaternary succession. Prior to the last (Laurentide) glaciation fluvial, lacustrine, and marine sediments were deposited over a wide area. Two or

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* Numbers and letters in parentheses indicate the National Topographic System designation of map-sheets.

more Laurentide glaciations resulted in the formation of distinctive deposits and landforms and this period was followed by further deposition of fluvial and lacustrine sediments.

J.C. McGlynn began a study of the Nonacho Group, a conformable sequence of polymictic conglomerates, conglomeratic arkoses, and shales in order to study the stratigraphy, structure, and sedimentary petrology of the group; to indicate correlation with Early Proterozoic (Aphebian) rocks; and to establish the age relationships of these rocks and the metamorphic and igneous rocks with which the group is in contact. Although no significant mineral showings were discovered the attention of prospectors is directed to fault zones, especially those near contacts between sedimentary and basement rocks. Consideration should also be given to the possibility that there are sedimentary or fossil placers within the Nonacho Group sediments.

E.W. Reinhardt began a study of the metamorphic rocks that occur between the McDonald Fault and Nonacho Lake and of the movement produced by major faults in the area. The study covered parts of map-areas 75 E, K, and L.

Portrait of Dr. Diamond Jenness

On the occasion of Dr. Diamond Jenness' eightieth birthday early this year, it was decided that friends would like to present him with an oil painting of himself to celebrate the day. Arrangements have been made and the artist, Mr. Robert Hyndman, is already at work.

Those who would like the opportunity to join in this gift should get in touch with Dr. A.E. Porsild, National Museum of Canada, Ottawa.

Change of Address

Members are earnestly requested to advise the treasurer, Mrs. A.H. Macpherson, 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. G.W. Rowley,
245 Sylvan Road, Rockcliffe,
Ottawa 2, Ontario.

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