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FLIGHTS IN 1947 OVER THE REGION OF THE NORTH MAGNETIC POLE AND THE MAINLAND BETWEEN THE ARCTIC COAST, GREAT SLAVE LAKE, AND HUDSON BAY, NORTHWEST TERRITORIES

(REPORT AND MAP)

By

Y. O. Fortier

OTTAWA

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Illustration

Preliminary map - Part of Northern Canada, showing approximate positions of flight routes and landings ..... In envelope

Flights in 1947 over the Region of the North Magnetic Pole and the Mainland between the Arctic Coast, Great Slave Lake, and Hudson Bay, Northwest Territories.

INTRODUCTION

The author travelled, in the summer of 1947, with a Royal Canadian Air Force plane carrying a Dominion Observatory party from Ottawa to the region of the North Magnetic Pole in the Western Arctic. Herewith are presented results of observations made during flights aggregating more than 20,000 miles, and of field investigations made at points of landing.

A flight was made from Churchill, Manitoba, to Baker Lake, thence across the barrens to Yellowknife, on Great Slave Lake. Many flights were made over the country between Yellowknife, Point Lake on Coppermine River, Cambridge Bay on Victoria Island, Bathurst Inlet, Regan Lake, and Aylmer Lake. Flights from Cambridge Bay were over the region lying between the east coast of Victoria Island, Prince of Wales Island, the southern part of Somerset Island, the northern half of Boothia Peninsula, and King William Island. Ground observations were made near the northern and southern parts of Prince of Wales Island, at Greely Haven on the east coast of Victoria Island, in the centre of King William Island, at Agnew River on the east coast of Boothia Peninsula, at Cambridge Bay, at Point Lake on Coppermine River, and at Aberdeen Lake on Thelon River.

In his work the author was assisted by H. S. Steacy of the Geological Survey. The trip was made through the courtesy of the Royal Canadian Air Force and with the co-operation of the Dominion Observatory. Many services were extended during the trip by F/L J. Drake, the captain of the amphibian Canso; F/O J.Goldsmith, the navigator; and by Paul Serson and Jack Clark of the Dominion Observatory.

Ice conditions were unfavourable during the season. On the large lakes of the mainland the ice was late in clearing; thus Baker Lake, Schultz Lake, Artillery Lake, and Lac de Gras were partly covered with ice in the fourth week of July, and McClintock Channel and Victoria and Franklin Straits in the Arctic were almost completely blocked with ice the entire summer. The difference in temperature between sea ice and snow-free land caused much fog.

Maps on the scale of 1 inch to 8 miles were used to plot results of observation. Most of the mainland flights were over areas for which maps had been drawn from air photographs, thereby facilitating map reading. In the Arctic Islands the maps are correct for the broad outlines of the coasts, but poor in detail except for the coast of King William Island, which has been photographed from the air. The interior parts of the islands are blank, or the features shown are generally incorrectly outlined. Over the Arctic Islands the writer's observations were recorded against time, and later plotted on maps by extrapolation between recognized fixed points or between areas where map reading was possible. Flight lines drawn on the maps involved some adjustment in plotting, and the writer assumes sole responsibility for inaccuracies. Alterations on the maps made by the navigator appear in red ink. All flight lines could not be plotted. These maps[1] should be consulted when reading the journal of each flight. The positions of most of the photographs mentioned in the journal are given on the maps.

Among features of interest recorded during the trip were: the widespread evidences of recent isostatic adjustment of the earth's crust; clear evidence of some geomorphic processes in the barrens; contrast in the features due to glaciation between low plain areas and highlands in the Arctic; widespread occurrences of drumlinoid topography or areas of drift-made forms somewhat resembling drumlins, but much more elongated and of rarely recognizable ovoid shape; escarpment or cuesta topography of areas underlain by formations classified as Proterozoic on the Geological Map of Canada; pattern and complexities of eskers between Great Slave Lake and the Arctic Coast.

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[1]The present report is illustrated by a general map of the entire region, showing the approximate positions of the principal flights taken. The author, however, has also plotted his flights, together with notes of interest, on a series of maps on a scale of 1 inch to 8 miles, and has accompanied this series with a detailed journal of each flight illustrated with photographs taken by himself. For obvious reasons it is impossible to publish these maps or the numerous photographs, but these, together with the accompanying journal are available for inspection at the office of the Chief Geologist, Geological Survey of Canada, in Ottawa.

DESCRIPTIONS OF REGIONS VISITED

THE MAINLAND

West Coast Hudson Bay, South of Churchill

This is a low, desolate, coastal plain, poorly drained, with abundant muskegs and poor vegetation. Lines of trees grow along rivers or around the shores of some small lakes, or mark abandoned streams on the periphery of muskegs. At Churchill, rocky areas rise 100 feet above sea-level, and are apparent remnants or outliers of the Canadian Shield. The rock examined at one locality was a schistose, arkosic quartzite. These rocky areas are surrounded by lower terrain covered with drift and apparently underlain by Palaeozoic strata. The coast has the appearance of an emerging land, as raised beaches, sandbars, and spits may be observed.

Churchill to Baker Lake

From Churchill to the mouth of Thlewiaza River, the west coast of Hudson Bay appeared from a distance as low, with numerous lakes inland and shallow water offshore.

From Thlewiaza River to north of Maguse Lake, the country is low, drift covered, and only rare rock outcrops were observed from the air. But this region is a beautiful example of drumlinoid topography. Long, low drift ridges and intervening valleys all trend north of west parallel with each other; they have not the ovoid shape of drumlins, but are similar forms. Small lakes, and shores, peninsulas, and islands of larger lakes are oriented parallel with the drumlinoids. Locally, some winding, low ridges may be eskers. Raised beaches are superimposed on the drumlinoids.

North of Baker Lake

The region north of Baker Lake is rocky, has much more relief than around Maguse Lake, and is apparently rising northward. Raised beaches are abundant. A tract of rocks along Thelon River, northeast of Baker Lake, is high, with linear escarpments apparently marking the site of faults. Some fractures appear from the air plainly as faults, and along some of them are bodies of quartz. The strata are apparently both sedimentary and volcanic; they are folded, and beds are steeply dipping. The structural trend is to the northeast.

Thelon River

The wide valley of Thelon River, with the large Schultz, Aberdeen, and Beverley Lakes, is a large sand plain apparently composed of deposits laid in an encroachment of Hudson Bay waters along Baker Lake and Thelon River after Pleistocene glaciation. This is suggested by raised beaches superimposed on glacial features such as drumlinoids.

Exposures of bedrock are rare in the sand plain. This is in contrast with the higher, rocky region northeast of Schultz and Baker Lakes.

The boundary between the two topographic terrains runs northwesterly from the west end of Schultz Lake and apparently marks the contact of Archaean rocks, to the northeast, and Proterozoic, to the southwest. Some coarse beds of light grey rocks with a reddish hue, apparently sandstone or quartzite, exposed on a peninsula in Schultz Lake, form a rocky cuesta in the sand plain. The strata dip gently in comparison with the steeply dipping formations east of Thelon River or northwest of Baker Lake, and may be Proterozoic. Near the west end of Aberdeen Lake, where a landing was made, is a small area of flat-lying blocks of rock that may be in situ. The rock is light greenish grey, quartzitic, gritty, with here and there pebbles up to an inch in diameter. West of Beverly Lake, are zones of low, coniferous trees along Thelon River. Near the bend of the river, at longitude 103 degrees, is a large area of drumlinoids oriented north of west. Many raised beaches were observed superimposed on these and trending across them. Between the bend of Thelon River, at longitude 103°30', and Biologist Lake to the west is the end of the sand plain, and most probably of the expanse of Proterozoic rocks.

Area between Yellowknife and Biologist Lake, Regan Lake, and Point Lake on Coppermine River

This area is higher than the sandy valley of Thelon River east of longitude 104 degrees. The relief is generally less than 500 feet, but some high hills lie north of Contwoyto Lake. The area may be divided into two parts: a southwestern part of much rock exposure and little drift cover lies within the tree-line, and has a hummocky surface; the rest of the area is covered by much glacial debris, yet has plentiful rock exposures; it occupies the barrens, extends southwestward beyond the tree-line, and includes numerous eskers.

Within the region of Yellowknife and Gordon Lake, and that of Regan Lake, Aylmer Lake, MacKay Lake, and southeast of Contwoyto Lake, rocks can generally be easily classified from the air into granitic, stratified, or basic volcanic. But elsewhere such a classificiation could not be made with assurance from a single flight.

The stratified formations within this region are those of the Archaean, Yellowknife group; they are finely bedded and complexly folded. Between Biologist Lake, the easterly point where exposures became common, and Aylmer Lake, the rocks appear to be mostly granitic, with large fractures or joints, but some restricted areas may be underlain by sedimentary and volcanic strata. Lineations in the rocks are to the northwest, the prevalent structural trend for the Yellowknife group. The above description holds also for the area between the east end of Contwoyto Lake and Hood River. The area with widespread morainal cover extends southwesterly to about Beniah Lake. Raised beaches were observed around Contwoyto Lake and the area to the southeast, and probably represent the former levels of a large, late-Glacial lake.

Area between Coppermine River, at Hepburn River, and a Large Unnamed Lake, 60 Miles to the East

This area is underlain by stratified rocks. The eastern boundary is at the large lake, and is marked by high escarpments. A large peninsula, extending almost the length of the lake, is formed by a very high ridge, perhaps more than 1,000 feet above the lake. In this eastern part of the area, the escarpments are facing east and dip slopes are to the west. Strata are either light coloured and sedimentary, or dark grey and possibly volcanic; they may be gently curving, but on the whole are straight. Granitic rocks are present. Some narrow ridges, also trending northerly and composed of dark rocks, are probably basic dykes. West of the lake the country is lower, and the rocks are well stratified. They include some coarse, light-coloured beds, probably quartzite, and apparently similar to rocks of the Snare group. But the strata are complexly folded like those of the Yellowknife group in the Gordon Lake-Beaulieu River region.

Area Between Hood River (where it trends north), Western River, Bathurst Inlet, Part of Kent Peninsula, and the Arctic Coast

This area is underlain by Proterozoic rocks forming escarpment and cuesta topography, which is especially well marked on the western part of Kent Peninsula and the islands and peninsulas of Bathurst Inlet. On Kent Peninsula some layers of diabase or basic rock, beautifully jointed, were observed capping some gently dipping slopes. Southeast of Bathurst Inlet the belt of strata is about 30 miles wide and commonly contains basic dykes forming long, narrow ridges of dark rock. Dips of strata are variable. The belt is bounded to the northeast by an escarpment facing southwest, which may be the locus of a fault.

Raised beaches are plentiful on the shores and islands of Bathurst Inlet. The lower part of Hood River is deeply incised.

Area between Western River and the Arctic Coast East of Kent Peninsula to Campbell Bay

A flight line between Western River and Campbell Bay was over a country with abundant rock exposures and many lakes, higher than to the southwest of the river, but with low relief, and lowering gradually towards Campbell Bay. The rocks are either structureless granitic or stratified formations; the latter could be either gneisses or sedimentary strata and their trend appeared to be northeastward. The coast at Campbell Bay is poorly drained, low, and with many raised beaches.

From this flight line and others over Kent Peninsula, higher hills appeared along the mainland coast south of the peninsula. The east end of the peninsula is low, poorly drained, and has many raised beaches. An esker was observed trending southwesterly, and exposures of granite were also seen.

THE ARCTIC ISLANDS

The parts of the Arctic Islands and of Boothia Peninsula visited may be roughly divided topographically, into: a western low plain, an eastern highland, and a central area that merges with the other two.

The Western Low Plain

The western plain includes Melbourne Island, the islands west of Alexandra Strait, King William Island, the eastern part of Victoria Island visited (from Cambridge Bay to Greely Haven), and the southwest part of Prince of Wales Island. The general characteristics of the plain are low relief, a multitude of lakes, poor drainage, rare bedrock exposures, a cover of unconsolidated material, glacial depositional forms, widespread raised beaches, and solifluction and frost features.

The general relief is less than 300 feet: exceptions are Mount Pelly and the two hills to the northwest, and areas in southwestern Prince of Wales Islands, which may be outliers of the central area. The surface of the plain is gently undulating to rolling. A few low escarpments are localized at exposures of flat-lying strata.

Lakes are very abundant. They vary from the sizable Ekalluk Lake to small ponds. Most of them are small and shallow, with low shorelines and outlets. Locally they extend to near the coast and to numerous small islands off the coast, so that the main shoreline is difficult to define. Streams are few. Low vegetation is centralized in low areas, as around lakes.

The land surface is grey to buff except in the lower areas, as around small lakes, where vegetation has coloured it brownish green. The unconsolidated material is boulder clay, gravel, beach shingles, and mud, with, locally, scattered erratics or boulders.

The coast line is indented by bays, and has many projecting points. Small islands are locally numerous off shore. The coast is generally low, and water off shore is shallow. Raised beaches can be observed everywhere, and are superimposed on glacial features such as eskers and drumlinoids.

An interesting feature of the plain is a belt of northwesterly oriented drumlinoids extending from the mainland south of Simpson Strait and covering the western part of King William Island, Collinson Peninsula on Victoria Island, and northward of Denmark Bay to Greely Haven. Gateshead Island is also part of this belt. The drumlinoids are elongated ridges of drift, longer than common drumlins, although locally the forms may be

called drumlins. The intervening valleys and lakes are elongated parallel with the drumlinoids, as are parts of shores of larger lakes and their peninsulas and islands, and islands off the coast. All these contribute to give the region a linear topography. Similar topography, but rather obscure, was observed locally between Ekalluk Lake and Albert Edward Bay, and also locally in the southwest part of King William Island. Striae on bedrock at Greely Haven have the same northwesterly trend as the linear topography. However, this is not the only trend of Pleistocene ice movement suggested, as eskers in the southern part of Victoria Island, on King William Island, and on Kent Peninsula trend southwesterly to southerly.

The entire plain is probably underlain by flat-lying strata, which are presumably of Palaeozoic age. Ordovician and Silurian faunas, identified by some earlier workers, have been collected at scattered points. The uniformity of topography suggests a uniformity of bedrock.

Exposures of bedrock appear rare from the air. The area around Albert Edward Bay contains the most exposures. Dolomitic strata, flat lying or with a very gentle dip, are exposed on the shores of Cambridge Bay. Flat-lying strata of crystalline limestone, containing bituminous material and fossils, occur on the west shore of Greely Haven. The fossils collected have not been identified. Flat-lying strata are also exposed on the east shore of Guillemard Bay, Prince of Wales Island.

The Eastern Highland

The eastern highland apparently occupies the area underlain by Precambrian formations, as shown on the Geological Map of Canada. It includes most of the northern half of Boothia Peninsula, the western part of Somerset Island, and apparently fringes parts of the eastern coast of Prince of Wales Island. The general characteristics of the highland are high relief, few lakes, long, deeply incised streams, a rocky appearance, and glacial erosional forms.

The highland may rise more than 2,000 feet above sea-level; highest parts observed were south of Agnew River, on the east coast of Boothia Penninsula, and west of Stanwell-Fletcher Lake on Somerset Island. Hummocky and rocky tracks are traversed by deeply incised streams, with steep rocky banks, or are separated by meandering rivers flowing in large valleys filled

with drift. A few long, narrow, northerly trending trenches are excavated in the rocks. Large areas are without lakes. The lakes south of Bellot Strait have rock basins and steep shores. The dissection of the highland is marked near its edges. Although the highland may be lower towards the coast, the coast itself is relatively high. At Fort Ross the highland rises remarkably rapidly above the low plains underlain by Palaeozoic strata to the east. East of Pasley Bay, on the west coast of Boothia, the highland rises abruptly above the central area, but to the north of Pasley Bay the rocky highland passes gradually into the lower, drift-covered, dissected central area, and the boundary could not be recognized.

There is a sharp contrast between the gently dipping Palaeozoic strata at Fort Ross, or of the eastern plain, and the crystalline, structureless rocks or steeply dipping strata of the highland. Previous workers have concluded that the latter were Precambrian, and structural relations as observed from the air support this conclusion. The steep dip of the highland strata suggests that the latter underwent more severe dynamic metamorphism than rocks of late Proterozoic age in the western part of the Arctic.

Many bands of stratified rocks were observed in the highland. In the western part, the strata trend northerly, whereas at Agnew River they trend northeasterly, and southwest of Fort Ross east of north. All are steeply dipping. Some are finely stratified and most probably sedimentary rocks, whereas others may be gneisses or volcanic rocks. At Agnew River some granitic gneisses with feldspar phenocrysts and small pegmatite dykes have tabular inclusions of biotite schists, probably of sedimentary origin; a band of stratified rocks was observed from the air, east of Agnew River, and trends northeasterly towards the mouth of the river.

Some long trenches and valleys trending north may be the loci of large faults. Rusty gossans were commonly observed between Pasley Bay and Agnew River, some occuring along linear depressions that may be faults.

The rocks are polished, and have rounded profiles of <u>roches montonnées</u>. At Agnew River, striae and grooves are oriented to the southwest. Erratic and boulder trains occur at all elevations in the last locality.

The Tasmania Islands off the west coast of Boothia Peninsula are composed of crystalline rocks, and should be included in the Precambrian.

The Central, Dissected Area

Between the western plain and the eastern highland is the central area, including the part of Boothia Peninsula extending from Pasley Bay almost to the Tasmania Islands, and also Prince of Wales Island, with the exception of the southwest part, which is part of the plain, and fringes off the east coast, which may form part of the highland. However, only limited areas of the east coast of the island were observed; the northeast part of the island was not visited; and not a single flight over the island was made without encountering fog or clouds.

The general characteristics of the central area are: varying relief, dendritic drainage, absence or scarcity of lakes, and a cover of unconsolidated material, with strata exposed on escarpments or in river cuts.

The relief of Prince of Wales Island increases eastward and northward, and attains its maximum in the northeast corner of the island, which may be some 2,000 feet high. North of Ommanney Bay are hills that on the horizons have pointed profiles. East of the bay the central area to the east and north rises above the plain by a succession of linear escarpments or steep slopes, with exposed horizontal strata, facing westward, or by a maturely dissected front facing south. Some scattered low areas in the plain covered with unconsolidated deposits may be outliers or remnants of higher strata of the central area. Between this region and the north coast of the island, streams with dendritic tributaries are separated from each other by undulating tablelands with rare or no lakes. West of Browne Bay, on the east coast, some higher escarpments with horizontal strata are facing east or onto wide valleys, with low floors and lakes, resembling the eastern plain. Areas between escarpments are cut deeply by streams or gullies. The streams flow on gravels or boulders, but commonly horizontal strata are exposed on their banks, and the suggestion is that the present drainage would be pre-Pleistocene if the unconsolidated mantle is glacial drift. From the air the soil around Browne Bay and northward appears reddish. The colour fades westward, but

is locally a deep red to the east, especially on the beaches at the coast. This is in an area where exposures of grey to buff horizontal strata are common in stream banks. A specimen of pinkish rock collected at Allen Lake, is a sandstone with ferruginous carbonate in the matrix.

On Boothia Peninsula the dissected, drift-covered area slopes towards Pasley Bay. The dendritic drainage has streams deeply incised, but there are tracks of land with lakes. Some local horizontal layering observed from the air suggests the presence of flat-lying strata in the vicinity of Pasley Bay.

The horizontal beds in the vicinity of Browne Bay on the east coast of Prince of Wales Island are more probably Palaeozoic than Precambrian, as indicated on the Geological Map of Canada. Fossils were collected at Allen Lake, at the north end of the island, in flat-lying, grey to buff weathering crystalline limestone. At that locality, some local dips of about 10 degrees were recorded along a stream.

From the air no features could be recognized as obvious results of widespread glaciation. Boulders, including granitic gneisses, observed on traverses at Allen Lake and Guillemard Bay were below raised beaches and could have been the result of ice rafting. On flying over McClintock Channel a large patch of ice was observed to be grey with laden debris. Short striae on a small area of polished rock at Allen Lake were observed below raised beaches, and again might have been the work of sea ice laden with rock debris.