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GEOLOGICAL NOTES ON CENTRAL DISTRICT OF KEEWATIN NORTHWEST TERRITORIES

(Map and Preliminary Account)

By

G. M. Wright

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GEOLOGICAL NOTES ON CENTRAL DISTRICT OF KEEWATIN, NORTHWEST TERRITORIES

INTRODUCTION

The following is an account of the geological reconnaissance of central District of Keewatin (Operation Baker). In this operation five geologists using two helicopters mapped an area of about 67,000 square miles in 98 days during the 1954 field season. This work constitutes a continuation northward of the Geological Survey's first helicopter reconnaissance, Operation Keewatin (1952), and the field methods used have been fully described elsewhere by Lord (1953b)[1].

[1] Dates in parentheses are those of references given at the end of this report.

The area covered by Operation Baker (1954) centres about Baker Lake, approximately 400 miles north of Churchill, Manitoba. It forms a rough rectangle, the diagonals of which extend from Peter Lake near Rankin Inlet northwest to Garry Lake, and from southwest of Dubawnt Lake northeast to within 40 miles of the west end of Wager Bay.

All parts of the area are accessible by aircraft from Churchill, with Baker Lake settlement a convenient refuelling point. The Hudson's Bay Company's supply ship, M. V. Rupertsland, usually makes two trips each year into Baker Lake, in August and September, and freight can thus be placed at Baker Lake for a relatively low cost per ton. The Thelon River system extends across the map-area from west of Beverly Lake to Chesterfield Inlet on the west shore of Hudson Bay. Except for several stretches of rapids between Schultz and Baker Lakes, with a total drop of 250 feet, this system could provide, if necessary, a water route for shallow-draught, small boats and barges from Hudson Bay into the centre of the barren grounds at Beverly Lake, a distance of approximately 325 miles.

Elevations range from near sea-level at Baker Lake to about 1,000 feet in the southwestern and northeastern parts of the map-area. Local relief is generally low, 100 feet or less, but in places it ranges up to several hundred feet. The greatest relief is commonly in areas underlain by Hurwitz quartzites (2)[2] or, in some instances, as in the

[2] Numbers in parentheses are those of map-units on the accompanying geological maps.

Marjorie Hills, by sedimentary rocks of the Dubawnt group.

Practically the whole area is treeless barren grounds; only in the valley of Thelon River west of Beverly Lake are there fairly extensive areas of small spruce trees. The amount of bedrock exposed varies greatly from place to place. In the Peter Lake area and north of the western part of Aberdeen Lake, there is practically no outcrop, but along Chesterfield Inlet outcrops are abundant. Lichens commonly cover rock surfaces, and in general these growths appear to be more extensive than farther south.

Wildlife is varied and relatively abundant. Caribou were noted, singly or in small groups, in many parts of the area throughout most of the field season, and were present in large herds north of Aberdeen Lake at the end of July. In the valley of Thelon River west of Beverly Lake, about forty musk-oxen were counted in mid-August. Wolves and white foxes were fairly numerous, but only one barren ground grizzly bear was seen. Arctic ptarmigan were relatively common early in the field season, and ducks and geese later in the summer. Fish, mainly lake trout and some grayling, were readily obtainable in many of the lakes and streams.

There are only a few small settlements within the area. Baker Lake, at the northwest end of Baker Lake, and Chesterfield Inlet, on the west shore of Hudson Bay, include establishments of the Hudson's Bay Company, Department of Transport, Royal Canadian Mounted Police, and Anglican (Baker Lake only) and Roman Catholic missions. At Baker Lake is an airstrip suitable for twin-engined transport aircraft. The Canadian Nickel Company Limited for several years has maintained a development-exploration base on the east shore of Ferguson Lake, approximately 100 miles south of Baker Lake, and North Rankin Nickel Mines Limited is developing a nickel-copper deposit at Rankin Inlet, on the west shore of Hudson Bay about 300 miles north of Churchill.

In 1954, a heavy mantle of snow covered much of the region up to the end of May, and the break-up period, during which neither ski- nor float-equipped aircraft could use Baker Lake, lasted approximately from June 20 to July 5. Of the 98 days spent in the operation area about 80 were suitable for geological traversing by helicopter.

ACKNOWLEDGMENTS

The writer gratefully acknowledges the able assistance of C. H. Smith, J. G. Fyles, J. A. Fraser, and R. C. Shields. Dr. Smith acted throughout as deputy-leader of the operation, and Mr. Fyles was primarily responsible for the study of the surficial geology. The unstinted assistance and co-operation rendered to the Geological Survey by personnel of the Department of Transport and of the Hudson's Bay Company at Baker Lake are acknowledged with thanks.

Helicopters and crews were supplied by Spartan Air Services Limited of Ottawa, and Norsemen and other support aircraft by Arctic Wings Limited of Churchill.

PLEISTOCENE FEATURES

By

J. G. Fyles

The map-area is characterized by large eskers, successions of abandoned shorelines, and fields of drumlins, drumlinoid ridges, and furrows. These linear Pleistocene forms are prominent components of the treeless landscape, especially as seen from the air, and the eskers, at least, serve as navigational aids for small aircraft in winter when snow conceals lakes and streams.

Glacial ice formerly covered the map-area and deposited a widespread mantle of sandy till and of loose blocks and boulders. Movement of the ice moulded much of this drift into drumlins, long ridges and furrows, and less-distinct lineations that parallel the striae on rock surfaces. The map of drumlins, striae, and related forms (Figure 1) reveals a pattern of southeastward glacial movements in the southeast part of the area and of westward to northward movements in the rest of the area; the two patterns meet and intersect headward along a linear ice divide trending southwest through Wager Bay, Baker Lake, and Yathkyed Lake. Numerous eskers, outwash deposits, and abandoned stream channels integrate into river-like systems 'flowing' outward, to the southeast and northwest, on either side of the ice divide. The ice divide is believed to be the zone into which the last glacial ice retreated. Drumlins and related forms probably were made at different times in the periferal part of the ice-sheet, by movement of ice towards successive positions of the glacial front. Thus, they do not necessarily reveal paths of continuous glacial flow.

During recession of the glacial ice, lakes occupied many valleys and depressions west of the ice divide and apparently were dammed by ice to the east. Prominent successions of abandoned shorelines in the Thelon Valley outline former large lakes that appear to have stood at successively lower levels as the ice-front receded eastward. The highest well-developed strand line between Aberdeen Lake and the west boundary of the map-area is 700 feet[1] above sea-level and 440 feet above Beverly Lake. Another former lake system is represented by beaches up to 140 feet above sea-level.

[1] Elevations are based on measurements by aneroid barometer.

With the disappearance of the glacial ice, the sea spread over much of the land bordering Hudson Bay, modifying the glacial deposits and leaving closely spaced shorelines and local accumulations of sand and clay. Marine shells have been found up to 400 feet above present sea-level, and the highest stand of the sea appears to be represented by a prominent shoreline at an elevation of 430 feet near Baker Lake, 480 feet along Kaminuriak Lake, and more than 500 feet at the southern limit of mapping south of Kaminuriak Lake. At this maximum stand, the sea covered most of the country east of Ferguson Lake and Kaminuriak Lake, extended northward about 30 miles beyond Baker Lake and Chesterfield Inlet, and occupied a maze of channels between Thirty Mile Lake and Schultz Lake. Presence of marine shells near Beverly Lake, at 360 feet above sea-level, indicates that an arm of the sea occupied the Thelon Valley and possibly extended beyond the western limit of the map-area.

General Geology

Introduction

The accompanying geological maps cover, in addition to the area mapped in 1954, approximately 20,000 square miles of the area mapped by Lord in 1952 and lying north of latitude 62 degrees. The line dividing the areas covered in 1952 and 1954, respectively, extends approximately from the south tip of Dubawnt Lake, eastward through Yathkyed Lake to a point 25 miles east of the south end of Kaminuriak Lake, thence northeastward through Meliadine Lake, northward to the 64th parallel, and eastward toward Hudson Bay.

Geological data presented in this report and shown on the accompanying maps were gathered almost entirely on helicopter traverses. The data are based on approximately 2,500 landings, about an equal number of low-level (below 50 feet) observations, and many high-level (above 50 feet) observations.

With few exceptions, the rock types and their sequence as established in 1952 by Lord in the south (Lord, 1953a) have been found to apply readily to the area studied in 1954. The proportion of greenstone and associated sedimentary rocks, however, is considerably less, and the relatively flat-lying rocks of the Dubawnt group (Late Proterozoic) are much more abundant. The latter have been subdivided into four map-units. Granitic rocks are widespread, and varied in composition and texture, but are generally similar in type and amount to those found to the south.

SEDIMENTARY AND VOLCANIC ROCKS OF ARCHAEAN AND/OR EARLY PROTEROZOIC AGE

Greenstone Assemblages (1)

The oldest rocks (1) recognized are intermediate to basic volcanic rocks (greenstone) with derived amphibole schist and gneiss, and associated, undifferentiated sedimentary rocks. Except in the general region Rankin Inlet-Corbett Inlet-west of Kaminak Lake, greenstones are not as abundant or as widespread in central Keewatin as in southern Keewatin. They underlie considerable areas near Yathkyed Lake, north of MacQuoid Lake, and across lower Thelon River, and outcrop in small, isolated areas northwest of Tehek Lake.

The greenstones are probably derived mainly from andesitic and dacitic lavas, and lesser pyroclastic rocks. Weathered surfaces range in colour from buff or light green to dark green and almost black, and fresh surfaces from grey, buff, or light green to dark green. Most of the greenstones are fine grained and schistose to massive. Some exhibit pillow structures, but most do not. In thin section they are seen to be highly altered aggregates of feldspar, amphibole, chlorite, epidote, zoisite, quartz, and other minerals. Some greenstones are massive, medium-grained, hornblende-rich rocks that may be, in part, of intrusive origin.

The greenstone body at Rankin Inlet comprises intercalated, pillowed to massive greenstones, undoubtedly derived from lavas; massive, medium-grained, dioritic greenstones that may be in part intrusive; and thin-bedded, light grey, quartz-sericite schists, possibly derived from tuffs. The east-trending greenstone belt north of MacQuoid Lake consists of fine- to medium-grained hornblende-rich rocks that are probably mainly of volcanic origin, but which may be to some extent altered basic intrusive rocks. They are well foliated in places, and carry many quartz veins. The wide, northeast-trending greenstone belt that crosses lower Thelon River is composed mainly of altered, schistose to massive, volcanic rocks near Half Way Hills, and to the north, pale green to buff weathering, fissile schists, some of which, under the microscope, are seen to be chloritic greywackes, or possibly tuffs. Several small areas northwest of Tehek Lake are underlain by dark green, relatively massive, chlorite- and/or hornblende-bearing rocks.

The greenstones are commonly foliated, with steep to vertical dips. They have been intruded by granitic rocks, and in many places have been altered to chlorite and hornblende schists and gneisses; they commonly contain irregular quartz veins.

In central Keewatin, the greenstones (1) are commonly associated with the prominent white quartzite (2) of the Hurwitz group.

In Half Way Hills, greenstones conformably underlie quartzite, although in places they are interlayered along the contact. This relationship of greenstone and white quartzite is similar to that observed in southern Keewatin. At MacQuoid and Yathkyed Lakes, the greenstones are not associated with the white quartzite, and there they may be older, although lithologically indistinguishable.

Hurwitz Group (2-4)

The name Hurwitz group is applied to the white quartzite (2) and associated greywacke, conglomerate, impure quartzite, dolomite, and sedimentary schist (3, 4) first mapped by Lord in southern Keewatin (Lord, 1953a, map-units 4-7).

The most prominent rock-unit in this group is a white weathering quartzite (2) that forms relatively high hills and ridges clearly recognizable from the air. The main exposures of this quartzite are between Pistol Bay and northern Kaminak Lake, in Half Way Hills, in the area south of Schultz Lake, northwest of Beverly Lake, and northwest of Tehek Lake, where it forms massive, white ridges in a wide, easterly trending belt about 60 miles long. Smaller bands of quartzite are present in granitic terrain north of Lunan Lake, north of Dubawnt Lake, and elsewhere. In most if not all cases the elongation of ridges is parallel with the strike of the quartzite.

Most of the quartzite (2) is thin to thick bedded, pure white or, less commonly, pink, and fine to medium grained, and is composed almost entirely of quartz. In some places it is schistose and carries considerable white mica and potassium feldspar. Less common are quartz-pebble beds, and impure, gritty, sandstone phases. Useful ripple-marks and crossbedding were not observed in this quartzite in central Keewatin, although they are fairly abundant in southern Keewatin. This change may be due to a northward increase in granitic intrusion and metamorphism rather than to an original absence of ripple-marks. The quartzite beds have moderate to steep dips and, in places, are probably overturned. In aggregate thickness the white quartzite strata may amount to several thousand feet (as in Half Way Hills), but this figure should be used with caution, as unrecognized isoclinal folding may well be present.

In the Half Way Hills region, quartzite (2) conformably overlies greenstone (1), and is itself overlain by conglomerate (3) that contains cobbles of quartzite (2) and granite (6). The underlying greywacke and conglomerate, etc., mapped by Lord to the south in 1952 (Lord, 1953a, map-unit 4) were not recognized as such in the Baker Lake region, although they may be present.

The younger rocks (3) of the Hurwitz group include dark grey to green greywacke, massive to bedded, pink or grey, feldspathic quartzite, conglomerate, buff weathering dolomite, lesser fine-grained quartz-mica schist and spotted, micaceous hornfels, and very minor amounts of crystalline limestone. Conglomerate structurally overlies quartzite south of Half Way Hills and in several places along the central part of the major quartzite belt northwest of Tehek Lake south-dipping quartzite (2) is conformably overlain by buff dolomite (3), and this in turn by greywacke (3). The younger sedimentary rocks (3) of the Hurwitz group are generally much lower lying and less well exposed than is the quartzite (2).

In some places undifferentiated, Hurwitz-type sedimentary rocks (4) cannot be reliably dated in relation to the quartzite (2), and they may be in part older. A considerable area underlain by these rocks lies east of Half Way Hills and north of Baker Lake.

The Hurwitz quartzite (2) is distinctive in colour and composition, and in topographic expression. It occurs over a north-south distance of several hundred miles in southern and central Keewatin, generally with closely comparable geological associations. It seems probable, therefore, that this white quartzite (2) is of approximately the same age throughout the District of Keewatin.

Gneisses

Several types of gneissic rocks (5), not specifically assignable to rock-units previously discussed, are present in many scattered parts of the map-area. They are particularly abundant between Rankin Inlet and Baker Lake and along Chesterfield Inlet, but they are also found near Tehek Lake and north and northeast of this lake, near latitude 66 degrees.

Many of these rocks, particularly those along Chesterfield Inlet, are well-banded, garnetiferous paragneisses. Some, however, are rich in amphibole and may be of volcanic origin. In the granitic terrain north and northeast of Tehek Lake, several bodies, mainly of garnetiferous gneiss and pyroxene-bearing granulites, are probably highly metamorphosed derivatives of sedimentary rocks. Their boundaries as mapped are approximate. Many of these gneisses are intimately intruded by granitic stringers or granitized, or both.

In most places it seems unlikely that these highly metamorphosed paragneisses are derived from sedimentary rocks of the Hurwitz group, and they imply, particularly in the Chesterfield Inlet area, the previous existence of an older group of sedimentary strata, perhaps pre-dating the greenstones (1).

DUBAWNT GROUP

Introduction

The name Dubawnt group (7-10) is suggested for relatively flat-lying, unfossiliferous, mainly dark red, green, or purple sedimentary and igneous rocks of, probably, Late Proterozoic age. These form an extensive, but discontinuous, unconformable cover over much of the older sedimentary and volcanic terrain previously described, and over the abundant granitic rocks of the region north and northwest of a line from the east end of Baker Lake to Yathkyed and Kamilukuak Lakes.

Tyrrell (1896), who carried out an epic canoe reconnaissance through the central barren grounds in 1893, encountered some of the conglomerates, sandstones, and igneous rocks described in this section. The sedimentary rocks he called Athabasca sandstone and conglomerate, and assigned them to the Cambrian. However, these rocks are separated by more than 200 miles from the type localities and major outcrop areas of the Athabasca series. Although the rocks in these widely separated regions may be of approximately the same age, and are physically similar in some respects, it is believed preferable to give a distinct name, Dubawnt group, to the conglomerates, sandstones, and associated igneous rocks here discussed. The rocks of both the Athabasca series and the Dubawnt group are now believed to be of Late Precambrian rather than Cambrian age.

In general, these younger rocks are fresher and much less indurated than the older volcanic and sedimentary rocks, and in most cases are readily distinguishable from them. On the basis of reconnaissance studies in 1954, the rocks of the Dubawnt group have been divided into four units for mapping purposes, but more detailed work in the future may well show a much greater complexity.

Lower Dubawnt Conglomerate (7)

The oldest known map-unit in the Dubawnt group is a basal conglomerate (7), which is clearly recognizable only at and south of the east end of Baker Lake. The conglomerate is mainly red, and contains pebbles, cobbles, and boulders, largely of granite and commonly well rounded, in a fine- to medium-grained, gritty, arkosic matrix. Arkose, with few or no pebbles, also occurs as intercalated lenses within the conglomerate. At the east end of Baker Lake the conglomerate dips west at about 40 degrees, and appears to rest, with marked unconformity, on the old, steeply dipping gneisses (5) of Chesterfield Inlet.

Dubawnt Sandstone (8)

A series of rocks mainly consisting of sandstones, arkoses, and siltstones (8) with gentle to moderate dips, apparently overlie the older conglomerate (7) conformably in the islands at the east end of Baker Lake and in the mainland to the south. Similar sandstones and arkoses occur southwest of Baker Lake and cover extensive areas in the Aberdeen-Beverly Lakes region, but the finer grained siltstones appear to be restricted largely to the east end of Baker Lake. Commonly the sandstones and associated sedimentary rocks (8) occur as scattered, low-lying outcrops, separated by wide expanses of grassland, sand, or rubble, but in some places, as in one section of the Marjorie Hills, they form prominent cuestas. There the arkosic sandstone is known to be more than 400 feet thick, but it seems likely that the true thickness of the Dubawnt sandstone varies greatly from place to place.

The sandstones and associated rocks vary in colour from white to buff to brick-red and are generally fine grained. Beds are from a few inches to several feet thick. Perfectly rounded to angular grains of quartz and feldspar lie in argillaceous to arkosic, aphanitic to fine-grained matrices. Pebble-rich layers are relatively common within the sandstone and in some instances the sandstone (8) as mapped contains sufficient pebbles and cobbles to be conglomerate. In such cases the distinction between pebbly sandstone (8) and conglomerate (7 or 10) is arbitrary. Ripple-marks and mud-cracks were noted in the siltstones and finer grained sandstones, and cross-bedding in the sandstones. Dips in most places are less than 25 degrees, but dips as high as 40 degrees or more have been observed. Over wide areas, particularly in the western part of the map-area, the sandstones are essentially flat-lying.

Dubawnt Porphyries (9)

The igneous rocks of the Dubawnt group are widespread in the region from Baker Lake southwest to Kamilukuak Lake and north to Dubawnt and Beverly Lakes. For the most part their thickness is unknown, but, where they are thought to be extrusive, it is unlikely that the thickness exceeds 100 or 200 feet. They commonly form low, rounded to mesa-like outcrops that in many cases occur widely scattered in grassland of low relief.

These rocks may be light to dark purple, shades of green or red, or almost black in colour. They vary in grain size from nearly aphanitic to coarse. Many of them are strikingly porphyritic, with phenocrysts of one or more of biotite, pyroxene, feldspar, and quartz, in an aphanitic to fine-grained groundmass. Most outcrops are relatively massive or display vertical or sub-horizontal jointing, but a few show amygdules, flow-layering, and, in one case, pillow structures.

A preliminary study of the Dubawnt porphyries indicates the following main types: massive, medium-grained, sub-porphyritic, generally dark-coloured rocks carrying biotite and pyroxene, as phenocrysts and in the groundmass; medium- to coarse-grained, porphyritic (feldspar and/or quartz), generally lighter coloured types; and relatively coarse-grained, deep red, porphyritic (feldspar) rocks. The groundmass varies from aphanitic to fine grained, and may contain the same minerals that make up the phenocrysts. In many cases, however, the groundmass consists largely of a fine-grained felt of potassium feldspar microlites. In general terms, the Dubawnt porphyries appear to be relatively basic in the east (Baker Lake) and southwest (Kamilukuak and Yathkyed Lakes) and more acidic in the central areas, particularly in the wide belt between Mallery Lake and Kazan River.

The Dubawnt porphyries and associated non-porphyritic rocks appear to have several modes of origin. They are known to occur as red porphyry dykes cutting other Dubawnt and older rocks. South of Baker Lake, where the Dubawnt igneous rocks are in part massive hill-formers, they are believed to be intrusive stocks or plugs. In the same general area, they have been found between layers of Dubawnt sedimentary rocks and are probably sills. From Thirty Mile Lake to Tulemalu Lake and elsewhere, porphyritic rocks occur in a very large area of widely scattered, low outcrops, separated by grassland, and there they are thought to be lava flows. The presence in scattered outcrops of chlorite-carbonate amygdules also suggests an extrusive origin for many of these rocks and a few tuffs, breccias, and agglomerates are known.

Upper Dubawnt Conglomerate (10)

Conglomerates of the Dubawnt group, not definitely known to be basal, and in many cases containing pebbles and cobbles of Dubawnt sandstone (8) or porphyry (9) or structurally overlying the latter rocks, are grouped together as one map-unit (10), although this unit may include conglomerates of different ages within the Dubawnt group, and may in places include some outcrops of the basal conglomerate (7).

The upper conglomerate, together with pebble sandstone and bands of intercalated sandstone, underlies areas around Schultz Lake and south of Aberdeen Lake, and forms isolated outcrops elsewhere in the region north and east of Dubawnt Lake and north of Thelon River.

Although this conglomerate may contain pebbles and boulders of any older rock, it is most distinctive where it carries cobbles of pure white Hurwitz quartzite (2) or of brick-red Dubawnt porphyry (9).

Internal Relationships of the Dubawnt Group

The subdivision of the Dubawnt group, as suggested here, represents a workable synthesis of opinion presently available, but it should not be too rigidly applied until further studies have been carried out, as it is based entirely on reconnaissance work.

At the east end of Baker Lake, conglomerate (7), containing abundant rounded boulders of granite (6), unconformably overlies older gneisses (5), and there and to the southwest sandstone (8) dips away from the conglomerate at low to moderate angles. Just west of Thirty Mile Lake, along Kazan River, porphyry (9) overlies pebbly sandstone (8) that dips north at 25 degrees. The stratigraphic sequence in this region appears to be conglomerate (7) overlain by sandstone (8) overlain by porphyry (9).

Fifteen miles northwest of Marjorie Lake, on the north shore of Dubawnt River, is a cuesta of Dubawnt sandstone (8) whose strata dip north at 25 degrees. To the north of this, and separated from it by grassland, is a line of low, black hills of coarse-grained, dull brick-red, feldspar porphyry (9). Farther north is conglomerate (10), dipping gently northward to Aberdeen Lake, that contains cobbles of the distinctive red porphyry. The succession here, from bottom to top, appears to be sandstone (8), porphyry (9), and conglomerate (10). In other isolated instances conglomerate is known to overlie porphyry and, in the Schultz Lake area, sandstone, at least in part, although the two rock types are also apparently interbedded in some localities.

It is quite possible, however, that there are actually two or more sandstone and porphyry units, in addition to at least two conglomerates. Any of the three main lithological types may be found resting on granite, as, for example, in the Tulemalu-Mallery Lakes region where a widespread blanket of porphyry (9) is believed to rest in large part directly on granite (6).

PALAEOZOIC ERRATICS

Twenty-five miles north of Aberdeen Lake, at longitude 98° 50' W., latitude 64° 57' N., are angular blocks of fossiliferous limestone. These blocks are not in place, and despite a thorough search no actual outcrop of the limestone was found. However, the softness of the rock and the angular nature of the blocks indicate that they cannot have moved far. A preliminary study[1] of the collection

[1]The fossil collection was examined by G. W. Sinclair, Geological Survey of Canada.

of fragmentary fossils contained in these erratics indicates that it may be tentatively assigned to the Silurian, with the possibility that it may be Devonian.

INTRUSIVE ROCKS

Granitic Rocks

Rocks of the granite family (6) are widespread and abundant in central Keewatin. They are highly variegated in colour, texture, grain size, and purity, and probably differ widely in age. Colours are pink, red, white, and grey; textures range from aplitic to porphyritic; grain size from fine to very coarse; and content of impurities from nil to more than 50 per cent. Probably the most common rocks of this map-unit are more or less gneissic, pink to grey, medium-grained, equigranular, biotite- and/or hornblende-bearing rocks ranging in composition from granite to quartz-diorite. Small aplite and pegmatite dykes are relatively common throughout the region, but no large pegmatite dykes were seen. Grey granite-gneiss is cut in innumerable places by dykes of massive, fine- to medium-grained, equigranular, pink granite. On the southwest shore of Chesterfield Inlet a gabbroic intrusion containing inclusions of the granitic gneiss is cut by dykes of pink granite.

Many of the granitic rocks are more or less gneissic; some are mylonitized. The dominant trend of gneissosity is northeasterly, especially in the eastern part of the map-area, but, locally, trends in gneissosity may be variable over short distances. In many places the granitic rocks exhibit a well-developed, sub-horizontal jointing, which, from a distance, simulates bedding.

In some areas the gneissic granitic rocks contain partly assimilated bands of amphibolitic rocks or paragneiss; between Chesterfield Inlet and Gibson Lake, for example, the granites are highly contaminated in this manner and grade into injection gneisses. In the Ferguson Lake area a complex (6a) of granites with greenstone, paragneiss, and basic intrusive rocks of several types has been outlined. The complex probably contains about 40 per cent granitic rocks, but it was not found possible to show the different rock types separately on the present scale of mapping. A somewhat similar, but smaller, complex of igneous and metamorphic rocks lies southeast of the sharp bend in Kazan River, west of Thirty Mile Lake. Many of the gneissic granitic rocks (6) in the area north and northeast of Tehek Lake are highly impure and some of them carry appreciable amounts of pyroxene. They grade into paragneiss and associated rocks (5).

Rocks of the granitic assemblages (6) have intruded and metamorphosed greenstones (1). In the Half Way Hills region they are known to intrude Hurwitz quartzite (2), at least locally, and there

and elsewhere the presence of considerable potassium feldspar and white mica in the quartzite, plus the fact that the associated greywackes (3) are in part altered to schists and hornfels, indicates that some granite is younger than the rocks of the Hurwitz group (2 to 4). On the other hand, the remarkably pure quartz sand that gave rise to the Hurwitz quartzite seems to require the existence of extensive older granite to provide a source. Furthermore, the presence of granitic cobbles in conglomerate (3) of the Hurwitz group proves that some granite, at least, is older than these rocks. On a reconnaissance scale, it was not found possible to differentiate granitic rocks by age, but in general terms, it is believed that much of the granite is younger than the main greenstone assemblages (1) and, probably, older than the Hurwitz group (2 to 4); that an appreciable, but unknown, part is younger than the Hurwitz group; and that most, if not all, of the granitic rocks are older than the rocks of the Dubawnt group (7 to 10), which in many places appear to overlie the granites with marked unconformity.

Basic Intrusive Rocks

Basic intrusive rocks (A, B, 11), occurring as dykes, sills, plugs, and irregularly shaped masses, are relatively common in the map-area. Except for the dykes of diabase and gabbro (11), which cut all other consolidated rocks and are, therefore, the youngest rocks in the region, the relative ages of the basic intrusive rocks are largely unknown.

Several types of dioritic and gabbroic rocks, in part similar in appearance and composition but differing in geological occurrence, are grouped together with minor basic syenite, ultrabasic rocks, and hornblendite as map-unit A. A common type in this group is a fresh-appearing, massive, medium- to coarse-grained, mottled greenish grey diorite or gabbro, which consists largely of intermediate to basic plagioclase and amphibole, or in some instances, altered pyroxene. These mostly form rounded, rugged, plug-like bodies, but similar rocks are known to occur as dykes. They are probably mainly older than the rocks of the Dubawnt group (7 to 10) and younger than some of the granites (6) and gneisses (5), although one intrusion at least is known to be cut by small dykes of pegmatite.

Also occurring in plug-like bodies are massive, medium-grained, purplish red or mottled green rocks (A) that consist mainly of potassium feldspar, with biotite or pyroxene. In some specimens the feldspar crystals show a distinct parallel orientation. Such rocks are present in the islands of Whitehills Lake 20 miles north of Baker Lake settlement, near the eastern end of Half Way Hills, and in two bodies 50 to 60 miles north of Yathkyed Lake. The age of these rocks is unknown, but some of them bear a marked resemblance to the more massive, probably intrusive, phases of the Dubawnt igneous rocks (9) that occur as stocks south of Baker Lake, and they may be of Late Proterozoic age.

Occurring in the region between Kaminak Lake and Corbett Inlet is a massive, medium-grained diorite and gabbro (A) comprising about equal parts of altered amphibole and andesine or labradorite. In most localities it lies between granitic rocks (6) and greenstones (1). It was not found in contact with the greenstones nor with the large granitic intrusions, but here and there it is cut by pegmatite and granitic stringers and by diabase dykes. Although its texture and distribution with respect to the granitic rocks suggest an intrusive origin, its proximity to the greenstones suggests that it may, in part, comprise a thoroughly recrystallized phase of the latter. It is, in places, at least slightly older than the granitic intrusions (6). The large body of greenstones (1) south of Quartzite Lake includes much of this type of gabbro in addition to the altered basic volcanic rocks.

A medium-grained, massive, dark green or grey-green metadiorite (A) cut by many seams of epidote outcrops as prominent rounded hills between parallel bands of Hurwitz quartzite (2) on Quartzite and northern Kaminak Lakes. Under the microscope this rock is seen to be composed of a felt of green actinolitic amphibole and laths of plagioclase, with a little epidote, zoisite, and other minerals. It was not found in contact with other rocks, but its massive appearance and dioritic texture suggest an intrusive origin. Its age relative to the nearby quartzite (2) is not known, although at one place it appears to lie stratigraphically above the quartzite and may, therefore, be younger.

Ultrabasic rocks (A) were seen in only a few places. Forty miles northwest of Tehek Lake, a body of basic intrusive rocks lies along the south border of white quartzite (2). A sample from this body is dull brown weathering, greenish black, and aphanitic. A thin section cut from it reveals serpentine, amphibole, and secondary iron ore minerals; it is probably a serpentinized dunite. Just south of the west end of Schultz Lake is a small outcrop of brown weathering, dark green rock (A) comprising almost 80 per cent serpentine, plus other secondary minerals. A sill of fine-grained, dull green, massive serpentinite, possibly derived from pyroxenite, contains the nickel-copper deposits being developed by North Rankin Nickel Mines Limited on the north shore of Rankin Inlet. It is presumably younger than the adjacent greenstones (1) and intercalated schistose tuffs or sedimentary strata, but its age relative to other rocks is not known.

The Ferguson Lake complex (6a) includes irregular, sill-like bodies of medium- to coarse-grained hornblendite, the largest of which contains the main zones of sulphide mineralization. Dykes of altered gabbro are also abundant in the complex. Small bodies of hornblendite occur elsewhere in the map-area.

One large body of anorthosite (B) forms rugged outcrops along the north shore of the east end of Baker Lake. The anorthosite in the western part of this body is mainly a massive, light purplish grey rock of very coarse grain, and consists largely of labradorite

with some remnants of pyroxene and amphibole. A second type in this body is light grey and medium grained, and consists almost entirely of plagioclase. The anorthosite (B) in places possesses a marked lineation, and the medium-grained type contains inclusions of schist. To the east, the anorthosite is well banded and apparently has been highly sheared and there the position of its contacts with gneiss (5) and gneissic granites (6) is indefinite. No signs of mineralization were seen in this rock. A second small body of purplish anorthosite (B) occurs 25 miles northeast of Tulemalu Lake, but its true extent and geological relations are not known.

Dykes of diabase and gabbro (11) are fairly abundant. A few are shown on the maps and one of them has been traced, with some gaps, for 150 miles from north of Schultz Lake to east of Kaminuriak Lake. Most of the dykes trend northwest, but several trend east, particularly north of Gibson Lake. The largest dyke examined is 325 feet wide. It dips vertically, as do most others, and is offset by northerly trending faults of small displacement. These dyke rocks are massive, brownish to reddish weathering, dark green to black, and consist essentially of labradorite and pyroxene, small amounts of magnetite and apatite, and in some cases quartz. Secondary amphibole, probably derived from alteration of pyroxene, is present in most of the thin sections examined.

Economic Geology

Some exploratory prospecting was done in parts of the map-area during 1928 and 1929 by such organizations as Cyril Knight Prospecting Company Limited, Dominion Explorers Limited, and Nipissing Mining Company. Other preliminary prospecting and some diamond drilling was accomplished by Hudson Bay Exploration and Development Company prior to 1946. More recent prospecting and development efforts include those of D. W. Cameron, Canadian Nickel Company Limited, International Nickel Company of Canada Limited, Kasba Explorations Limited, Rankin Inlet Nickel Mines Limited (now North Rankin Nickel Mines Limited), and Kennco Explorations (Canada) Limited.

The only underground work in the area has been done by North Rankin Nickel Mines Limited on its property at Rankin Inlet. This work includes a shaft sunk to a depth of about 300 feet and development drifting and crosscutting that, together with extensive surface and underground drilling, is reported to have disclosed 460,000 tons of ore averaging 3.30 per cent nickel and 0.81 per cent copper a ton. The mineral bodies occur near the foot-wall of a southerly dipping serpentinite sill 200 to 300 feet in width and 3/4 mile or more in length (Drybrough, 1931). The metallic minerals include, in order of abundance, pyrrhotite, pentlandite, chalcopyrite, magnetite, pyrite, violarite, marcasite, and gersdorffite (?) (Pelzer, 1950, p. 79).

The Canadian Nickel Company Limited is drilling other nickel deposits on Ferguson Lake, between Yathkyed and Kaminuriak Lakes. The sulphides, including pyrrhotite and chalcopyrite, occur in zones within elongated bodies of hornblendite.

Various mineral occurrences have been described in reports on exploratory surveys (Tyrrell, 1896, 1898; Weeks, 1932, 1933) and, despite the incompatibility of aerial reconnaissance and detailed search, many other occurrences were noted in 1952 and 1954. Gossans are relatively common, particularly in the greenstones (1), and perhaps to a lesser extent in the gneisses (5) and in some of the Hurwitz sedimentary rocks (3, 4). The locations of some of these gossans are shown on the maps. In several places, particularly in or near the greenstone body south of Schultz Lake, zones of rotten rock, breccia, or shearing with abundant hematite or specularite and small quartz stringers were observed. No sulphides, however, were seen in any of them. About ten grab samples of sulphide zones from scattered gossans have been assayed by the Mines Branch. Although the results of these assays have been generally disappointing, traces to small amounts of gold, silver, copper, and nickel were reported.

In far northern areas the problems of prospecting and development are inherently bound up with those of transportation. In the region covered by the accompanying maps, almost all transportation during the prospecting season is dependent, to some extent at least, on aircraft support, except, possibly, for the coast of Hudson Bay. The inland water route from Chesterfield Inlet to Baker Lake could be used for the transportation of heavy supplies and equipment for about 2 months of each year, but the westerly extension of this water route would require major portages in the stretch between Baker and Schultz Lakes.

Bearing in mind the heavy transportation demands of development work, it appears that the greenstones (1) in the Mistake Bay-Rankin Inlet area, the gneissic rocks (5) along Chesterfield Inlet east of Baker Lake, and the belt of green schists (1) on both sides of lower Thelon River comprise, at present, the most attractive prospecting terrain in the map-area. Nevertheless, many other areas not so accessible are worth attention. These include: all greenstone belts; the gneissic terrain northwest of Rankin Inlet, where, however, outcrop is sparse; the areas south, north, and northwest of Tehek Lake underlain by sedimentary rocks and gneisses; and the Ferguson Lake complex. During the helicopter operations of 1952 and 1954, numerous gossans and quartz veins were seen in many of these areas and it is reasonbly certain that an even greater number were not seen due to the reconnaissance nature of the mapping.

On the whole, the Late Proterozoic rocks of the Dubawnt group (7 to 10) do not appear to contain mineralized zones to any great extent.

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