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PAPER 70-24

RECONNAISSANCE GEOLOGY OF A PART OF THE PRECAMBRIAN SHIELD NORTHEASTERN QUEBEC AND NORTHERN LABRADOR; PART II

(Report and Map 8-1970)

F. C. Taylor

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CONTENTS

ABSTRACT

The land surface in the northeast part of the area, the Torngat Mountains, attains elevations of over 4, 500 feet but most of the region is plateau-like and rarely over 2, 500 feet above sea-level.

The bedrock is entirely Precambrian and except for a zone, up to 25 miles wide, of Archean rocks along the coast it is all Proterozoic. The Proterozoic rocks consist of five main divisions: (1) a large area of gneisses in the western part of the area; (2) large plutons of anorthosite and adamellite; (3) the Ramah Group; (4) the Mugford Group; (5) the Siamarnekh Formation.

No mineral deposits of economic importance were discovered but the area has not been thoroughly prospected. Massive pyrrhotite, associated with a small ultrabasic pluton, contains small amounts of nickel and copper. Areas underlain by the Ramah Group and the Mugford Group, and layered anorthosites, offer the best prospecting opportunities.

RECONNAISSANCE GEOLOGY OF A PART OF THE PRECAMBRIAN SHIELD NORTHEASTERN QUEBEC AND NORTHERN LABRADOR; PART II

INTRODUCTION

This report and map provide preliminary results of the second phase of Operation Torngat, a helicopter-assisted geological mapping program in northeastern Quebec and northern Labrador. The first phase of this program, involving approximately 30,000 square miles, is reported in Taylor (1969). The present report covers an additional 20,000 square miles of territory.

Two Bell G4 helicopters were used for traversing and an Otter aircraft, under full-time charter, was used for camp moves, gas caching and service flights. All supplies were obtained in Schefferville, Quebec, about 100 miles south-southwest of the southwest extremity of the map-area.

Field work started on 21 June, the day Squaw Lake, the seaplane base at Schefferville, was free of ice. A late spring in the area was a prelude to continuous poor weather throughout the field season and only during a period of fourteen days at the end of July was the weather fine. The remainder of the field season was plagued by low cloud, wind, rain and snow.

Nain, Labrador, a coastal community and only settlement within the map-area, is inhabited chiefly by Eskimos. CN coastal ships make frequent calls but Nain is inadequate as a major supply centre. Saglek, a United States Air Force Base, located at the entrance to Saglek Fiord, is equipped with a paved airstrip and living quarters for station personnel. Clearance is required to use these facilities.

PHYSIOGRAPHY

The region offers a variety of landforms with local relief ranging from a few hundred feet in the southwest to over 4,500 feet north of Saglek Fiord in the Torngat Mountains. In the western half of the map-area, which is dominated by the George River valley, terrain consists of bedrock hills projecting through a fairly extensive cover of glacial debris. In this area glacial lake shorelines are prominent, especially along the George River valley, as well as the usual glacial deposits of till, eskers and drumlinoid ridges. Between George River and the Torngat Mountains the land surface

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is plateau-like and elevations gradually increase from the river to the northeast into the mountain area. In this plateau area elevations range from 2,000 to 3,000 feet.

The Torngat Mountains, typical of glaciated mountain areas, display numerous cirques, arêtes, hanging valleys and on the east side many well-defined fiords. Although rock is well exposed in this mountainous terrain much of it is inaccessible for it occurs as precipitous cliff faces. The mountain tops are commonly covered with rubble or felsenmeer. In 1969 extensive snow cover at higher elevations covered much rock and limited aerial observation.

South of the Torngat Mountains elevations gradually decrease until in the southeastern part of the map-area hill tops are rarely over 2,000 feet. The coastal portion is dominated by fiord development. In this area two anomalously high topographic areas are present, the Kaumajet and Kiglapait mountains, both of which have summits over 3,000 feet. Outcrop is fairly extensive and in the anorthosite terrain is abundant except in major valleys.

The region west of Nain is marked by several straight and deep valleys, the most noteworthy being that occupied by Fraser River and Tasisuak Lake. These prominent topographic features may be fault valleys.

The southern part of the area is sparsely forested at low elevations and sufficient timber for local consumption is available. The northern part, which is chiefly at higher elevation, is devoid of trees except in a few well protected valleys.

GENERAL GEOLOGY

The bedrock is probably all Precambrian. The only younger rocks are a few Ordovician boulders reported by Roy (1941) to occur 21 miles northeast of Nain. The area contains elements of both the Churchill and Nain (structural) Provinces according to Stockwell (1963) and includes both Archean and Proterozoic rocks.

ARCHEAN

Migmatite, Granulite, and Amphibolite (unit 1)

Archean rocks form the major part of the coast from Saglek Fiord to south of Okak Bay and from there to the south boundary of the area a narrow strip is intermingled with intrusive anorthosite and adamellite. The Archean is characterized by a great diversity of rock types that for the most part must be mapped as migmatite on the present scale of exploration. The granitic elements of the migmatite are predominantly granodioritic but granitic, aplitic and pegmatitic phases are common. The granitic rocks contain either or both hornblende and biotite and in places also pyroxene. Muscovite is present locally. Quartz is commonly bluish in the Archean rocks, a feature not common in younger rock types. Scattered throughout the Archean terrain are amphibolite bands that comprise up to 50 per cent of the rock in places. The amphibolites show a wide variation in percentage of mineral

components, grain size and textures. Many are probably metamorphosed sills or dykes but others may be metasedimentary rocks. Garnet is common in the Archean amphibolites. Granulites are represented by greyish green, weakly foliated, medium-grained, quartzofeldspathic rocks with hypersthene. Such rocks are more common in the northern part of the Archean area than elsewhere.

Small amounts of lime silicate rocks, garnet-biotite-quartz-feldspar gneiss, quartzite and other well-layered metasedimentary rocks are erratically distributed throughout the Archean terrain. At present no attempt has been made to subdivide these from the migmatites.

A few tiny areas of ultrabasic rocks are also present. Lithologically they are chiefly peridotite with lesser amounts of amphibolite and pyroxenite. None exceed a few tens of feet in thickness.

One of the most characteristic features of the Archean rocks is the presence of numerous diabase dykes. These chiefly form an easterly striking swarm but other orientations are common. Most of the dykes are less than 200 feet wide.

Archean rocks may also occur in the western part of the area. A K/Ar determination on biotite from a granitic rock in the migmatite area in map-area 24 H, gave an age of 2,160 m.y. This age, the only one over 2 billion years outside the area shown as Archean on the present map, may indicate that some of the gneissic granite and migmatite (units 11 and 12) is reworked Archean basement. Other samples are being examined to determine, if possible, the significance of the 2,160 m.y. date.

PROTEROZOIC

Proterozoic rocks occur in five divisions: (1) the large area of gneissic rocks underlying the western three-fifths of the area; (2) the intrusive rocks in the southeast; (3) the Ramah Group; (4) the Mugford Group; and (5) the Siamarnekh Formation.

Amphibolite (unit 2)

Amphibolite is widespread throughout the gneissic terrain but only locally covers large enough areas to be shown separately on the present scale of mapping. Most amphibolite displays strong, well-developed foliation and banding. Medium-grained rocks are commonest but fine- and coarse-grained varieties are also present. Whereas chlorite is developed in some bodies, hornblende is the most common mafic mineral. The origin of the vast majority of the amphibolite is unknown as primary sedimentary, volcanic or intrusive characteristics are not preserved. However some of the amphibolite in the area to the north and west (Taylor, 1969) is of sedimentary origin.

Paragneiss (unit 3)

Metasedimentary rocks in the gneissic terrain show a wide diversity of colour, texture and mineralogy. Medium to dark grey rocks predominate

but light grey to slightly pinkish varieties also occur. In a few places where biotite content is particularly high rocks are almost black. Whereas medium-grained rocks are most characteristic fine- and coarse-grained rocks are also well represented. In part the paragneiss shows feldspar augen. Almost all the paragneiss shows a well-defined foliation with layering prominent locally. The planar features in the paragneiss are highly contorted in some outcrops but in others a persistent uniform strike is typical.

Mineralogically feldspar and quartz are dominant with biotite, the commonest mafic mineral. Hornblende and garnet occur in variable amounts.

Sillimanite occurs sporadically forming fibrous clusters most of which parallel the foliation or banding.

Included with this unit are small amounts of quartzite, amphibolite, rusty graphitic quartz-rich paragneiss, and granitic gneiss. Contacts with all rock types are gradational except for intrusive rocks such as pegmatite and diabase.

The muscovite and biotite schists, and arkose shown in the area south of the southwest corner of the present map-area (Taylor, 1969) could not be extended into the present area. Scarcity of outcrop in this region precludes resolution of this anomaly but an interlayering is probable.

Lime Silicate Rocks and Marble (unit 4)

Lime silicate rocks and marble are scarce. Typically the lime silicate rocks are fine to medium grained, grey-green, poorly banded to well foliated, and contain diopside. Small amounts of calcite are present in all specimens along with brown mica and garnet in most. Contacts are gradational over short distances.

The marble is white to very pale yellow and fine to medium grained. Tremolite is characteristic along with rarer serpentine. Bedding planes are well defined and observed contacts with bordering rocks are sharp.

Quartzite (unit 5)

Quartzite commonly occurs as thin bands in the paragneiss (unit 3) but in a few places also forms a mappable unit. The large area of quartzite east of the George River consists of medium-grained, grey to white, well bedded rock with local rare ripplemarks and crossbeds. Much of this quartzite is very pure and only sporadic bands of argillaceous rocks with sillimanite are present. Elsewhere most of the quartzite is characterized by biotite and more rarely graphite. Bedding planes are well defined in most occurrences but other structures are rare or nonexistent. Contacts with other rock units are gradational and feldspathization is locally common.

Ultrabasic Rocks (unit 6)

Ultrabasic rocks of Proterozoic age are relatively common in the north to central part of map-area 24 H. A few small plutons are also present in map-areas 24 A and 14 L. Most ultrabasic plutons are small, rarely more than 400 feet thick and less than 1/2 mile long. A few bodies are however

up to 5 miles long and 1/4 mile thick. These larger plutons show a crude layering with serpentine and pyroxene-rich bands. All are characterized by a distinctive, moderate yellowish brown weathered surface that is readily recognized from the air. They consist of serpentinized peridotite, pyroxenite and amphibolite. The peridotite is dark greenish black, fine to coarse grained, partly foliated and locally banded. The amphibolite is dark green, massive and almost entirely hornblende. Pyroxenite which is less common, is grey-green and medium grained.

Gabbro and Diorite (unit 7)

Gabbro and diorite are very restricted in their occurrence. Gabbro forms a small pluton west of George River in the north part of map-area 24 A, and in the same vicinity, but east of the river, diorite forms another small pluton. Both are primarily massive and medium grained with local coarse-grained phases. The gabbro is mottled dark green and grey and contains both biotite and hornblende. The coarse-grained phases show hornblende up to 1 inch long. The diorite contains clinopyroxene and very small amounts of biotite. Contact relationships with other rock units are unknown but because of the massive nature of most of the rock these plutons possibly post-date the foliation.

Rusty Graphitic Quartz-rich Paragneiss (unit 8)

Distinctive rusty weathering graphitic paragneiss occurs locally in the western parts of the area but rarely forms a mappable unit. The characteristic rusty surface of these rocks contrasts sharply with the surfaces of other rock types and hence the unit is readily distinguished from the air. It consists of well-banded, cream to white, fine- to medium-grained graphitic quartz-rich rocks containing variable amounts of feldspar. The weathering of tiny, widely disseminated pyrite grains produces the rustiness. Small amounts of garnet and biotite are also present.

Garnet-Quartz-Feldspar Gneiss (unit 9)

White, well-banded, fine- to coarse-grained garnet-quartz-feldspar gneiss characterized by extensive mylonitization comprises much of the northern part of the map-area. Quartz and feldspar form lenticular grains with dark reddish brown to locally pale purple garnets up to 1/2 inch in diameter scattered throughout which in many places appear to have been rotated in the plane of the foliation. Graphite is present in small amounts with scarcer biotite, pyrite and sillimanite. Thin bands of granulite (unit 10) are common as well as rare granitic gneiss (unit 12), minor quartzite and amphibolite.

Granulite (unit 10)

Granulitic rocks, characterized by the presence of hypersthene in a dominantly quartzofeldspathic gneiss, underlie a large part of the north-central part of the map-area. A light rusty-brown-weathered surface is typical and fresh surfaces are pale yellowish brown. Granulites are very well layered, probably representing a relict bedding, and commonly show streaky foliation. Biotite is common, hornblende less so and garnet occurs locally. In some places there are thin interbands of amphibolite (some garnet-bearing), granitic gneiss and garnet-quartz-feldspar gneiss (unit 9).

The granulite area west of George River, in the southwestern part of map-area 24 A, is in part massive and locally shows porphyroblastic feldspars. Similar rocks are present in the granulite that lies east of the large area of quartzite (unit 5) east of George River.

Migmatite, Granitic Gneiss (units 11, 12)

Migmatite and granitic gneisses are common rock types throughout much of the map-area. The granitic gneiss is a grey to pink rock that is generally biotite rich but locally contains hornblende either with biotite or alone. Compositionally these rocks are dominantly granodiorite but granite and diorite are also represented. The granitic gneiss probably is of metasedimentary origin and grades into well defined paragneiss (unit 3) in many places. Intrusive massive granitic rocks, in the form of small dykes and sills, are included with the granitic gneiss unit. Numerous schlieren, fragments, and blocks of metasedimentary rocks and amphibolite are characteristic and where these form a significant part of the rock mass the latter is mapped as migmatite (unit 11). Where dykes and sills of granitic rocks have penetrated metasedimentary rocks, amphibolite, or granitic gneiss and form the major part of the rocks, they are mapped as agmatite. This rock is less common than in the area to the west and forms less than 10 per cent of unit 11. All gradations exist between units 11 and 12, and within areas shown as either unit 11 or 12 rocks of the other unit may be represented.

Foliation is well defined in both map-units and banding present in some places. Elsewhere these rocks are highly contorted and structures are chaotic especially over short distances.

Granite and Granodiorite (unit 13)

Granite and granodiorite of unit 13 are typically massive, contain few inclusions and show a more uniform texture and colour than those granitic rocks of unit 12. These rocks are primarily pink and coarse grained with biotite as the chief mafic mineral. Hornblende is less common. Quartz content is variable but generally is less than 15 per cent. The large mass in the west part of map-area 24 A is chiefly porphyritic with feldspar crystals up to 4 inches long in a medium- to coarse-grained matrix. These feldspar crystals commonly show a preferred orientation but are also randomly oriented. Joints are well developed in parts of this pluton.

The pluton in the southeast part of map-area 24 A shows similarities with the rocks of both unit 15 and unit 13. Until these rocks have been examined in detail the assignment of this pluton to unit 13 must be considered as tentative.

Anorthosite and Adamellite (units 14, 15)

A large area of intrusive rocks in map-areas 14 C, 14 D E/2, and 14 E E/2 consists chiefly of anorthosite and adamellite. These rocks were first described by Wheeler (1942, 1955). The Kiglapait layered intrusion made up of a suite of basic rocks lies on the north side of the anorthosite. The anorthosite (unit 14) shows intrusive relationships with units 1, 9, 10 and 12, and is in turn intruded by adamellite (unit 15). At the contacts with the gneisses intrusive characteristics include contact metamorphism, the presence of inclusions of gneisses in the intrusive rocks and structural disconformity. In many places, and particularly well displayed in coastal exposures, the adamellite contains inclusions of anorthosite, attesting to the younger age of the adamellite.

The anorthosite is primarily a medium grey, massive, equigranular coarse-grained rock that in many places is almost pure plagioclase. However colour ranges from very dark grey to light grey, and grain size from fine to pegmatitic. A few plagioclase crystals attain several feet in length. In part the anorthosite is layered, a feature that is marked by a variation in grain size and content of mafic minerals. Mafic minerals are chiefly monoclinic pyroxene but hypersthene is also common. For a description of the Kiglapait layered intrusion the reader is referred to papers by Morse (1962, 1963). Small amounts of grey-green, massive, equigranular, medium- to coarse-grained gabbro are present locally within the area of unit 14.

The adamellite is coarse grained, equigranular and massive. Colour is commonly masked by deep, extensive, rust-coloured weathering so that only in recent rock falls or along the seacoast can fresh surfaces be obtained. In these places the rock is chiefly pale pink. The adamellite is composed primarily of potash feldspar, plagioclase and quartz, with small quantities of hornblende, clinopyroxene, hypersthene, biotite and olivine forming the mafic fractions. Fluorite occurs as tiny grains in some places. Wheeler (1955) assigned various facies to the adamellite on the basis of the mafic mineral content. In part this rock, on the basis of field examination, is a granodiorite and where this phase of the intrusive is encountered weathering is less severe and hornblende the most common mafic mineral.

The pluton straddling Okak Bay is chiefly granodiorite and is dissimilar to most of the rocks of unit 15, in that it shows less weathering and is garnet-bearing in part. This pluton may be Archean in age for it is remote from most of the adamellite. However it is assigned to unit 15 until further examination of specimens is completed.

Diabase (unit 16)

Diabase dykes are of several ages but are grouped here for convenience. They are most common in the Archean rocks but rare elsewhere.

None of those in the Archean are known to extend into either the Ramah or Mugford groups and are therefore older than either of these groups. These dykes are probably Archean for the most part. Elsewhere dykes are relatively rare. A few are known to intrude the anorthosite (unit 14) and adamellite (unit 15), and small northwest oriented dykes cut gneisses and quartzite near George River.

Most of the dykes show good chill contacts but some in the Archean rocks are slightly schistose.

Ramah Group (unit 17)

A small area of Ramah Group rocks on the south side of Saglek Fiord consists of orthoquartzite, mica schist and slate. Exposure is poor except along cliff faces. The west contact is probably a west-dipping fault, an extension of that on the north side of the fiord. The south and east contacts were not seen but are probably an unconformity.

Mugford Group (unit 18)

The Mugford Group, which was named by Daly (1902), forms the spectacular and rugged Kaumajet Mountains. This group lies unconformably on the Archean rocks and this relationship can be seen in many places.

Lithologically the Mugford Group appears to be dominated by several hundreds of feet of basic volcanic rocks with associated agglomerates, tuffs and flow breccias. However sedimentary rocks are well represented, chiefly by black slates but also by chert, carbonates, quartzite, and green slates. The seaward side of the Kaumajet Mountains shows an almost vertical face and there several hundred feet of slate can be seen lying beneath the volcanic rocks.

Until this group is mapped in detail the volume of sedimentary rocks in relation to volcanic rocks will be in question.

A quartz porphyry dyke intrudes the sedimentary rocks at Green Cove (Douglas, 1953).

Douglas considers that the Mugford Group is younger than the Ramah Group and lies unconformably on it as he correlates some of the slates at Green Cove with the Ramah Group slates. A brief examination of this locality failed to confirm Douglas' interpretation as the correlation of the slate unit is questionable.

Siamarnekh Formation (unit 19)

The youngest rocks, the Siamarnekh Formation (Wheeler, 1964) occur in two small areas. The strata are flat lying and are nonconformable on the underlying adamellite. A medium-grained pale red to buff, friable, sandstone, commonly containing scattered pale yellowish brown spots, is the most common rock type. This sandstone grades into arkose and pebble-conglomerate. The latter locally contains grey to white, well-rounded quartzite

pebbles. Bedding planes are well defined and crossbedding and ripple-marks are locally present. Approximately 200 feet of strata are present. Nowhere was the nonconformity observed.

The total absence of metamorphism, nonconformable structural attitude, and lack of post-depositional disturbance suggests that this formation is the youngest rock unit.

STRUCTURAL GEOLOGY

Although no attempt has been made to analyze the structure of the map-area the major trends are apparent. Both Archean and Proterozoic rocks have a persistent north to northwest structural trend when viewed on a small scale. Many local variations occur and in places trends normal to the regional directions exist. Structures are particularly well defined in the granulites (unit 10) and in the Ramah and Mugford groups. Dips of axial surfaces are steep in general but in the higher mountains low to medium dips are discernible in cliff walls. Plunges in general are low but local steep plunges do occur particularly in the Archean rocks.

Faults are chiefly of two orientations, those parallel to the regional trend and those normal to it. The north- and northwesterly-trending faults are characterized by extensive mylonitization which is particularly common in unit 9. The magnitude of the movements along these faults is not known. The west boundary of the Ramah Group is a north-striking, west-dipping reverse fault. The Mugford Group is disrupted by north-striking faults so that faulting is in part post-Mugford Group and Ramah Group time. Wheeler (1964) reports that adamellite is thrust over part of the Siamarnekh Formation but this was not confirmed.

East-trending valleys in the southeast part of the map-area form conspicuous topographic features and are probably the loci of faults. The valleys themselves are chiefly filled with drift so that fault features, if any, are buried. In some places, such as at Tasisuak Lake, an offset is apparent on the contact between anorthosite and adamellite, but not between granulite and garnet-quartz-feldspar gneiss. It is tentatively suggested that these are relatively recent (that is post-adamellite) hinge-type faults with the axis of the hinge located near the west boundary of map-area 14 D.

ECONOMIC GEOLOGY

No economic mineral deposits are known in the area. The only economic mineral concentration observed consists of massive pyrrhotite in an ultrabasic boulder found on the west side of the largest ultrabasic pluton (unit 6) in map-area 24 H. Although obtained from a loose block this mineralized sample is undoubtedly of local origin. A spectrographic analysis in the laboratories of the Geological Survey shows the following results: Ni 0.30, Cu 0.20, Co 0.050, Ag <0.00070, Au and Pt not found.

Although no other mineralization was encountered, the Ramah and Mugford groups, because of their low metamorphic grade and diversity of rock types, are probably worthy of examination. The layering in the anorthosite suggests that this pluton is a layered body, in which case it is possible that the lower parts contain gravity-settled heavy metals. However,

present information has not permitted delineation of zones within the mass and hence the location of any such basal portion is unknown. It may be at depth. Chromite has been reported in the Kiglapait body (Morse, 1962) but not in economic amounts.

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