GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MEMOIR 333

PETROLOGICAL SCIENCES DIVISION

SNOWBIRD LAKE MAP-AREA, DISTRICT OF MACKENZIE

F. C. Taylor

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SNOWBIRD LAKE MAP-AREA, DISTRICT OF MACKENZIE

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By
F. C. Taylor

DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
CANADA

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PREFACE

Although much of the reconnaissance mapping in the Northwest Territories is now being done by large, helicopter-supported operations, some areas cannot reasonably be fitted into such a program. Until all such areas have been explored geologically, however, the economic potential of the region cannot properly be assessed. One such area is the subject of this report.

The reconnaissance has disclosed three distinct stratiform units, granitic rocks, and various basic intrusions, all involved in structures of considerable complexity. Some iron-formation is present.

J. M. HARRISON,
Director, Geological Survey of Canada

OTTAWA, September 6, 1962

Bericht 333—Kartenblatt Snowbird See, Mackenzie-Distrikt. Von F. C. Taylor.

Dieser Bericht beschreibt eine geologische Erkundungsaufnahme eines Gabietes des Kanadischen Schildes.

Мемуар 333. Геологическая карта. Лист озеро Сноубёрд района Мекензи.

Автор: Ф. К. Тейлор.

В отчете описывается маршрутная съёмка одного района канадского щита.

CONTENTS

	Page
Introduction	1
Location and accessibility	1
Physiography	1
Field work	2
Previous geological work	2
General geology	3
Table of formations	3
Sedimentary and volcanic rocks	4
Paragneiss and gneissic granite	7
Massive granitic rocks	9
Hurwitz Group	11
Basalt and diabase	13
Conglomerate	14
Amphibolite	15
Gabbro	16
Pleistocene and Recent	18
Structural geology	20
Folds	20
Faults	21
Economic geology	22
Bibliography	23

Illustrations

Map 1138A.		Snowbird Lake, District of Mackenzie, geology	*In pocket*
Plate	I.	Steeply dipping, well-bedded quartzite east of Snowbird Lake	4
	II.	Volcanic bomb in tuff northeast of Bourassa Lake	5
	III.	Contorted gneissic granite with basic inclusions northwest of Snowbird Lake	8
	IV.	Frost-heaved blocks of granite northwest of Snowbird Lake	10
	V.	Low-dipping, well-bedded quartzite of the Hurwitz Group	12
	VI.	Interbanded anorthosite and pyroxenite east of Snowbird Lake	17
Figure	1.	Glacial and post-glacial features in Snowbird Lake map-area	*Facing p. 18*

SNOWBIRD LAKE MAP-AREA, DISTRICT OF MACKENZIE

Abstract

A reconnaissance geological survey between latitude 60°00′ to 61°00′ and longitude 102°00′ to 104°00′ in the Churchill Province of the Canadian Shield disclosed the existence of three lithologically distinct units of stratiform rocks. The oldest of these, composed of intercalated greywacke, quartzite, and basic volcanic rocks, has been extensively metamorphosed, particularly in the west half of the area, to form paragneiss and gneissic granite. Granitic rocks, some of which are magmatic, vary greatly in texture and composition and more than one age is probably represented. The Hurwitz Group, confined to the area about Kasba Lake, consists of quartzite, limestone, dolomite, argillite, dacite, and andesite, and is probably younger than the above-mentioned rocks but nowhere adjoins them. Some massive granite near Kasba Lake may be younger than the Hurwitz Group. The youngest rock-unit—unmetamorphosed, flat-lying conglomerate and quartzite—in the Snowbird Lake basin probably lies unconformably on all other rock types.

Amphibolite, hornblendite, gabbro, pyroxenite, and anorthosite, of more than one age, occur sporadically throughout the map-area but none is known to be younger than the Hurwitz Group. Basalt and diabase dykes post-date all but the youngest sedimentary rocks.

The dominant structural trend is to the northeast but local deviations are common. In the south-central part of the area the oldest layered rocks form a large northeast-plunging syncline. The Hurwitz Group rocks form an asymmetrical syncline, with a vertical east limb. Southwest of Snowbird Lake a southward-plunging anticline and syncline are the chief structural elements in gneissic rocks. A major fault extends along the course of Striding River and the east side of Snowbird Lake where extensive mylonitization is prevalent. The southeast side of the fault may have moved southwest. Small faults are numerous east of Snowbird Lake.

Except for a few bands of iron-formation, no minerals of economic importance are known.

Résumé

Entre les parallèles 60° et 61° et les méridiens 102° à 104°, dans la province de Churchill du Bouclier canadien, une première étude géologique a révélé l'existence de trois unités lithologiquement distinctes de roches stratiformes. La plus ancienne des trois, composée de lits alternants de grauwacke, de quartzite et de roches volcaniques basiques, a subi un métamorphisme étendu, surtout dans la moitié ouest de la région étudiée, pour aboutir à du paragneiss et du granite gneissique. Les roches granitiques, dont certaines sont magmatiques, sont de texture et de composition extrêmement variables, et elles représentent probablement plusieurs âges. Le groupe Hurwitz, reconnu seulement aux environs du lac Kasba, se compose de quartzite, de calcaire, de dolomie, d'argilite, de dacite et d'andésite. Il est

probablement plus récent que les roches granitiques, mais il n'est nulle part en contact avec elles. Il se peut que le granite massif situé près du lac Kasba soit en partie plus récent que le groupe Hurwitz. Dans le bassin du lac Snowbird, du conglomérat et de la quartzite non métamorphisés et horizontaux constituent l'unité la plus récente et reposent probablement en discordance sur tous les autres types de roches.

Dans toute la région, il y a ça et là de l'amphibolite, de la hornblendite, du gabbro, de la pyroxénite et de l'anorthosite, datant de plus d'un âge, mais on sait qu'aucune de ces roches n'est plus récente que le groupe Hurwitz. Des dykes de basalte et de diabase sont plus jeunes que toutes les roches, sauf les roches sédimentaires les plus récentes.

Les structures s'orientent surtout vers le nord-est, mais dévient par endroits de cette direction. Dans le Centre-Sud de la région, les plus anciennes roches stratifiées forment un grand synclinal plongeant vers le nord-est. Les roches Hurwitz forment un synclinal asymétrique à flanc est vertical. Au sud-ouest du lac Snowbird, un anticlinal et un synclinal plongeant vers le sud sont les principaux éléments structuraux des roches gneissiques. Une grande faille longe la rivière Striding et borde le côté est du lac Snowbird où la plupart des roches sont largement mylonitisées. Il se peut que la lèvre sud-est de la faille se soit déplacée vers le sud-ouest. A l'est du lac, il y a nombre de petites failles.

Sauf quelques rubans ferrifères, on ne connaît pas de minéraux ayant une valeur marchande.

INTRODUCTION

Location and Accessibility

Snowbird Lake map-area extends from latitudes 60°00′ to 61°00′ and from longitudes 102°00′ to 104°00′ in the District of Mackenzie, encompassing almost 4,700 square miles. It lies 200 miles east-northeast of Uranium City, Saskatchewan, and 300 miles northwest of Churchill, Manitoba. Charter aircraft, provisions, and supplies are available at both centres. A canoe route to Dubawnt and Baker Lakes from Stony Rapids, Saskatchewan, 60 miles southwest, passes through the northwest part of the area via Wholdaia Lake. Within the map-area, Kasba, Snowbird, and Wholdaia Lakes, provide access to much of the country. A few streams—such as Striding River—and numerous closely spaced lakes allow access to most parts without undue hardship.

The area is uninhabited except for a few trappers in winter. Break-up commences in early June, and float-equipped aircraft may be used locally about mid-June. The largest lakes are commonly partly ice covered until late July. Snow occurs in the late summer and freeze-up starts in early October.

Physiography

The map-area is at the headwaters of three drainage areas; the east two-thirds lies in the Kazan River drainage system and most of the remainder is in the Dubawnt River system. Both river systems drain into Hudson Bay. A small part of the map-area in the southwest is drained by Striding River, which forms part of the Mackenzie River system. The divides are low, and intermixing of the three drainages probably occurs during periods of high water. None of the drainage is well developed and rapids are common on all streams.

The land surface, which is about 1,200 feet above sea-level, is slightly rolling and of low relief. Where outcrops are common steep-sided hills occur, but in most places glacial debris has filled the valleys. Local relief is probably at its maximum surrounding Kasba Lake where a few hills rise to 210 feet above the lake level. Outcrops are rare in large parts of the area as glacial and post-glacial deposits form an almost complete if not thick cover. This cover is particularly extensive around Kasba Lake, where outcrops are especially scarce. In a few places, notably in well-jointed rocks such as massive granite, large frost-heaved blocks form the only outcrops. Outcrops are common only in three areas: 12 miles west of Atzinging Lake, and along the north and east sides of Snowbird Lake.

The northeast third of the map-area is in the barrens where only scattered black spruce and willow grow in sheltered places. The rest of the map-area is

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lightly forested with black spruce, tamarack, and rare white birch and jackpine. Sufficient timber is locally available for construction of small cabins and for firewood.

Field Work

The field work was done between mid-June and mid-September in 1955. Pace and compass traverses were made on approximately 2-mile intervals except in drift-covered areas where traverses were selected so as to examine as much outcrop as possible. The examination of airphotos aided in delimiting outcrops within these drift-covered areas. Aeromagnetic maps, 1 inch to 1 mile, were used in the field to aid in planning traverses. Airphotos were used extensively for ground control of traverses, planning, and interpretation.

H. H. Bostock, G. Johnston, B. Rawson, D. Loveridge, and M. P. Anderson rendered capable assistance in the field. Bostock and Johnston were responsible for independent mapping of a large part of the area.

Previous Geological Work

Previous geological work was done by J. B. Tyrrell in 1893 and 1894. On the first of these expeditions (Tyrrell, 1898)[1] he reported "Laurentian" granite-gneisses on the shores of Wholdaia Lake (then known as Daly Lake) and at the headwaters of Dubawnt River. The following year he entered the southeast part of Kasba Lake by a series of portages from Little Partridge River and proceeded northward along the lake to Kazan River, which he followed farther north. During this brief second journey through the area Tyrrell recognized the existence of rocks younger than the Laurentian gneisses bordering Kasba Lake and classified then as Huronian.

In 1954 the Geological Survey of Canada carried out an airborne magnetometer survey of the map-area. An extreme positive magnetic anomaly (*see* p. 22) about 6 miles east of Atzinging Lake was disclosed (Map 218G, 1954). Sixteen aeromagnetic maps, 1 inch to 1 mile, have been issued covering the Snowbird Lake map-area.

The adjoining map-areas were mapped by Lord (1953) on the east, Wright (1957) on the north, Tremblay (1960) on the south, and Taylor (1959) on the west.

[1]Names and dates in parentheses are those of references cited in Bibliography.

GENERAL GEOLOGY

The entire map-area lies within the Churchill Province of the Canadian Shield (Gill, 1949; Wilson, 1949) and all the known bedrock is of Precambrian age.

The oldest rocks are still recognizable interbedded sedimentary and volcanic rocks. These rocks, particularly the sediments, have been metamorphosed to various degrees so as to form rocks mapped as paragneiss and in part gneissic granite. In fact, most of the area is composed of rocks derived from the metamorphism of the original sediments.

Granitic rocks of both magmatic and metamorphic origin are common. They vary greatly in texture and composition, and probably represent more than one age.

Table of Formations

Age	Group	Description
Pleistocene		Peat, patterned ground
		Unconformity
		Till, eskers, drumlinoid ridges, ribbed minor moraines, lake beaches
		Unconformity
Precambrian		Conglomerate, quartzite
		Unconformity (?)
		Basalt, diabase
		Intrusive contact
	Hurwitz Group	Quartzite, feldspathic quartzite, limestone, dolomite, argillite, dacite, andesite
		Granite, granodiorite, and allied rocks; probably of more than one age Gneissic granite and granodiorite, pegmatite Paragneiss: quartz-rich gneisses with variable amounts of biotite, hornblende, feldspar, garnet, and pyroxene; derived from the older rocks Interbedded volcanic and sedimentary rocks: basalt, tuff, greywacke, quartzite, iron-formation
		Relations not known[1]
		Amphibolite, hornblendite gabbro, quartz gabbro, pyroxenite, anorthosite

[1] More than one age represented; none known to be younger than the Hurwitz Group.

Rocks of the Hurwitz Group, including quartzite, carbonates, and small amounts of volcanic rock, possibly unconformably overlie the older layered rocks. These rocks are relatively fresh when compared with the older sedimentary rocks, and are possibly younger than most of the granites.

Gabbro, anorthosite, and amphibolite, probably of more than one age, are widely distributed throughout the map-area. Small, fresh diabase and basalt dykes are known to cut all pre-Hurwitz Group rocks and probably post-date that group also. A flat-lying conglomerate, in the Snowbird Lake Valley, is probably the youngest rock.

Pleistocene glacial and post-glacial deposits are widespread in extent and diverse in form.

Sedimentary and Volcanic Rocks (1 and 2)

The *sedimentary rocks* (1) consist of greywacke and quartzite occurring chiefly southeast of Snowbird Lake. The greywacke is a fine-grained, dark grey rock, composed of subrounded to rounded grains of quartz and feldspar with small amounts of secondary hornblende, chlorite, and biotite. Most of the greywacke shows a well-developed fine lamination but in a few outcrops the rock is massive. Only rarely is graded bedding discernible. Grain size of the detrital minerals averages 0.1 mm, with a few grains up to 0.4 mm long. Secondary minerals such as hornblende and biotite are mostly the same size as the detrital minerals but some are as large as 1 mm. Carbonate in the sedimentary rocks is probably secondary, as it is present in small amounts, chiefly as veinlets, and is most common in outcrops close to granite.

The quartzites are probably less extensive than the greywackes. They are light to dark grey, fine- to medium-grained rocks that locally show crossbedding and more rarely graded bedding. Only rarely are they massive. Small veins and

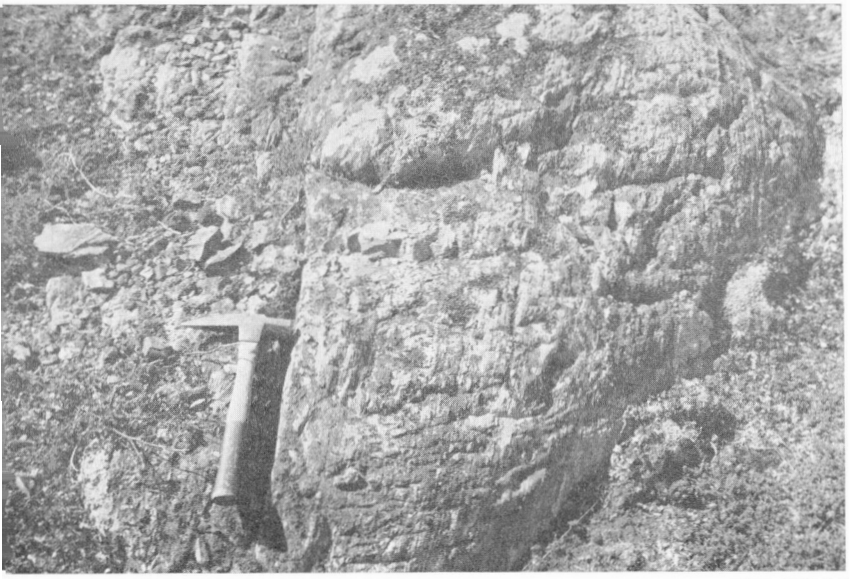

PLATE I

Steeply dipping, well-bedded quartzite (1) east of Snowbird Lake.

pods of quartz occur in many outcrops along joints and bedding planes. Quartzite, composed of subrounded quartz with small amounts of feldspar, commonly grades into greywacke. Biotite is present almost everywhere and tiny garnet crystals are common. Grain size averages 0.1 mm with a few grains up to 0.3 mm long.

A few beds of magnetite iron-formation are interlayered with quartzite and greywacke, none is more than 10 feet thick. All are low in iron content with the exception of a bed near Bourassa Lake represented solely by boulders. These boulders show much more magnetite than those elsewhere in the area (*see* p. 22).

The *volcanic rocks* (2) are chiefly exposed in the south-central part of the area and in the northeast corner. Although basalt forms most of these rocks, tuffs, laminated metavolcanic rocks, and hornblende-feldspar gneiss are also present.

Basalt flows range from 10 to 200 feet thick and average about 40 feet. In the area near Bourassa Lake, 3- to 6-foot beds of greywacke are interbedded with the flows, but comprise less than 10 per cent of the rock. Most of the basalt is massive but some flows display poorly developed pillows; others show scoriaceous tops and flow top breccias, with fragments up to 6 inches long. Only rarely are the vesicules filled, and where they are quartz is the sole mineral. However this may be only a surface feature. In the Atzinging-Obre-Barr Lakes area basalt commonly intrudes the greywacke at a low angle to the bedding planes. Thus some of the basalt is intrusive and may be feeders to the flows, but whether the basalt is of more than one age is not known. As some of the dykes (9) in the north-central part cut the granite, they are undoubtedly younger than most of the basalt to the south.

The basalt is fine grained, greenish black to greyish green, and consists of highly altered plagioclase, hornblende, and chlorite, with lesser amounts of epidote, quartz, biotite, sphene, and magnetite. A few grains of identifiable plagioclase are in the andesine range.

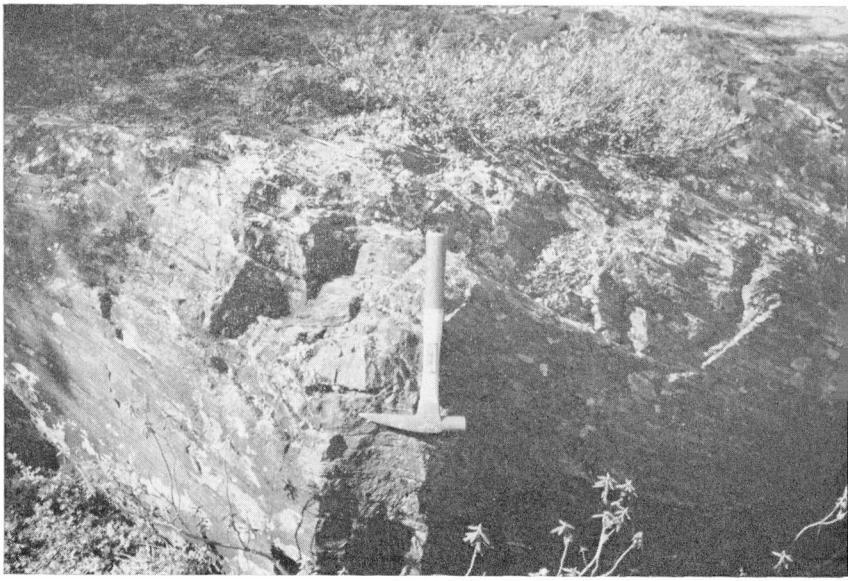

PLATE II

Volcanic bomb in tuff (2), 3 miles northeast of Bourassa Lake.

Associated with the flow rocks are grey to grey-green tuffs. Near Bourassa Lake these rocks are well bedded, rarely crossbedded, and contain a few volcanic bombs up to 7 inches long. As with the flow rocks, interbeds of sedimentary rocks are present. The dips of the tuffs are low near Bourassa Lake, whereas those of the other rocks in the area are much steeper, suggesting that the tuffs may be younger than the flow rocks and unconformably overlie them. However, sufficient structural evidence is not available to determine the relationship.

In the same area chlorite schist is developed in the volcanic rocks. This schist is probably the result of local low-angle shears rather than of regional metamorphism.

The tuffs are composed of about equal parts of plagioclase and green hornblende. The plagioclase is in the andesine-labradorite range and is chiefly cloudy and anhedral; the hornblende, in part subhedral, is largely altered to chlorite. Small amounts of sphene, biotite, magnetite, and pyrite are present.

Throughout the volcanic rocks in the south-central part of the map-area, laminated metavolcanic rocks show layers of hornblende and feldspar. Typically these are medium-grained with green and white to grey laminae ranging from one eighth to an inch thick. Locally aggregates of hornblende form knots up to 2 inches in diameter along the lamination planes. Rare primary structures present are scoriaceous tops. Mineralogically the laminated rocks are similar to the flow rocks and tuffs. The plagioclase is altered to epidote and sericite, and the hornblende to chlorite. A small amount of brown biotite is developed among the chlorite grains. Sphene, quartz, and magnetite occur as accessories.

The laminations in these rocks may have survived from a tuffaceous origin. However, similar rocks occurring in Manitoba, were considered by Harrison (1949, p. 33) and McGlynn (1959, p. 14) to be metamorphosed flow rocks. The laminations are the result of regional metamorphism that induced a concentration of crystallization centres of one mineral in particular layers to produce mineral banding. The presence of rare scoriaceous tops suggests that these laminated rocks are also derived from flow rocks.

Rocks mapped as hornblende-feldspar gneiss (2a), mineralogically similar to the volcanic rocks described above, form tabular bodies in the gneisses in the northwest part of the area. The only primary structures preserved are pillow-like structures in the hornblende-feldspar gneiss on the southeast side of Wholdaia Lake. These structures suggest that the rocks were derived from lavas. However, elsewhere they may be metamorphosed sills. In places the hornblende-feldspar gneiss grades into amphibolite and the division between these two rock types is arbitrarily set at 50 per cent hornblende. Small bodies of the latter rock commonly form boudins in the paragneiss.

The hornblende-feldspar gneiss is greenish black, fine to medium grained, equigranular, and weakly gneissic. The ratio of plagioclase and hornblende varies but in general is similar to that of the volcanic rocks. Garnet, quartz, and magnetite are present in small amounts.

Paragneiss and Gneissic Granite (4 and 5)

With an increase in the intensity of metamorphism the sedimentary rocks were transformed into paragneiss (4) and gneissic granite (5). The volcanic rocks (2) are probably represented within the gneissic terrain by hornblende-feldspar gneiss (2a) and amphibolite (A). In the western part of the area where there is a preponderance of gneiss of sedimentary origin volcanic rocks may have been less abundant. Metamorphism of the sedimentary rocks took place by a reconstitution of existing minerals and by the addition of soda and lesser amounts of potash. The addition of soda is probably the most important process.

Paragneiss and gneissic granite underlie most of the northwest half of the map-area in about equal proportions areally. In the same area small amounts of both rock types, too small to map separately, are common throughout many of the other rock-units. Gneissic granite is present in small amounts within the area chiefly underlain by sedimentary and volcanic rocks near Bourassa Lake and forms most of the extreme northeast corner of the area. Much of the paragneiss (4) consists of quartz-rich rocks with garnet, biotite, and hornblende the commonest minerals. These rocks can be traced into sedimentary rocks and were undoubtedly derived from them. The paragneiss is well banded, medium to coarse grained, medium to dark grey, and crystalline. The banding is probably a relict of the bedding in most places. An outcrop 7 miles west of Snowbird Lake has crossbedding preserved although the rock is now a coarse-grained biotite-quartz gneiss. In most places the banding is highly contorted and primary structures have been destroyed.

Small bodies of granite up to a few feet thick are present throughout the area shown as paragneiss. These occur in myriad shapes and sizes. The simplest forms are *lit-par-lit* injections, chiefly half an inch thick, or less, that follow the contorted banding of the gneiss. These individual bands of granite are commonly joined by irregular dykes of granite with serrated boundaries which contrast with the smooth boundaries of the bodies that parallel the gneissosity. In other places irregular patches of granite within the gneiss show no conformity with the enclosing rock.

The minerals in the paragneiss although highly variable in amounts from place to place, show a consistency in type. Quartz, plagioclase, biotite, and hornblende are the commonest. Garnet is abundant and smaller amounts of potash feldspar, muscovite, chlorite, epidote, magnetite, and hematite occur locally. Pyroxene occurs sporadically in the southwest part of the area where the metamorphic grade is probably higher than elsewhere. Rusty streaks, caused by the weathering of small amounts of pyrite, are a common phenomenon.

A common feature of the metamorphism is the development of feldspar in the paragneiss. Typically a few small porphyroblasts of feldspar form along bedding planes and eventually the feldspar content increases and grains coalesce to form a continuous streak of feldspar. As the number of porphyroblasts and streaks increases in concentration the rock becomes essentially feldspathized and as such includes most of the rock mapped as gneissic granite (5). Rocks showing the

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PLATE III. Contorted gneissic granite (5) with basic inclusions northwest of Snowbird Lake.

incipient stages have been mapped as paragneiss. Another type of feldspathization occurs where feldspar development is more dispersed so that grains of feldspar replace part of the sediments and eventually become an essential part of the rock. Hence much of the paragneiss is a biotite, or hornblende-feldspar-quartz, or quart-feldspar gneiss, and in part essentially indistinguishable from gneissic granite.

In many places, these gneissic granites (5) grade into paragneiss and sedimentary rocks. At the northwest end of Kasba Lake the feldspar content of the sedimentary rocks gradually increases until the rock becomes a medium-grained gneissic granodiorite in which the planes of foliation parallel the bedding of the sedimentary rocks. There red alkali feldspar occurs in granitoid bands up to 2 feet thick parallel to the bedding, and in one place crossbedding has survived the period of alkali introduction. The area of gneissic granite contains remnants of partly feldspathized quartzite and volcanic rocks that contain metacrysts of pink alkali feldspar up to ¼ inch long.

The gneissic granites are highly variegated in colour, texture, grain size, and mineral composition. Although primarily in shades of pink, some are grey, red, or white and in most places all colours are present within small areas. Rarely does one colour persist for very far either along or across strike. The gneissic texture is chiefly the results of the alignment of the mafic minerals, biotite or hornblende, but in places feldspar and quartz occur as distinct layers. Feldspar augen, sometimes as much as 2 inches long, is a common feature of these rocks. Locally, particularly along the east side of Snowbird Lake and southwest of the lake, mylonitization is prevalent. There too the rocks are darker (chiefly dark

red) than elsewhere, and ferromagnesian minerals are finer grained. Finely disseminated hematite and magnetite are common. Petrographically these rocks range from granite to quartz diorite but most are granodiorite.

Pegmatite phases are present but these are narrow, short, and irregularly shaped. None is well defined, and tourmaline, biotite, and muscovite are the only non-essential minerals.

Massive Granitic Rocks (6)

Many of the granitic rocks, particularly in the eastern third of the area, are texturally distinct from the gneissic granites in that they are predominantly massive. In places (indicated on the map by a foliation symbol) some rocks within areas shown as massive granite are foliated, chiefly as a result of biotite alignment. Similarly small plutons[1] of massive granite are present throughout much of the area underlain by gneissic granite (5) and paragneiss (4). Lenses, dykes, and sills of massive granite, up to 2 feet thick, are common in the gneissic granites northwest of Kasba Lake.

The massive granites are chiefly pink, rarely grey, and range from fine to coarse grained. Locally they are porphyritic. Mineralogically these rocks are similar to the gneissic granites. Granodiorite is probably the most abundant rock type, but potash feldspar is more common in the massive rocks than in the gneisses, so that more of them fall into the granite class.

The massive granites of the Kasba Lake area are in the form of a batholith composed of three distinguishable rock types: a fine- to medium-grained, grey to pink, foliated type; a fine- to medium-grained, pink-red, massive type; and a pink, coarse-grained porphyritic type. The first type is confined to the west shore of Kasba Lake but extends from the south border of the area northward to the large peninsula west of Gothe Island. This rock is well jointed with three sets of joints chiefly: strike north, dip vertical; strike east, dip vertical; and horizontal. Locally a few orthoclase grains, up to one quarter of an inch, occur as augens. Pegmatite dykes and veins, of at least two ages and up to 4 feet thick, are common locally. The foliated granite consists primarily of orthoclase and quartz with small amounts of plagioclase and microcline. Biotite occurs in most places. The quartz is commonly restricted to particular horizons and accordingly imparts a foliate quality to the rock. A well-defined contact of this foliated rock with the fine- to medium-grained massive granite is present on the large peninsula west of Gothe Island, but this contact provides no evidence as to the respective ages of the two components. However, some of the massive granite occurs in sill-like bodies, 6 inches to 2 feet thick, parallel with the foliation, suggesting a possible younger age for the massive rock.

The fine- to medium-grained massive granite is found chiefly on the east side of Kasba Lake. Lesser amounts occur with the foliated rock on the large peninsula west of Gothe Island. Prominent joint attitudes are N35°E, dip vertical,

[1]The terms pluton, batholith, stock, sill, and dyke are used in a descriptive sense only, with no genetic implications.

and N55°W with steep dips both north and south. This granite is composed of colourless quartz, locally with blue cores, 55 per cent orthoclase, and 15 per cent sodic plagioclase. Biotite, the commonest accessory, rarely exceeds 5 per cent. On the east side of Kasba Lake this rock contains only small amounts of plagioclase and commonly is slightly porphyritic with rare ¼-inch orthoclase grains and a few quartz grains up to one eighth of an inch. On the west side of the lake the rock is equigranular with more plagioclase and colourless quartz.

The porphyritic granite occurs only on the east side of Kasba Lake in the southernmost outcrops. Joints are prominent and result in large blocks of loose rock. Common joint attitudes are: N30°E, dip 15 to 30°E; N30°E, dip vertical; and N50° to 60°W, dip 65°SW to vertical. A few aplite dykes up to 8 inches thick strike east. The porphyritic granite is composed of about 15 per cent blue quartz, commonly with clear rims, 10 per cent brown biotite, a small amount of pale cream plagioclase. Pink orthoclase phenocrysts, up to 1 inch long, form the bulk of the rock.

Lord (1953, p. 7; unit 8) suggested that the porphyritic granite may be younger than the other granites, as evidenced by an imperfectly exposed contact southeast of Ennadai Lake, east of the map-area. There, porphyritic granite possibly cuts early Proterozoic quartzite (the Hurwitz Group), and therefore may be of late early Proterozoic age. No corroborating evidence occurs in Snowbird Lake map-area, as the contact between the porphyritic granite and the sedimentary rocks of the Hurwitz Group is not exposed. The only suggestion of this relationship is a few alkali feldspar veins in Hurwitz Group rocks on an island near

F.C.T., 1955-3-5

PLATE IV. Frost-heaved blocks of granite (6), 5 miles northwest of north end of Snowbird Lake.

the outlet of Kasba Lake. The occurrence of a few feldspar phenocrysts in the massive granite in close proximity to the coarse-grained porphyritic granite on the east side of Kasba Lake suggests a single age for these rocks. If Lord's interpretation is correct, all the granite on the east side of Kasba Lake and the massive granite on the west side is younger than the Hurwitz Group. The age of the foliated rock with respect to the Hurwitz Group remains unknown. Stockwell (pers. com.) sampled a granite body south of Ennadai Lake (Lord, 1953; unit 8) which has been dated at 1,800 m.y. A similar age is suggested for the rocks on the east side of Kasba Lake. The massive granite on the west is probably also of the same age.

Numerous granite stocks in the northwest two thirds of the map-area are chiefly pink, but locally grey or more rarely white. They are fine to medium grained, equigranular and massive to gneissic. Biotite or hornblende or both are the chief accessory minerals, with biotite being the most common. Most stocks are poorly outlined due to the dearth of outcrops. Elsewhere the granites grade into granite-gneiss.

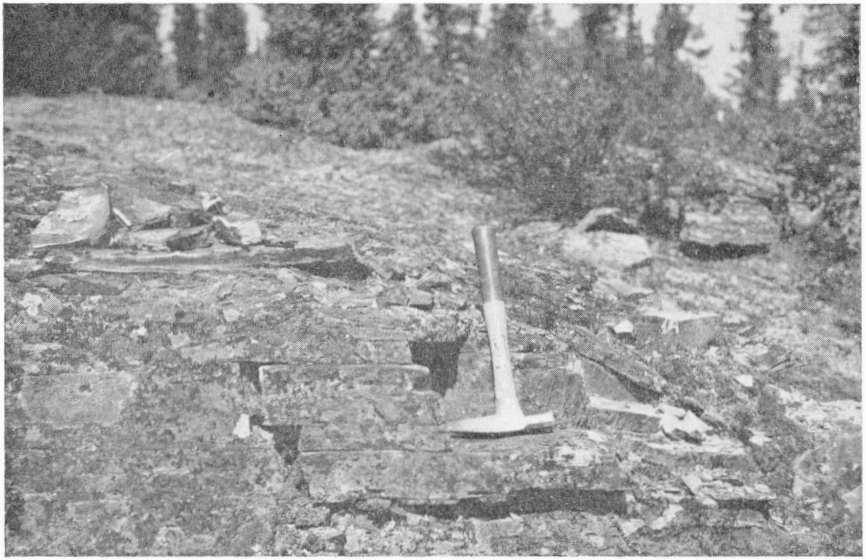
The granite stock west of Kakoot Lake is a poorly zoned pluton with a medium-grained, equigranular margin and a porphyritic centre. Hornblende is the only ferromagnesian mineral in this pale pink body. The core of this pluton shows somewhat less quartz than the marginal areas and in places approaches a syenite in composition.

Hurwitz Group (7 and 8)

In Snowbird Lake map-area rocks of the Hurwitz Group were first examined by Tyrrell (1898, p. 121F). At Kasba Lake he recorded the presence of limestone and quartzite, that he called Huronian, indicating that he considered these rocks to be younger than the rocks that he called Laurentian. Lord (1953) recognized, but did not name, a mappable unit in the southern District of Keewatin consisting of white quartzite and associated greywacke, conglomerate, impure quartzite, dolomite, limestone, and sedimentary schist. He assigned these rocks to the early Proterozoic, as they are similar to others lying unconformably on Archaean rocks. They form part of the east shore of Kasba Lake in Lord's map-area. Wright (1955, p. 6) named these rocks the Hurwitz Group when he traced them northward into central Keewatin.

Scattered outcrops of quartzite, feldspathic quartzite, limestone, dolomite, argillite, dacite, and andesite border much of Kasba Lake. The quartzite and feldspathic quartzite (8) are the most abundant on both the east and west sides of the lake. Numerous boulders of quartzite are present on the east side of Kasba Lake east of Gothe Island, and south of the granite mass, although no outcrops are exposed. Most of the southern half of Kasba Lake is probably underlain by rocks of this unit.

Quartzite is the most widespread rock type of this group. It is a fine- to medium-grained, dark grey to light grey, rarely white, rock which is thin bedded



F.C.T., 1955-1-8

PLATE V. Low-dipping, well-bedded quartzite of the Hurwitz Group (8), on the mainland 2 miles west of Kai Island.

to massive. Biotite is common in the thin-bedded rock but rare in the massive beds. Locally conglomerate containing quartz pebbles up to half an inch long is interbedded with the quartzite. On the northeast side of Kasba Lake, northeast of Simons Island, small amounts of limestone are intercalated with the quartzite and in some places the carbonate has weathered away leaving elongate pockmarks on the surface. Thin beds of dark grey argillite are interlayered with the quartzite in a few outcrops. Elsewhere quartzite grades into feldspathic quartzite containing up to 20 per cent subrounded feldspar grains. Quartz grains average 0.1 mm, and are as much as 0.8 mm long. Garnet, pyrite, and intergranular chlorite are common constituents.

Interbedded with the quartzite on Kai Island are minor amounts of limestone and dolomite. Most of these carbonate rocks in which bedding is poorly preserved are contorted and brecciated with fragments up to 2 feet in diameter. Both the limestone and dolomite are traversed by irregular quartz veins which commonly project above weathered surfaces. The limestone is a light to dark grey, fine- to medium-grained, crystalline rock which is poorly bedded to massive. The dolomite is a fine-grained, grey to white, massive rock characterized by reddish brown weathered surfaces. Both carbonates contain approximately 15 per cent of rounded quartz grains averaging 0.08 mm in diameter, rare grains of plagioclase, and a few pyrite crystals, that are probably of diagenetic origin. On the east side of Kai Island radiating crystals of tremolite are common in limestone breccia.

On the mainland, west of White Partridge Island, medium grey, thin-bedded subgreywacke is the dominant rock type. Crossbedding and graded bedding occur

locally. White quartzite is interbedded with the subgreywackes and a few quartz lenses parallel the bedding in some areas.

Numerous small faults strike N25°E in an outcrop of thin-bedded micaceous quartzite on the small island near the outlet of Kasba Lake. Associated drag-folds indicate that the east side moved north with respect to west. Veins of pink alkali feldspar and quartz occur along the fault planes, and epidote masses up to 1 inch thick occur as saddles in the crests and troughs of the drag-folds.

On the northeast side of Kasba Lake andesite and dacite flows (7), about 30 feet thick, are intercalated with the quartzite. Most flows have vesicular tops with vesicules locally calcite filled and up to 1½ inches long. The rock is aphanitic but contains scattered tiny magnetite octahedra up to 1 mm in diameter. Most flows are dark greenish grey although slightly lighter shades predominate in the vesicular zones. Thin sections show these rocks to consist of a fine-grained, weakly foliated aggregate of chlorite, clinozoisite, epidote, amphibole, quartz, and feldspar.

On the mainland west of Kai Island similar schistose and brecciated basic volcanic rocks are interbedded with feldspathic biotite quartzite. There, tiny carbonate veinlets and irregular shaped, narrow quartz veins are characteristic. These are probably associated with a shear that strikes southeast across the peninsula on the north end of the outcrop area.

In Snowbird Lake map-area the only visible contact involving Hurwitz Group rocks is a fault. The volcanic rocks (7) interbedded with quartzites on the northeast and southwest side of Kasba Lake could be Archaean and if so the quartzites in those areas are Archaean also. However, both Lord (1953, p. 3) and Wright (1955, p. 6) stated that greenstones show several relationships to the Hurwitz Group, in that they underlie it, are interlayered with, and overlie it in several widely separated localities. Thus some of the volcanic rocks are probably Proterozoic.

South of Snowbird Lake map-area Tremblay (1960) regarded fresh sedimentary rocks—similar to those of the Hurwitz Group—as relatively unmetamorphosed or ungranitized parts of the Archaean succession. However, as rocks of the Hurwitz Group are lithologically distinct from the sedimentary rocks in the west part of this map-area, they are regarded as younger, until additional evidence is obtained to warrant including them in the Archaean.

Basalt and Diabase (9)

The youngest intrusive rocks, common west of Snowbird Lake but rare elsewhere, are diabase and basalt dykes, only a few of which are shown on the accompanying map. Few of the dykes are more than 50 feet thick, and none is known to be of great length. Most trend northwesterly but some trend northeasterly. They cut all rock-units older than the Hurwitz Group but their age relative to that group could not be determined within the map-area. Lord (1953, p. 8) reported that similar dykes intrude quartzites of the Hurwitz Group, and this relationship is consequently assumed in Snowbird Lake map-area. These

dykes are chiefly fine-grained, dark green to black basalt. They are composed of fresh, fine-grained labradorite, augite, and small amounts of magnetite, with scattered subhedral labradorite and augite phenocrysts. Medium-grained diabase is common in the central zones of the larger dykes.

Conglomerate (10)

Nearly flat lying conglomerate with an arkose matrix and minor quartzite outcrop on an island in Snowbird Lake and in a single exposure north of the lake. These are probably outcrops of the youngest rocks in the area, but as both outcrops are isolated from other rock-units, the age and the areal extent of these rocks are inferred. Two feet of grey quartzite overlies the conglomerate north of Snowbird Lake but does not occur elsewhere. Boulders of pale brown to red arkose with small amounts of maroon shale cover many of the islands in the north half of Snowbird Lake and probably represent the underlying bedrock. South of Bourassa Lake a few arkose boulders are present in the till but the bedrock there is not arkose. The total thickness of unit 10 is unknown but it is probably not great, as the unit is confined to the depressed area in which the lake lies.

The arkose boulders near Bourassa Lake are composed of angular to rounded grains of quartz, pale red, more rarely white feldspar, and granitic rock fragments averaging 1 mm in length. The shale parts contain a few feldspar and quartz grains similar to those in the arkose.

The conglomerate consists of well-rounded pebbles and cobbles averaging 1 inch but as much as 6 inches in their greatest dimension. These consist of gneissic granite, white quartzite, quartz, and rare basic rocks. The matrix is coarse-grained, pale red to greyish red arkose. A few streaks of very dark red shale are present with a random distribution.

The stratigraphic position of these rocks, which are nowhere in contact with any others, can only be surmised. Coarse clastic rocks are not known anywhere in the immediate area. The Athabasca Formation is 125 miles southwest and Nonacho Group rocks 240 miles west-northwest; both of these are too far away for direct correlation. Conglomerates from Dubawnt Lake described by Lord (1953) and Wright (1955) are similar in some respects to these rocks; nevertheless, Wright (oral com.) regarded samples as not typical of the Dubawnt Group rocks although in places similar rocks are present in that group. Another possible correlative exists at Nicholson Lake, 110 miles north of the map-area, where highly weathered conglomerate is associated with Ordovician limestone (Wright, 1957, p. 15).

The presence of ripple-marks, mud-cracks and crossbedding suggests shallow-water deposition, and the large size of some of the fragments suggests deposition close to the source. Hence these rocks may be locally developed. As they are flat lying or close to it, show no signs of metamorphism, and are not intruded by any diabase or basalt dykes, they are assumed to be the youngest rocks in the area.

Amphibolite (A)

The rocks mapped as amphibolite (A) consist of metamorphic rocks with more than 50 per cent hornblende and the remainder chiefly plagioclase. A few rocks with no feldspar are included in this unit. In part they grade into hornblende-feldspar gneiss (2a) and some of these rocks could be and probably are placed in the hornblende-feldspar gneiss group.

Most of the amphibolites are greyish black to greenish black, medium grained, with well-formed hornblende and feldspar. Although much of the amphibolite is massive, many bodies show a gneissic or more rarely schistose texture, particularly along their margins. Reddish brown garnet crystals up to one quarter inch in diameter are a common constituent. Quartz occurs sporadically.

A few outcrops of coarse-grained, greenish black amphibolite occur along the west side of the peninsula 4 miles west of Kai Island. This rock is massive for the most part but a distinct foliation striking N40°W and dipping 45 to 70°SW is visible at both the north and south ends of the outcrop area. In the centre of the body a 10-foot wide, sill-like body of light brown weathering, dark greenish grey pyroxenite strikes N60°W and dips vertically. This rock is slightly coarser grained than the amphibolite. A few grains of white weathering plagioclase are visible at the northernmost outcrop of amphibolite but were not seen elsewhere.

At the south end of the outcrop area the amphibolite is cut by a strong shear; strike N70°W, dip 45°S. Slickensides suggest that the north side moved down and to the east with respect to the south side. This amphibolite consists almost entirely of subhedral actinolitic hornblende. Although pyroxene is not present, faint pyroxene crystal outlines are visible and the rock may have been a pyroxenite originally. A few tiny grains of plagioclase, muscovite, pyrrhotite, pyrite, chalcopyrite, and magnetite occur interstitially, but comprise less than 3 per cent of the rock.

The large amphibolite body east of Sherwood Lake is a complex mass containing many inclusions of rocks characteristic of the paragneiss (4) and throughout shows considerable variation in the relative percentage of hornblende and feldspar. Garnet is probably more abundant along the western side than elsewhere in this body. Along the eastern part of the southern limit serpentinized olivine forms part of the rock. There, the amphibole is tremolite and feldspar is absent. Whereas the olivine is completely serpentinized and minute veinlets of serpentine occur throughout the rock, the amphibole is unaltered. The diversity of the amphibolite within this body suggests a complex history.

The amphibolite northeast of Bourassa Lake is chiefly massive but in part shows weak banding due to slight differences in plagioclase content. This greenish black amphibolite consists of subhedral ¼-inch hornblende grains in a matrix of fine-grained hornblende and plagioclase. Although it occurs in an isolated outcrop, the banding parallels that in the volcanic rocks (2) to the south and probably it is a sill-like body.

The petrogenesis of the amphibolites is open to controversy. The meagre information available suggests that the amphibolites of Snowbird Lake map-area are derived in diverse manners, but the small amounts or total absence of quartz suggests that most of it had a basic igneous source.

Gabbro (B)

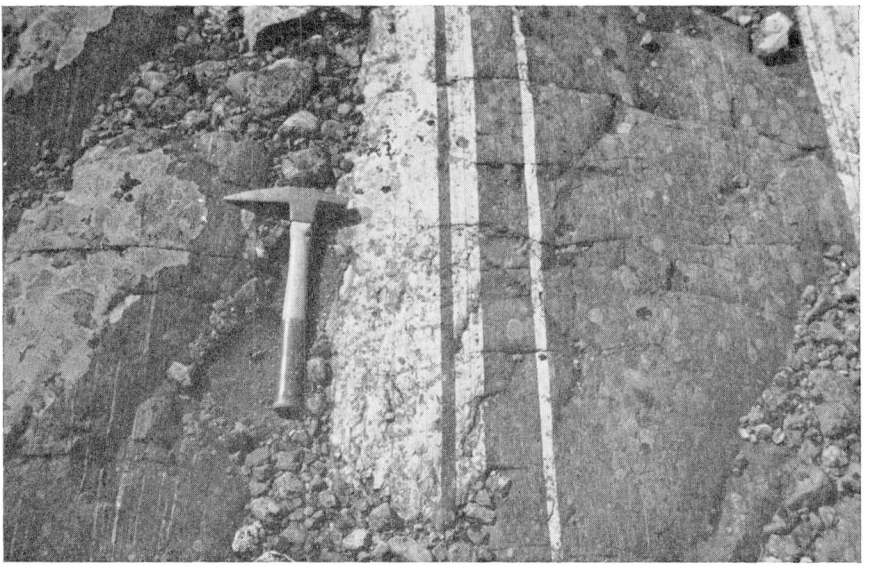
Rocks of gabbroic composition occur in several parts of the map-area. The size of individual bodies ranges from small tabular dykes and sills to plutons a couple of miles long. In general all are similar in that they are medium-grained, massive to gneissic, dark grey-green to dark green rocks. Hornblende, biotite, and chlorite are the most common mafic constituents. Locally they are quartz gabbros. More than one age is probable as relationships with other rock types are diverse.

The gabbro stocks west and north-northwest of Linklater Lake are chiefly medium- to coarse-grained, dark greenish grey to greenish black, massive rocks with abundant hornblende. A weak foliation occurs in the finer grained parts of the northern stock and also in a pyroxene-bearing zone in the other pluton. Quartz is common in the southern part of the stock west of Linklater Lake and there also the rock tends toward a diorite composition.

These two stocks show different relationships with the granitic rocks. Pink gneissic granite (5) intrudes the northernmost stock and this pluton is probably pre-granite. On the other hand the gabbro west of Linklater Lake is chilled against pink to grey gneissic granite (5) along a contact that shows an intertonguing of the two rocks. On the east side of this stock, gabbro dykes are intrusive into the massive granite (6). Therefore, the pluton west of Linklater Lake is possibly younger than the massive granite (6).

The elongate plutons 4 miles east of Snowbird Lake are complex masses composed of anorthosite, pyroxenite, and fine-grained pyroxene gabbro. Typically anorthosite and pyroxenite are interbanded, the bands ranging from one quarter inch to 6 feet thick. These bands maintain a constant thickness for several tens of feet. However, in a few places pyroxenite bands join, form lenses and die out by interfingering with the anorthosite. All these contacts are sharp but microscopically a slight mixing of minerals across contacts is discernible. In places the pyroxenite is the dominant rock type but elsewhere anorthosite predominates so that on the whole pyroxenite and anorthosite are probably equally abundant.

Numerous small faults, normal to the banding show left-hand strike separations of as much as 6 feet and much of the rock is brecciated. Associated with the anorthosite and pyroxenite is finer grained, medium dark grey gabbro. The relationship of this gabbro to the anorthosite-pyroxenite rock is not known; mineralogically it is similar to the bulk composition of the banded rock and may have had the same source. Garnet is present in most of the rock, brown hornblende in the pyroxenite and rare tiny grains of pyrite and magnetite in



F.C.T., 1955-2-7

PLATE VI. Interbanded anorthosite and pyroxenite (B), 4 miles east of Snowbird Lake.

the pyroxenite and gabbro. The age of these gabbroic rocks is not known as contacts are covered. The gabbro is structurally conformable with the sedimentary rocks on the west side suggesting that it is probably a sill-like intrusion. Although granite occurs nearby, no relationship was discovered.

The gabbro pluton on the east side of Dehoux Bay and two others, one 7 miles west and another 16 miles southwest of the bay, show some similarities and may be related. A large part of each pluton consists of a light grey to white weathering brecciated leucocratic gabbro. Selected samples of each could be classified as anorthosite. The plagioclase is primarily fine grained but is in part coarse grained, particularly at Dehoux Bay. A weak foliation trends easterly to northeasterly. Small amounts of chlorite, pyroxene, garnet, and quartz in order of decreasing abundance, are present in each. Tiny calcite veins transect the leucogabbro in the pluton to the southwest of Dehoux Bay. The same body is strongly fractured at N40°E and N20°W, with small displacements chiefly to the south and east. These fractures are particularly noticeable where dark coloured finer grained garnet-bearing gabbro forms sills or dykes in the leucocratic gabbro. Some basalt occurs on the southern end of this stock.

The Dehoux Bay stock is fine to medium grained on the north end, with texture ranging from aphanitic to diabasic. No evidence as to relative age of these rocks was available. Brecciation suggests post-consolidation movements in these areas and may be related to the fault along the east side of Snowbird Lake.

A mile south of Jenne Lake medium-grained, pyroxene-hornblende gabbro is traversed by a few randomly oriented bands of hornblende and plagioclase crystals up to 1½ inches long. These are possibly a late stage cooling phenomenon.

The gabbro in the Lone Lake area is a dark grey to dark green, medium- to coarse-grained rock that commonly shows mineral banding. A few irregular patches of basalt occur locally. Hornblende is present throughout, and locally biotite, garnet, and quartz are also present. Relationships with other rocks are indefinite except where the gabbro shows chilled contacts with granite (6). Within the gabbro, granite fills fractures and forms lenses. Pegmatite patches occur here and there. An interbanding of granite and gabbro is apparent in places and alkali feldspar locally permeates the gabbro. Contacts with the paragneiss (4) are gradational and concordant. Granite is commonly more mafic close to gabbro. The contradictory relationship between the granite and the gabbro in this area suggests either that two ages of gabbro or granite are represented or that the relationship is the result of selective granitization of sedimentary rocks after the emplacement of the gabbro.

Pleistocene and Recent

Glacial striae, ice polish, and friction cracks indicate that the map-area was glaciated by an ice-sheet moving southwestward. The direction of glacial striae ranges from S30° to 80°W, and averages S50°W (*see* Fig. 1).

Glacial and proglacial deposits are common. Till covers much of the area and consists of loosely packed gravels containing many boulders derived primarily from the underlying bedrock. Clay-sized particles are scarce. Drumlinoid ridges, prominent in much of the till-covered area, are up to about 60 feet high and range from half a mile to a mile long.

Ribbed minor moraines up to 1,500 feet long and 500 feet wide are common, particularly in the vicinity of Obre Lake. They form steep-sided ridges consisting of coarse gravels and boulders up to several feet in diameter. Most are normal or roughly normal to the direction of ice flow but some show no preferred orientation.

Numerous eskers form prominent features and extend as much as 32 miles with only minor breaks. Most of the longest eskers trend southwest or south-southwest approximately parallel with the direction of ice movement. Some eskers coalesce or branch and many have outwash sands along the flanks and on their southwestern ends.

The hills bordering Kasba Lake are characterized by abandoned lake beaches attesting to the occurrence of a glacial lake in this area. Lee (1959) named this Pleistocene lake, at its maximum extent, glacial Lake Kazan. The highest strand line in the Snowbird Lake map-area, barometrically measured, is 160 feet above the present level of Kasba Lake (elev. 1,093; Lee, 1959) or 1,253 feet above sea-level. Lee gives 1,260 feet above sea-level for the highest strand lines in the adjoining map-area (op. cit., p. 15).

In places eight strand lines are present between the topmost line and the present lake level. Some of the hills formed islands in Lake Kazan as strand lines completely encircle them.

Although prominent on airphotos, the beaches are difficult to recognize on the ground as most are only slight swells on the hillsides. Vegetation changes from spruce to willow make the beaches more discernible; those examined consisted of medium- to coarse-grained sand.

The areal extent of glacial Lake Kazan in Snowbird Lake map-area is unknown. Strand lines are rare west of Klokol Lake and the western limit of Lake Kazan is probably in that area. A few strand lines occur on islands in Obre Lake and between Atzinging and Obre Lakes but these may belong to a lake more local in character. Lake Kazan extended southward into Saskatchewan, as strand lines are present 24 miles west of Kasba Lake at the provincial boundary. The northern limit probably is not more than 10 miles north of Kasba Lake as no evidence of farther northward extension was found. Abandoned beaches also occur northwest of Snowbird Lake, on the large peninsula in Sherwood Lake, and 10 miles southeast of the northwest corner of the map-area. These are probably not part of the glacial Lake Kazan development. No bottom deposits of glacial Lake Kazan were identified and the lake bottom area is chiefly ground moraine.

Numerous deposits of peat have been formed, particularly north and northwest of Snowbird Lake, in post-glacial time. Accumulation must have been rapid as deposits up to 15 feet thick are visible in some cut-banks along lake shores. Polygons, 40 to 60 feet in diameter, are developed in some of the peat-covered areas. The interpolygon areas are V-shaped depressions 3 to 4 feet deep and 8 to 10 feet wide. The surface of the polygons is covered with low vegetation which contrasts with the peat-covered interpolygon areas. Polygons are visible on airphotos of the area north of Snowbird Lake and east of Sherwood Lake.

Permafrost is present throughout the area; most swamps thaw about 6 to 12 inches in summer.

STRUCTURAL GEOLOGY

Rock structures in most of the area trend northeast; in the northeast part an eastward trend is prominent in some of the gneisses and the volcanic rocks. The Hurwitz Group rocks trend northward on the west side of Kasba Lake whereas on the northeast side they follow the regional trend. The plunge of the folds is uncertain but in most places is probably shallow.

Top determinations are scarce as primary structures, such as crossbedding, grain gradation, and pillows, have for the most part been destroyed. Hence the structure in most of the area is known only in the broadest outline. Foliation and gneissosity probably coincide with the trend of the original structures; in places bedding can be traced into gneissosity. Except where produced by faulting, schistosity probably also parallels the primary layering.

Folds

The most prominent and largest fold is a syncline in the oldest sedimentary and volcanic rocks (1 and 2) in the south-central part of the area. There top determinations, more common and uniformly oriented than elsewhere in the area, suggest a great thickness of rocks. The small syncline to the northeast of Bourassa Lake is possibly a large drag-fold associated with the major structure, and as such indicates the major fold plunges to the northeast about 30 degrees. Corroborating evidence is present in some of the rocks in the vicinity of Bourassa Lake where drag-folds plunge to the north between 10 and 20 degrees. However, in the same area some drag-folding is complex and its relation to the major structure is unknown.

With the exception of the incompetent carbonates, the Hurwitz Group rocks (7 and 8) on the west side of Kasba Lake, face and dip gently eastward. Rocks on the east side of the lake (Lord, 1953) show vertical dips and strike northward. These attitudes suggest that an asymmetrical syncline with a vertical east limb underlies the southern end of Kasba Lake. Drag-folds are common in some of the Hurwitz Group sedimentary rocks but most of these are related to small cross faults. However, where faults are unknown, some drag-folds show plunges of 20 to 30 degrees at N30°E. These may be related to the syncline. On the other hand the Hurwitz Group rocks on the northeast side of the lake show tops to the southeast. These rocks may form part of the same syncline, and if so, a southward plunge is more probable.

Folding in the gneisses is most prominent southwest of Snowbird Lake where a large southward-plunging anticline and syncline form the chief structural element. The structure is probably more complex than shown but the scarcity of outcrops prevents the recognition of more than the major outline. Several folds are recognizable in the west-central part of the map-area particularly west of Snowbird Lake

and southeast of Wholdaia Lake. However, a large area of gneiss in the southwest shows consistent dips to the west. There, isoclinal folding is possible.

Faults

The most important fault in the map-area extends from along the east side of Snowbird Lake southwestward along the course of Striding River. Rocks are extensively mylonitized along the northeast side of Snowbird Lake and there the fault probably occupies a zone of considerable width. Mylonitization is also prevalent along the course of Striding River but there the zone is narrow. It is not known whether the fault extends to the southwest corner of the map-area. No indication of a fault is shown in the area to the southwest (Furnival, 1939). The easterly trend of the sedimentary and volcanic rocks (1, 2, and 3) west of Obre Lake may be the result of drag along this fault. If so, a movement of the southeast side of the fault toward the southwest is indicated.

The preservation of the conglomerate (10) in and north of Snowbird Lake is possibly the result of movement along this fault. Two possibilities exist with respect to the age relationship between the fault and the conglomerate. The conglomerate may once have covered a large area, a small part of which has been preserved from erosion by a downward movement along the fault. The fault would then be post-conglomerate and the youngest structural feature of the area. On the other hand the fault may pre-date the conglomerate, which could have been deposited along the down-dropped side of the fault. In either case a downward movement of the northwest side of the fault is suggested. It is probable that the movement was in general the southeast side upward and to the southwest.

Parallel with this fault and 6 miles to the southeast, another large longitudinal fault may lie along the course of the small river that flows northeastward into Atzinging Lake. A dearth of outcrop in this area prevents the establishment of this structure with certainty but a prominent linear is visible on aeromagnetic maps. Rocks to the west of this linear are in general more intensely metamorphosed than those to the east.

To the northeast of Snowbird Lake numerous well-defined linears, probably the sites of faults, are visible on airphotos. On the ground, local shearing is present along some of these linears but in most places overburden covers the low-lying ground.

ECONOMIC GEOLOGY

The area has not been thoroughly prospected, and its remoteness and the scarcity of outcrops make prospecting difficult and costly. However, much of it is worthy of the prospector's attention.

Gold is known to be present at Ennadai Lake, east of the map-area (Lord, 1953, p. 9), in the same band of volcanic rocks that extends westward through Rochon Lake. Several rust zones examined in the sedimentary rocks, paragneiss, and amphibolite, showed disseminated pyrite and rarely arsenopyrite, and intensive prospecting might disclose ore minerals.

Report of a magnetic anomaly east of Atzinging Lake (Map 218G, 1954) led to the staking of several claims in this area. A few boulders of banded magnetite iron-formation in this drift-covered area suggest that the magnetic high is due to this type of rock. A concentration of a non-representative sample (Jenkins, 1954) showed the magnetite to be extremely fine grained, with the grains averaging 10 microns in diameter but with many smaller. A quantitative analysis of a head sample of approximately 14 mesh showed the following:

	%
Total iron	39.38
Soluble iron	39.29
Nickel	0.02
Manganese	0.05
Sulphur	0.037
Phosphorus	0.085
Silica	33.7
Insoluble	38.1
Titanium dioxide	None detected

Analysts: A. M. C. U. Upton, F. W. Brethour, R. A. Smith, Mines Branch, Dept. of Mines and Tech. Surveys.

Tests showed that a grind of 200 mesh would be required to produce a concentrate of 60 per cent iron or better. Silica content was sufficiently high that the concentrate would require blending with a low silica content concentrate.

Several narrow bands of iron-formation occur elsewhere within the oldest sedimentary rocks and the paragneiss, but none is considered to have economic importance.

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