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TONNANCOURT - HOLMES MAP-AREA, ABITIBI COUNTY

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Department of Mines

Honourable Jonathan ROBINSON, Minister

A.-O. DUFRESNE, Deputy Minister

DIVISION OF GEOLOGICAL SURVEYS

I. W. JONES, *Chief*

GEOLOGICAL REPORT 24

TONNANCOURT-HOLMES MAP-AREA

ABITIBI COUNTY

by

W. W. Longley.



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1946



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ABITIBI COUNTY

by W. Warren Longley

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MAP AND ILLUSTRATIONS

Map No.604.-Tonnancourt-Holmes map-area (in pocket)

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- Plate I.-Strangway rapids, Bell river; also showing the flat-lying, tree-covered nature of the western part of the map-area.
- Plate II.-South central part of Holmes township, showing rock exposures and uneven topography characteristic of central part of map-area. The lakes occupy depressions which are controlled by northeasterly trending structural features.
- Plate III.-Esker-formed islands, south end of Cuvillier lake.
- Plate IV.-Quartz-diorite hill, northeast corner of Holmes township. The winding Kiask river lies just north of the map-area. The concentric pattern on bare rock is believed to represent beach zones of glacial-lake Ojibway.
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TONNANCOURT-HOLMES MAP-AREA

ABITIBI COUNTY

by W. Warren Longley

INTRODUCTION

Location of Area

The Tonnancourt-Holmes map-area is about thirty-five miles north of the town of Senneterre, Abitibi county. It includes, from east to west, Cuvillier, Holmes, and Tonnancourt townships, and the eastern part of Laas township, a total area of rather more than 300 square miles. The northern boundary is one mile north of the forty-ninth parallel, and the area extends from longitude 77°10', a short distance west of Bell river, eastward to about a mile beyond longitude 76°30'.

Means of Access

Bell river affords a good canoe route to the area from Senneterre. The only portage necessary at most seasons of the year is along the three-mile stretch of the river extending southward from near the mouth of Taschereau river, which enters the Bell near the southwest corner of the map-area. This portage now forms a branch of the Rose Lake road and may be travelled by truck.

The Rose Lake road, which is intended eventually to join Senneterre and Rose lake (25 miles north of the map-area), passes through the western part of the area, on the west side of Bell river. The section of the road northward from the upper end of the three-mile portage is gravelled and is in fair condition for motor travel. The section from Senneterre to the portage is at present only a winter road.

The central and eastern parts of the area may be reached from Bell river by way of Cuvillier river, Holmes lake, and Cuvillier lake. There are twelve portages along Cuvillier river up to Holmes lake and six along that part of the river east of this lake. Nearly all of them are short, and on most of them the footing is good. The longest portage downstream from Holmes lake is slightly more than half a mile long, and there are two others of nearly half a mile and four of about a quarter of a mile. On that part of the river between Holmes and Cuvillier lakes, the two longest portages are each about a quarter of a mile.

Robin river, which empties into the northeastern end of Parent lake about six miles south of the southwest corner of Holmes township, offers an optional route into either Cuvillier lake or Holmes lake via Bell river from Senneterre.

Although there are several lakes in the area they provide few suitable landing surfaces for aeroplanes.

Method of Field-Work

The field work on which this report and the accompanying geological map are based was carried out during the summer of 1940. Land traverses were run systematically by pace and compass at intervals of approximately half a mile. The greater number of these were in a north-south direction so as to cross the structural trend of the rock formations, which is predominantly east-west.

Acknowledgments

The base-map upon which the geology of the area was plotted was compiled from maps and plans supplied by the Bureau of Geology and Topography, Ottawa, and the Department of Lands and Forests, Quebec. Some changes were made as a result of surveys by the writer. Vertical aerial photographs, taken by the Royal Canadian Air Force for the preparation of the base-map, were of great assistance in the field and in the preparation of the geological map.

The field party consisted of R.M. Sternberg and Josaphat Gilbert, assistants; P.E. Gonthier, cook; and Paul Blondin and Aimé Imbeault, canoeemen. All discharged their duties in a satisfactory manner.

The writer wishes to express his appreciation to Radio Operator C.M. Conway, of Dominion Skyways, for his services in relaying messages, and also to Inspector Alcide Comeau, of the Quebec Forest Ranger Service, and his assistants, who rendered many favours.

Description of Area

Topography and Drainage

The section of the area which extends along Bell river and the lower part of Cuvillier river is flat and, in places, is poorly drained. As indicated on the accompanying map, however, even this flat part of the area is relatively free of swamp ground. It includes the portion of Laas township which was mapped, and all but the southeastern quarter of Tonnancourt township.

Numerous knolls and ridges feature the remainder of the area. The largest of these, 'Moose mountain', located in the southeastern part of Tonnancourt township, is two miles long and its crest rises about four hundred and fifty feet above the surrounding terrain. A group of prominent hills extend eastward near the northern boundary of the area, in the western part of Cuvillier and the eastern part of Holmes township.

With the exception of the hill in the northeastern corner of Holmes township, which is formed of quartz diorite, the more prominent hills and ridges are composed of greenstone. Rock exposures are abundant in the hilly central and eastern parts of the area, but there are few outcrops in the flat, western section.

Bell river drains the western part of the area. The greater part of the central and eastern section of the area also drains into Bell river by way of Cuvillier lake and river, and Holmes lake.

Timber, Fish, and Game

The greater part of Holmes township and considerable portions of Tonnancourt and Cuvillier have been ravaged by recent forest fires. There are good stands of spruce and jackpine, with some fir and occasional small groves of birch, in Laas and Tonnancourt townships. Scattered areas of spruce, with some birch, occur in Holmes, and spruce and fir cover large tracts in the northwestern and southeastern parts of Cuvillier township and around Cuvillier lake.

Pike and pickerel abound in all the lakes and slow streams. Speckled brook-trout are plentiful in the swifter streams and in several of the rapids along Cuvillier river.

Some recent beaver work was observed. A number of muskrats were seen but only few rabbits, and there was little evidence of the presence of other fur-bearing animals. Moose were seen on many occasions. Partridge and duck are fairly abundant.

Previous Work

With the exception of a narrow strip along Bell river, the lower part of Cuvillier river, and the northern margin of the map-area, little geological mapping had been done in the area prior to the present study. There has, however, been a considerable amount of prospecting in the northern part of Laas township, and in Tonnancourt, especially in the immediate vicinity of Cuvillier river (west of Holmes lake). Some prospecting has been done also in Holmes and Cuvillier townships.

Areas adjoining the present map-area on the south (2), north (8 and 9), and east (7) have been geologically mapped in recent years. The reports on these areas, and other reports relating to nearby areas, are listed below.

Bibliography

- (1) AUGER, P.E., Lower Laflamme River Area, Abitibi District, Western Section; Que. Bur. Mines, Geol. Rept. No.2, 1939.
- (2) BANNERMAN, H.M., Josselin-Delestre Map-Area, Abitibi County; Que. Bur. Mines, Ann. Rept., Pt.C, 1935.
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- (8) LONGLEY, W.W., Grevet (Kamshigama) Map-Area, Abitibi District;
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- (10) MACKENZIE, G.S., Pusticamica Lake Map-Area, Abitibi District;
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Que. Bur. Mines, Ann. Rept., Pt.B, 1935.

GENERAL GEOLOGY

General Statement

In Laas township and the northern and western parts of Tonnancourt, bed-rock is almost everywhere concealed beneath a heavy coat of till and glacial clays. In the southeastern part of Tonnancourt, and over the greater part of Holmes and Cuvillier, rock exposures are abundant, chiefly on the many ridges and knolls which characterize this central and eastern part of the map-area.

The consolidated rocks of the area are all of Precambrian age. Fully two-thirds of the area is underlain by granite, diorite, and related intrusive rocks. Greenstones (that is, volcanic rocks with probably some of sedimentary origin), occupy the northern part of Laas township and the greater part of Tonnancourt. In Holmes township, they are restricted to narrow bands near the northern and southern boundaries of the township, but they have a wider development to the east, in Cuvillier township.

At least two large dykes of gabbro are exposed intermittently across the area, one extending southwestward from the northeast corner of Tonnancourt township and the other, also trending southwestward, from the north-central part of Holmes township to Moose mountain, in the southeast corner of Tonnancourt.

Table of Formations

Quaternary	Pleistocene and Recent	Till, glacial lake silts, eskers
Great unconformity		
Precambrian	Post-Keewatin Intrusives	Gabbro dykes (Keweenaw?)
		<u>Tonnancourt Quartz Monzonite</u> : biotite-quartz monzonite
		<u>Cedar Rapids Granite</u> : biotite granite
		<u>Strangway Granite</u> : hornblende-biotite granite
		<u>Wilson Granite</u> : gneissic hornblende-biotite granite
		<u>Holmes Gneiss</u> : biotite-quartz diorite gneiss; coarse-grained massive quartz-diorite
	<u>Josselin Gneiss</u> : biotite-quartz diorite gneiss	
	Keewatin (?)	Massive, ellipsoidal, and fragmental flows and tuffs, amphibolite, some interbedded sediments(?)

Keewatin (?) Volcanic and Sedimentary Rocks

The volcanic (with some possibly sedimentary) rocks of the area resemble rocks which, elsewhere in the Canadian Shield, have been classified as Keewatin in age. In view of this resemblance, they are here also assumed to be Keewatin.

Distribution

Keewatin-like rocks, or 'greenstones', underlie about one-third of the map-area. These rocks extend across the northern three and a half miles of Laas township and continue eastward across Tonnancourt, at or near whose eastern boundary they are cut off by a body of intrusive gneiss. They form part of a large body of greenstone that extends for twenty-six miles northward, to Rose

lake (1). A lobe of this body, bounded on the west and east by granitic rocks, continues southward through Tonnancourt township and beyond into Josselin (2). It has a general width of some five or six miles, but it is cut almost completely through by a wedge-shaped body of quartz monzonite which projects into it on its eastern side, about a mile north of the south township line. A part of the same greenstone body that extends southward from Tonnancourt township into Josselin also projects into the southwest corner of the map-area. From the southeast corner of Tonnancourt, a narrow band of the greenstone extends eastward for about eighteen miles, across the southern parts of Holmes and Cuvillier townships, almost as far as the eastern boundary of the map-area. It is from one to two miles north of the south township line and has quartz diorite gneiss to north and south of it. The irregular south margin of the large body of greenstone north of the map-area projects for a short distance into Holmes township and, to the east, a tongue from this body enters Cuvillier township and, forking, continues as a band trending east-southeast which passes completely across the township, and as a narrower band that extends southward to the southern end of Cuvillier lake where it joins the long narrow east-west band of greenstone which crosses the southern part of the map-area. In the southeastern part of Holmes township and the west-central part of Cuvillier there are two small bands of greenstone lying within diorite gneiss. Small inclusions of greenstone are common in the gneisses. The foliation of these inclusions parallels that of the gneiss, and they are more highly metamorphosed than the rock of the main greenstone bodies.

Massive and Ellipsoidal Lavas

The greenstones in Laas and Tonnancourt townships consist predominantly of massive flows with interbedded ellipsoidal lava and banded tuffs. Coarser fragmental beds are present in minor amount. The massive and ellipsoidal lavas are highly altered, but examination of thin sections indicates that, originally, they were of andesitic composition. In the majority of exposures examined, the ellipsoidal lavas are little distorted, and there has been little shearing in either the ellipsoidal or massive lavas.

Good exposures of ellipsoidal lava were observed in the vicinity of Kiask falls, northern Tonnancourt and Laas townships; in the northeastern part of Holmes township; and in the northwestern part of Cuvillier township. In the last named locality there is slight local shearing and sulphide mineralization in the pillow lavas and associated fragmental material. Shearing and sulphide mineralization was also observed in pillow lavas at Kiask falls, and on a hill about two miles southeast of the falls.

The extreme southwestern corner of the map-area is occupied by greenstone which is part of a body that extends for a considerable distance to the south. The portion included within the area consists of well banded chlorite-hornblende schists and massive lavas which, in places, are considerably altered and silicified.

Basic Intrusives (?)

At several places in Tonnancourt township, patches of amphibolite were observed within the greenstone. The rock is medium to coarse grained and consists essentially of chlorite, 'uralite', hornblende, and epidote, with some plagioclase and quartz. In some

- (1) LONGLEY, W.W., Que. Bur. Mines, Ann. Rept., 1936, Pt. B, pp. 66-68; Geol. Rept. No. 2, 1939, pp. 25-26.
- (2) BANNERMAN, H.M., Que. Bur. Mines, Ann. Rept., 1935, Pt. C, pp. 10-13.

of these occurrences, the rock has been rendered schistose, but in others it is massive and the outlines of the original ferromagnesian crystals are discernable. These are short and stubby, strongly suggesting that they were pyroxene rather than hornblende. In one such occurrence, the massive amphibolite was seen to grade into medium grained dioritic rock, which appeared to be intrusive into the greenstone. On the basis of this evidence, it is thought that these patches of amphibolite represent small bodies of basic rock that were intruded into the greenstone flow rocks, with, probably, no great time interval separating the two igneous episodes. The amphibolite is definitely older than the folding.

Tuffaceous and Fragmental Lavas

The best exposures of tuffaceous and fragmental lavas are in the southern part of the area, especially in Tonnancourt township and it is possible that some of the quartz-hornblende schists in the same belt, in the southern part of Holmes, also represent rocks that were originally tuffaceous lavas. In places, all exposures for distances as great as half a mile across the strike are finely banded rock, either tuffs or fine grained sediments, and probably form an interbedded series of tuffs and sediments.

Good exposures of tuff and fragmental lava interbedded with ellipsoidal and massive lava also occur at and west of Kiask falls. The tuffs and fragmental lava in this vicinity have been considerably sheared and altered along some zones, in places to such an extent that fissile sericite-chlorite schists have resulted. These zones have been carbonatized and also somewhat mineralized with disseminated pyrite.

Good exposures of a fine-grained laminated greenstone, interbedded with ellipsoidal lava, were seen in the northwestern part of Cuvillier township. This finely laminated greenstone, some of which has been mapped as quartz-hornblende schist, probably consists in part of tuffaceous material, and in part of clastic sedimentary material.

Sedimentary(?) Rocks

The narrow bands of greenstone in Holmes and Cuvillier townships consist for the most part of well banded, fine grained, quartz-hornblende schists, especially in their eastern parts, where recrystallization has been more complete than elsewhere. The typical schist consists of hornblende, with quartz (20 to 60 per cent), and a small amount of plagioclase. Occasionally, biotite also is present.

Usually, other types of 'greenstone' are interbedded with the quartz-hornblende schists. In the narrow greenstone band that extends eastward from Moose mountain across the southern part of Holmes and Cuvillier townships, such interbeds consist of finely laminated, very fine grained material, probably recrystallized tuff; and the band trending east-southeast across the northern part of Cuvillier township includes, in addition to quartz-hornblende schist, considerable amounts of pillow lava, finely banded tuffaceous material, and very fine grained hornblende schist.

In northern Holmes and Cuvillier townships, most of the exposures of quartz-hornblende schist lie south of the ellipsoidal lavas. As the shapes of the pillows in these lavas indicate that the tops of the flows face southward, the schists are presumably overlying, and younger than, the lavas. They are possibly of late Keewatin or of Temiscamian age.

The quartz and feldspar in the schist are in small regular grains that fit compactly together when they are abundant, but do not interlock or interpenetrate. In places, scattered quartz grains, with apparently random orientation, occur as inclusions within hornblende grains. The schist has a well defined parallel banding, due to variations in the relative amounts of hornblende and quartz in adjacent layers. Individual bands range in width from about one-sixteenth of an inch to one inch, and contacts between the bands are sharp.

The evidence strongly suggests that these schists are of sedimentary origin, and that in all probability they represent impure, fine-grained, calcareous sandstones. As noted, however, they are interbedded with tuffaceous material and lavas and, in all cases observed, they are in close proximity to intrusive rocks. Thus, it is possible that they have been produced by metamorphism of banded tuffs. However, the writer is of the opinion that successive layers in beds of tuff would not exhibit such variations in composition, nor have such sharply defined boundaries, as are characteristic of the quartz-hornblende schist.

At one locality, nearly a mile east of the long southern arm of Holmes lake, the contact between the schist and the Holmes gneiss is well exposed for a distance of about eight feet. Several 'leaves' of the schist are separated slightly (not more than three feet) from the main body of schist by a tongue of the gneiss. The 'leaves' are not more than two inches thick and apparently they extend beyond the limits of the exposure. They show no visible sign of more extreme contact action than the main body of the schist, and they are not corroded.

In the vicinity of the central and southern part of Cuvillier lake, metamorphism of the greenstone has been exceptionally intense. Certain hornblende gneiss here are of somewhat doubtful origin. Since, however, the intrusive gneisses of the area are biotite gneisses, it is concluded that these hornblende gneisses represent the final stage in the metamorphism of the greenstone. In general, such rocks exhibit banding, but the parallel orientation of the constituent mineral grains is poorly developed in contrast to the well defined foliation of the intrusive gneisses.

Post-Keewatin Intrusives

Intrusive rocks occupy the greater part of the area examined. They underlie about nine-tenths of the area of Holmes township, three-quarters of Cuvillier, one-third of Tonnancourt, and a large part of Laas.

These rocks are all intrusive into the greenstone and hence are post-Keewatin in age. If, as appears possible, the presumed sedimentary rocks (quartz-hornblende schists), which in places occur within the greenstone bands, are of Temiscamian age, some at least of the intrusive rocks must be post-Temiscamian. This would be in accord with what has been found in other parts of the Canadian Shield in this general region, where the intrusive granitic rocks cut sediments that are thought to be of Temiscamian age.

The intrusive rocks within the present area include a variety of granitic and closely related types, and contact and cutting relationships between the several bodies show that they are not all of identical age. Field evidence is lacking to determine with certainty their order of intrusion, but tentatively they are here classified in six groups, as indicated in the table of formations on page 7. Evidence for this age classification is summarized below.



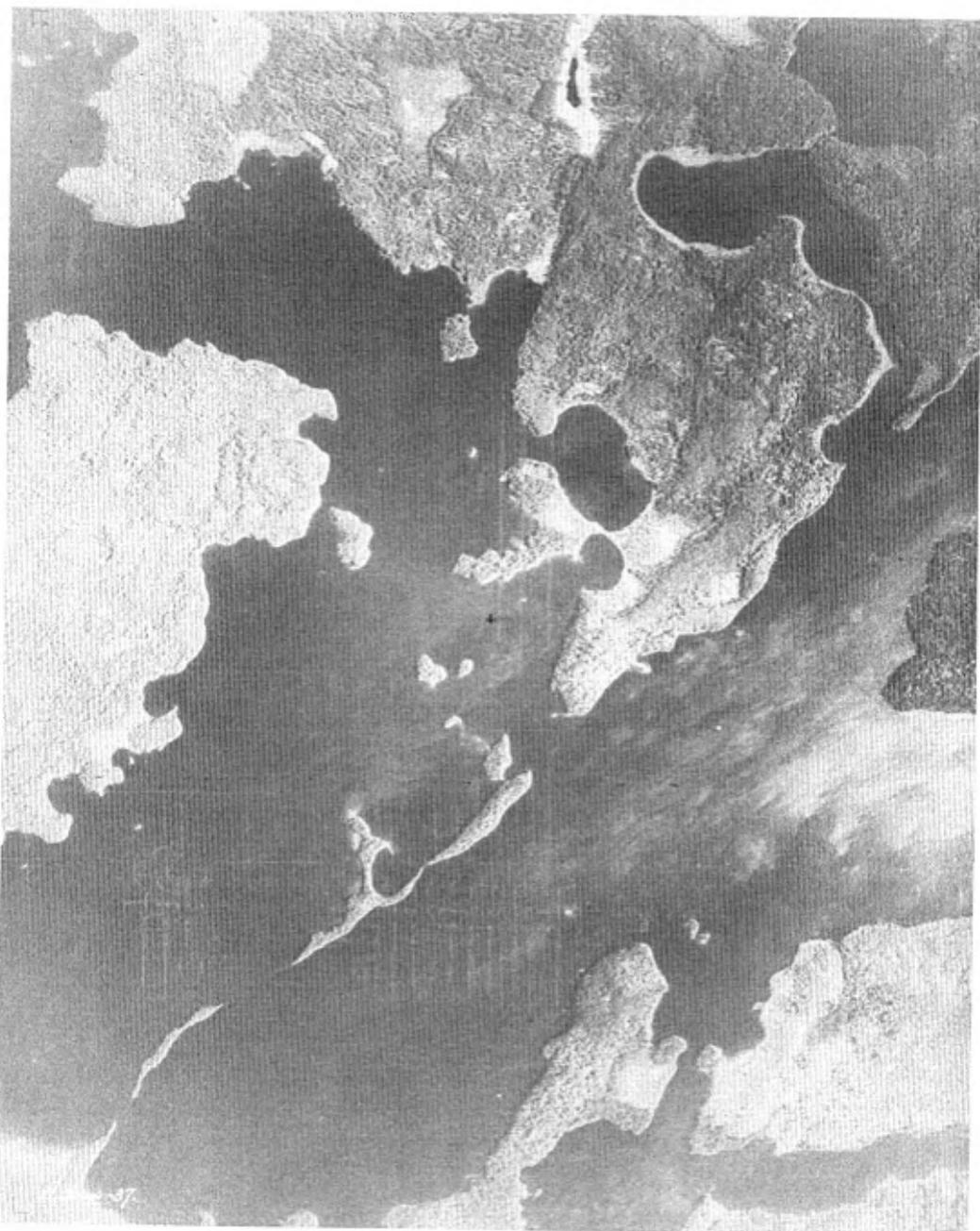
(C.A.R.C., photo A 4971-13)

Strangway rapids, Bell river; also showing the flat-lying, tree-covered nature of the western part of the map-area.



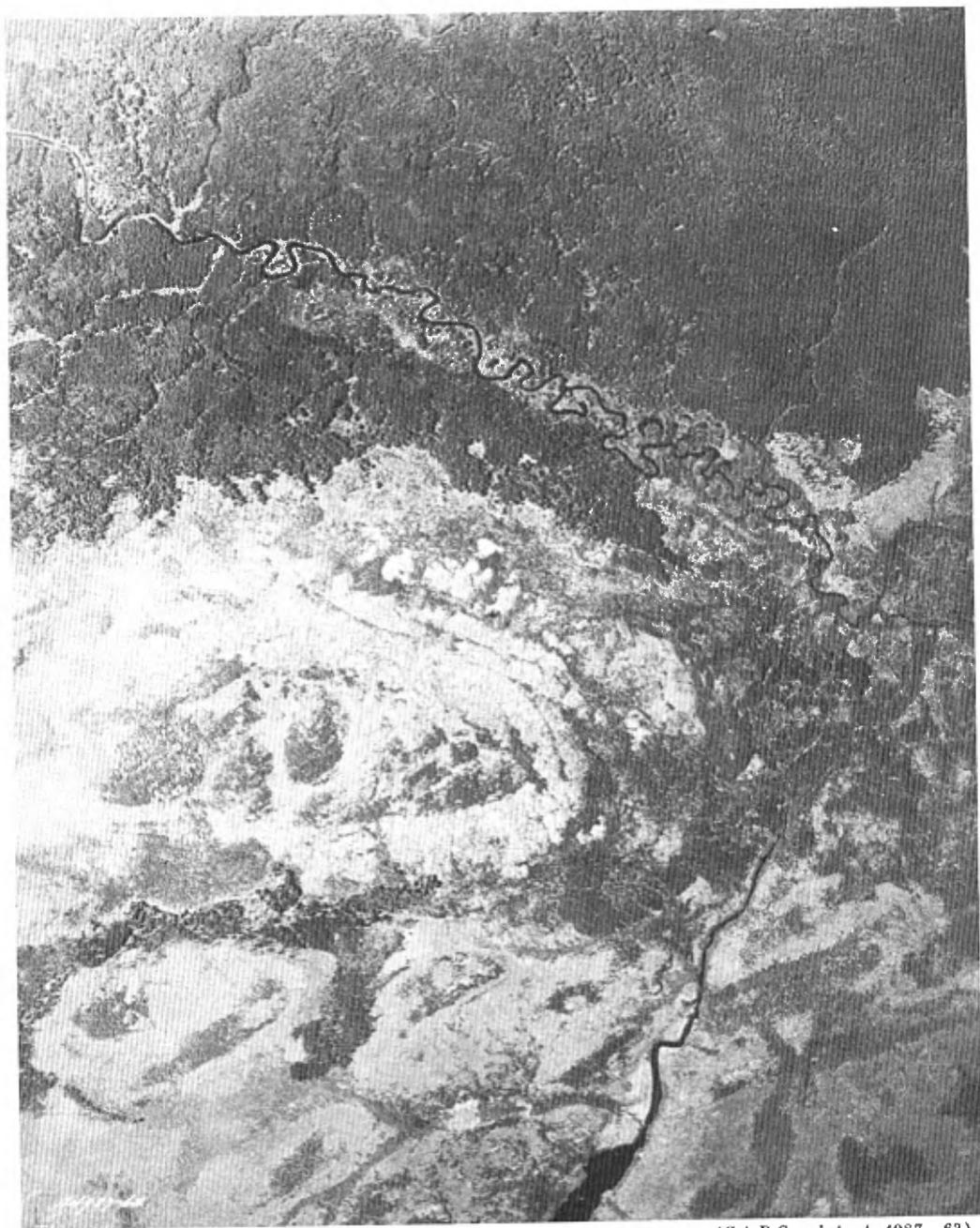
(C.A.R.C., photo A 5004—21)

South-central part of Holmes township, showing rock exposures and uneven topography characteristic of central part of map-area. The lakes occupy depressions which are controlled by northeasterly trending structural features.



(C.A.R.C., photo A 5004-37)

Esker-formed islands, south end of Cuvillier lake.



(C.A.R.C., photo A 4987-63)

Quartz-diorite hill, northeast corner of Holmes township. The winding Klask river lies just north of the map-area. The concentric pattern on bare rock is believed to represent beach zones of glacial-lake Ojibway.

A narrow strip adjacent to the southern boundary of Holmes and Cuvillier townships is occupied by medium grained grey to pink gneiss, the northern margin of a body of that rock that extends southward into Robin and Lecompte townships, and southwestward into Josselin and Delestre townships (1). It will be referred to here as the Josselin gneiss. It appears to be much more altered than the other intrusives of the area, and it also contains a greater number of pegmatite and aplite dykes. For these reasons the writer has assumed it to be the oldest intrusive body of the area.

The greater part of Holmes township is occupied by quartz diorite gneiss, the western end of a body of this rock that continues eastward across the central part of Cuvillier township. It is here named the Holmes gneiss. It may be the extension northward of the Josselin gneiss, but the rock is much fresher in appearance, is cut by fewer dykes, and is more basic in composition. It has a strongly developed mylonitic schistosity, in view of which it is assumed to be older than the non-foliated intrusives discussed below.

Toward the eastern end of this body, in Cuvillier township, outcrops of granite were observed that resemble the rock (Wilson granite) in the northeastern corner of the area, and several dykes of this granite were seen cutting the gneiss. It is believed that the contact between the Holmes gneiss and the main body of the Wilson granite must lie near the eastern border of Cuvillier township.

The granite in the northeastern corner of Cuvillier township is rather fine grained, somewhat schistose, and considerably altered. This body extends to the east (2) and north (3) for considerable distances. It was first described in Wilson township, which adjoins Cuvillier on the north, and it is here named the Wilson granite. As already noted, dykes of the Wilson granite were seen cutting Holmes gneiss in Cuvillier township. It is believed to be older than the massive intrusive rocks, described below, because of its altered and schistose character.

One small, massive, intrusive body lies wholly within the map-area, and portions of two others extend into the area. Evidence concerning the age relations of these to one another, or to the several gneissoid bodies already discussed, is meagre or lacking.

One of these bodies, thought to be the oldest of them, enters the map-area from the west and south and occupies an area some 6 by 7 miles in Laas and Tonnancourt townships. The rock, a hornblende-biotite granite, is well exposed along Strangway rapids, on Bell river, and it is here referred to as the Strangway granite.

The southern margin of a small stock of biotite granite (4) projects into the map-area at its northwest corner, where it occupies an area about 3 by 1½ miles in Laas township. This has been named the Cedar Rapids granite, after the rapids on Bell river, just north of the map-area, which are near the eastern side of the stock.

(1) BANNERMAN, H.M., Que. Bur. Mines, Ann. Rept., 1935, Pt.C, p.14.

(2) FAIRBAIRN, H.W., Que. Bur. Mines, P.R. No.151, 1940.

(3) LONGLEY, W.W., Que. Bur. Mines, Ann. Rept., 1936, Pt.B, p.69.

(4) LONGLEY, W.W., Que. Bur. Mines, Geol. Rept. No.2, 1939, pp.27-28.

The third of these massive intrusive bodies, and probably the youngest of them, lies wholly in Tonnancourt township, with its eastern border approximately at the township line. It is named after the township in which it occurs. The rock is quartz monzonite. Dykes, believed to be offshoots of this body, cut the Holmes gneiss. In composition, the quartz monzonite is more closely related to the Holmes gneiss than to any of the other intrusive rocks of the area but it is not believed to be a part of the gneiss body because of its intrusive relationship and because it is not schistose.

Josselin Gneiss

The Josselin gneiss underlies a strip adjacent to the southern boundary of the area. It extends eastward across Holmes and Cuvillier townships, gradually increasing in width to about one and three-quarter miles. The gneiss is cut by many dykes, chiefly of pegmatite and aplite.

This body of gneiss probably extends for a considerable distance to the south and southwest. The writer is of the opinion that it is the northward extension of the body described by Bannerman (1) in the eastern parts of Josselin and Delestre townships, immediately south of the map-area.

The rock is medium to fine grained in texture and grey to pink in colour. It has a well-developed schistose structure and in places has a definite banded appearance. Only one thin section of the rock was examined. It contained about 30 per cent quartz, 15 per cent biotite, and 50 per cent calcic oligoclase, with sericite and epidote as alteration products. A gneissoid rock of this composition should be classified as a biotite-quartz diorite gneiss, but, in general, as viewed in hand specimens, the rock could be termed a biotite granite gneiss. It is possible that the gneiss described below as the Holmes gneiss is a part of the same body.

Holmes Gneiss

A body of biotite-quartz diorite gneiss occupies the major part of Holmes township and extends, with a width decreasing from 6 miles to $3\frac{1}{2}$ miles, across Cuvillier. Near the central part of the latter township, its continuity is interrupted by the southerly trending strip of greenstone, about half a mile wide, referred to on an earlier page. There is a strong tendency for the schistosity of the diorite to parallel contacts with the surrounding greenstone. Thus, at the western end of the body it trends slightly east of north, with dip to the west, but in the central and eastern parts it has a direction slightly south of east, with northward dip. The dip is steeper in the southern part of the body than in the northern part.

The rock is medium grained and of a light grey colour. An abundance of glassy quartz and black mica are conspicuous features. In the central part of Cuvillier township and south of Kiask lake (in the northwest corner of the township), the gneiss is much coarser grained than elsewhere.

Typical specimens of the gneiss were found to contain calcic oligoclase (50 per cent), quartz (30 per cent), and biotite (10 per cent). A small amount of microcline and orthoclase was noted in some of the thin sections examined. Secondary epidote and sericite are present, and zircon is a common accessory mineral.

(1) Que. Bur. Mines, Ann. Rept., 1935, Pt. C, p.14.

In the northeastern corner of Holmes township, an area $2\frac{1}{2}$ miles long and one mile wide is occupied by a very coarse grained quartz diorite which is only faintly gneissoid. This may represent a later intrusion than the main body of gneiss.

Wilson Granite

The northeastern corner of Cuvillier township is underlain by gneissic granite, part of a body of such rock that extends to the east and north for a considerable distance. It has been described by the writer as a "gneissic hornblende-biotite granite" (1), although, owing to the lack of potash feldspars, it may be more appropriately termed a soda-granite.

The rock usually exhibits a gneissic structure. It is medium to fine grained in texture and is usually light pink in colour. It is composed essentially of quartz, sodic plagioclase, and microcline; with small amounts of hornblende and biotite. The plagioclase has undergone considerable alteration, and the microcline is probably of secondary origin. Epidote is a common secondary mineral and often occurs as a filling in minute fissures andmiarolitic cavities.

Many dykes, similar in all respects to the Wilson granite, cut the Holmes gneiss in the central and southern parts of Cuvillier township, and in the east-central part of this township there are numerous outcrops within the area mapped as Holmes gneiss which are probably Wilson granite. This would indicate that the Holmes gneiss is the older body.

Strangway Granite

The eastern end of the Strangway batholith enters the western part of the map-area in Laas township and extends eastward as a blunt lobe to occupy also the southwestern quarter of Tonnancourt township. Its eastern boundary is four to five miles east of Bell river.

The rock is medium grained and varies from pink to grey in colour. In general, it is massive, but locally the structure is somewhat gneissoid. In hand specimen, hornblende and biotite are conspicuous, each making up 15 to 20 per cent of the rock. The former is usually the more abundant. The other main constituents, as seen in thin section, are quartz (about 25 per cent), and microcline (30 per cent). Plagioclase (oligoclase-andesine) and orthoclase, are present in minor amount. The orthoclase and plagioclase are somewhat altered, but the microcline is fresh in appearance and is probably secondary. Zircon, titanite, and apatite are common accessory minerals. The rock may be classified as a medium grained hornblende-biotite granite.

Cedar Rapids Granite

The Cedar Rapids granite, which projects for two or three miles into the map-area at its northwest corner, is massive, medium to coarse grained, and grey to pink in colour. It is composed chiefly of sodic plagioclase and quartz, with lesser amounts of orthoclase, microcline, and biotite. The rock can be classed as a biotite granite (or perhaps, strictly speaking, soda-granite). It is somewhat similar in composition to the Tonnancourt quartz monzonite and Holmes gneiss.

(1) Que. Bur. Mines, Ann. Rept., 1936, Pt. B, p.69.

Tonnancourt Quartz Monzonite

An irregular stock of granite rock occupies the south-eastern corner of Tonnancourt township. Its eastern margin lies at, and closely follows, the eastern boundary of the township, and, after reaching its maximum north-south width of rather more than three miles, it wedges out at a point about four and a half miles west of the township line.

The rock is massive, medium grained, light grey to pink in colour, and is characterized by an abundance of quartz that has a glassy appearance. Some of the quartz is in euhedral grains. In many places, there is an unusually well developed, closely spaced, sheet-jointing in this rock.

In thin section, the rock is seen to contain about 30 per cent quartz; 30 to 45 per cent plagioclase (calcic oligoclase); a fair amount of microcline and orthoclase; and about 5 per cent biotite. No hornblende was seen in the thin sections examined. The rock differs from the Strangway granite in the absence of hornblende and the smaller content of biotite. It may be classified as a quartz monzonite.

The Tonnancourt quartz monzonite stock approaches to within less than half a mile of the Strangway granite, to the west of it, the two intrusive bodies being separated by a strip of greenstones. As a consequence their relative ages could not be determined. Dykes that are believed to be quartz monzonite cut the Holmes gneiss to the east.

Gabbro Dykes (Keweenawan?)

Several dyke-like exposures of gabbro were observed. They range in width from about 50 feet to 200 feet, and have a general north-northeasterly trend. The writer is of the opinion that these intermittent exposures represent portions of two dykes: one - with few and widely spaced exposures - extending from a point within the Strangway granite, $1\frac{3}{4}$ miles northwest of Gilbert lake, to the north-eastern corner of Tonnancourt township; the other, more frequently exposed, extending northeasterly from the eastern end of Moose mountain, in the southeastern part of Tonnancourt township, to the northern edge of the map-area, nearly midway along the north boundary of Holmes township. The latter dyke is apparently the central segment of a dyke described by Bannerman (1) in the area to the south, and by the present writer (2) in the area to the north.

The dykes cut the Keewatin greenstone, the Holmes gneiss, the Strangway granite, and the Tonnancourt quartz monzonite. Thus they are probably the youngest rocks of the area. Dykes similar to these occur at numerous points within the Canadian Shield and, characteristically, they have a north-northeasterly strike. They have generally been regarded as of Keweenawan age.

The rock is a medium to coarse grained gabbro in which a diabasic texture is common. The marginal parts of the dykes are fine grained due to the chilling effect of the enclosing rock.

(1) Que. Bur. Mines, Ann. Rept., 1935, Pt. C, p.17.

(2) Que. Bur. Mines, Ann. Rept., 1936, Pt. B, p.71.

Pleistocene and Recent

The western part of the area is covered by a thick blanket of till and glacial clays. In the central and eastern parts, such deposits are thin or absent, and much bed-rock is exposed on the numerous small hills and knolls.

Remnants of at least three eskers were observed in the area. One of these, which has been used as a source of gravel, forms a prominent ridge about a mile and three-quarters west of Kiask falls. What is probably the same esker crosses Bell river about half way between Kiask falls and Strangway rapids, and again just above the mouth of Taschereau river, in the southwest corner of the map-area. Prominent ridges of a second esker, apparently with a west-southwest trend, may be seen near the northern boundary of Tonnancourt township, just west of Kiask river. A third esker forms four elongated islands in the enlarged southern end of Cuvillier lake, and follows a sinuous course in a southwesterly direction from the lake to and beyond the southern limit of the map-area.

Many glacial striae were observed in the area. They indicate a direction of ice movement slightly west of south.

STRUCTURAL GEOLOGY

The larger structural features of the area have a predominant east-west trend and a northward dip. The dip is in general within the limits of 40° and 70° north, but locally it is steeper, or flatter, than this and in a few places dips to the south were noted. In detail, however, it was found that, in the vicinity of contacts between greenstone and intrusive rocks, the strike and dip of schistosity and foliation follow very minutely the contour and attitude of the intrusive body.

Thus, in the northeastern part of Tonnancourt township, along the southerly trending contact between the greenstone and the Holmes gneiss, the foliation of the gneiss and the banding of the greenstone are north-south with dip to the west. In places the strike of these structures is even northwest, and, as may well be observed in that part of the area just southwest of the point of crossing of Cuvillier river and the Holmes-Tonnancourt township line, it definitely curls completely around every curve in the western margin of the Holmes gneiss. The same is true of the banding in the greenstone in the vicinity of its contact with the Strangway granite, in the southwestern quarter of Tonnancourt township and in the northern and southern parts of Laas. This parallelism between structural features and contact boundaries is noticeable also in several places in Cuvillier township.

Such close correspondence between structural features and contact boundaries strongly suggests that these features are due to the thrust of intrusion rather than to broad regional stresses.

In many places, study of the ellipsoidal lavas made it possible to determine tops and bottoms, and hence the true attitude, of the flow rocks. These determinations indicate that a synclinal axis trends easterly through the northern parts of Laas and Tonnancourt townships, passing immediately south of Kiask falls. It probably turns northeastward to pass out of the map-area just within Holmes township, but it appears to re-enter that township near its northeast corner and from there continue, with trend $S.60^{\circ}E.$, to the general vicinity of the northern part of Kiask lake, in the northwest corner of Cuvillier township.

Elsewhere in the area, it was not possible to determine the attitude of the flow rocks, but the similarity of the rocks in the narrow belt of greenstones adjacent to the southern boundary of the area to those near the axis of the syncline which passes through Kiask lake suggests that this southern belt also marks the axis of a syncline.

There are two narrow bands of quartz-hornblende schist, thought to be of sedimentary origin, between the southern part of Holmes lake and Cuvillier lake. Their structural relationship to the persistent greenstone belt extending through the southern part of the area is not entirely clear. Further work in the area to the east of the present map-area may help in solving this problem.

The general trend of shearing observed in the area is east-west.

Many depressions and other topographic features in the area trend or are aligned in a direction about N.30°E., suggestive of control by faulting. In the northwestern corner of Cuvillier township, a high greenstone ridge is cut in several places by depressions trending in this direction, the most prominent of which is marked by the creek draining from the lake on the northern boundary of the township into Kiask lake. In line with this depression and probably representing a fault-zone trending across the entire map-area, with a length of at least thirteen miles, are the eastern part of Kiask lake, the narrow six-mile trough occupied by Holmes lake, and the valley of the creek that crosses the southern boundary of the map-area nearly three and three-quarter miles east of the Holmes-Tonnancourt line.

Although this is a common direction of alignment of topographic features in the area, and many escarpments having this trend were observed, no evidence was seen of rock displacement or actual faulting along such lines. However, since these features cut through both the greenstone and the intrusive rocks, a general structural weakness at least is indicated.

It happens that the direction of ice movement in the area, as indicated by glacial striae, closely parallels this topographic trend. The present depressions, or series of depressions, having this trend are thus, in all probability, the result of glacial action along pre-existing lines of weakness caused by powerful earth stresses.

ECONOMIC GEOLOGY

There has been considerable prospecting in past years in Tonnancourt township and in the northern part of Laas, but apparently very little in the eastern half of the area. However, the majority of the claims which were staked have been abandoned.

The most extensive work was done about 1936 on a group of claims on Laas brook, two miles south of the northwestern corner of the map-area (1). Quartz-tourmaline lenses and stringers occur here along a narrow zone of strong east-west shearing in a finely banded rock which is probably a tuff. The zone was explored by trenching, but, although, in places, the lenses were found to be heavily mineralized with pyrite, assays are reported to have indicated that their gold and silver content is negligible.

At Kiask falls, on Bell river, in the northwestern part of the map area, the greenstones are locally sheared over a width of

(1) Que. Bur. Mines, Geol. Rept., No.2, 1939, p.30.

about 500 feet. Within some of the shears, which trend east-west, stripping has revealed a number of small quartz-carbonate lenses and stringers, some of which are slightly mineralized with pyrite. Apparently, the results obtained from this work were not encouraging as there is no evidence of recent activity in the vicinity.

In the course of the summer's work, shear zones containing pyrite mineralization, and also occasional small pyrite-bearing quartz veins were seen in the greenstones at a number of localities. For the most part, these shears are of small extent, and the pyrite tends to occur in pockets rather than uniformly distributed along the zone. So far as observed, shear zones in the granite and gneiss are only very rarely mineralized with sulphides. Samples taken by the writer from a number of the better looking of these occurrences were assayed in the laboratories of the Quebec Bureau of Mines, at Quebec, with the results shown in the accompanying table. As will be noted, the gold content generally was found to be very low.

Table of Assay Results

Sample No.	Gold, oz./ton	Sample No.	Gold, oz./ton
1	0.018	7	0.008
2	0.002	8	0.006
3	0.003	9	trace
4	0.005	10	0.030
5	0.010	11	0.007
6	0.020		

Following are brief descriptions of the occurrences from which the samples assayed were taken.

No.1.—Hill about half a mile west of Bell river, in southwestern corner of map-area. Natural outcrops and a small amount of stripping expose banded and considerably altered greenstone. At least one of the bands is a finely laminated schist, probably recrystallized tuff, and this band has been silicified and contains many irregular stringers of quartz. Coarse pyrite in considerable amount is disseminated through the schist and is present in lesser amount in the quartz stringers.

No.2.—About three miles west of Kiask falls, northern part of Laas township. Narrow shears in a small outcrop of banded and silicified andesite at this locality are mineralized with pyrite.

Nos.3 and 4.—About half a mile west of Kiask falls. At this locality there are numerous outcrops along what appear to be former channels of Bell river. Much of the rock in these outcrops is strongly sheared tuff(?), and in many places it has been extensively carbonatized and mineralized with finely disseminated pyrite. The schist is cut by many quartz-carbonate stringers, some of which are slightly mineralized with pyrite. Sample No.3 was taken from a quartz stringer, and No.4 from the schist.

No.5.—About two miles west of mile-post No.7, eastern boundary of Tonnancourt township. Extensive outcrops of massive, well preserved ellipsoidal lava at this locality are cut by easterly trending stringers and narrow veins of barren-looking, milky quartz. In a few places, however, small pockets of chalcopryrite were observed within the quartz. Assay No.5 is of a sample of the massive chalcopryrite.

No.6.—Northwest corner of Holmes township. A small quartz vein cutting the gneiss here contains scattered aggregates of coarse, granular pyrite. The sample assayed was composed largely of pyrite.

No.7.—About half a mile west of mile-post $3\frac{1}{2}$, eastern boundary of Tonnancourt township. In this vicinity, a narrow tongue of greenstone projects southeastward for about one mile into granitic rocks, being bounded on its northern side by Holmes gneiss and on the south by Tonnancourt quartz monzonite. A short zone, one to two feet wide, in well-banded greenstone has been slightly sheared in a northwest direction, and along this zone the rock is considerably altered and silicified, and mineralized with pyrite. Although the sample from this locality that was assayed contained only a negligible amount of gold, the writer is of opinion that any shear zones in this tongue of greenstone, and particularly in the vicinity of its contacts with the intrusive bodies, merit the attention of prospectors.

No.8.—About one mile northwest of No.7. The sample assayed was from a small quartz vein carrying scattered flakes of specularite.

No.9.—About three-quarters of a mile south of the southern tip of Holmes lake. Chalcopyrite occurs here, distributed over a length of three feet and a width of three inches, in rust-stained greenstone schists. Similar rusty zones were observed at numerous places along the long, narrow greenstone belt in the southern part of the area and in the belt trending southeasterly across the northern part of Cuvillier township. Observations indicate that the alteration of pyrite to limonite is primarily responsible for the rusty staining, but it is possible that chalcopyrite also occurs in some of these zones.

Nos.10 and 11.—Adjacent to northern boundary of map-area, at Holmes-Cuvillier township line. Locally, in this general area, alteration of the greenstones has been exceptionally severe, and along some rust zones the rock is mineralized with pyrite. Of the samples assayed, No.10 was from a mineralized zone in interbedded pillow lavas and fragmental lavas in Cuvillier township, just east of the township line, and No.11 from a similar zone in massive andesite in Holmes township, just west of the township line.

General Considerations

The samples assayed were taken from the most favourable looking mineralized zones observed in the course of geological mapping which, of necessity, is very different from actual prospecting. While the gold content of the samples was in all cases low, it is at least noteworthy that nearly all the samples contained an appreciable amount of gold.

The greenstones of the area include a considerable proportion of tuffaceous, fragmental, and sedimentary material, and they are cut by several bodies of intrusive rock. In many places, the greenstone shows the effect of hydrothermal action from the intrusives. So far as observed in the course of mapping, only a small amount of mineralization has accompanied the alteration of the greenstone, but it is quite possible that intensive prospecting would reveal that, in some of the contact zones, extensive mineralization has taken place.

In the western part of the area, outcrops are scarce in the vicinity of Bell river, except in the section around Kiask falls. However, in other parts of the area, exposures of greenstone are abundant, and all of them can be reached easily. The accompanying

map shows the distribution of the greenstone and gives some indication as to the abundance of rock exposures. Study of the map will enable the prospector to work in the area with a minimum of unproductive time. Although much of the greenstone has what the prospector terms a 'dry' appearance, in many places it appears favourable as a host for mineral deposits and merits careful prospecting.

In much of the area, the greenstone is massive and little altered, but in many places it is sheared, silicified, and otherwise highly altered. The most pronounced of these zones of shearing extends across and west of Kiask falls. There is another zone of strong shearing in the northeast corner of Tonnancourt township.

Other greenstone belts that appear favourable for prospecting are: at the northern boundary of Holmes township; the narrow belt extending east-southeast across Cuvillier from the northeastern corner of Holmes; and the long, narrow belt extending eastward from the south-central part of Tonnancourt township to Cuvillier lake. It may be suggested that, in general, the most promising ground is near the margins of these greenstone belts, in the immediate vicinity of their contact with intrusive bodies, and particularly the younger granite bodies.

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