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Geology of Northwestern Timagami Area

District of Nipissing

By
P. S. SIMONY

Geological Report No. 28

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GEOLOGICAL MAP
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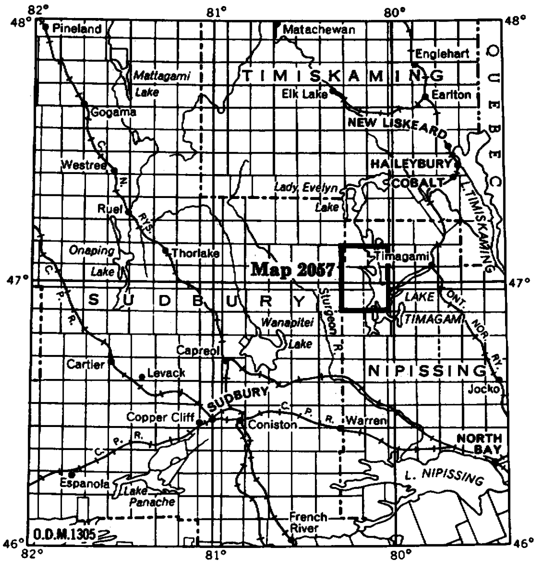
Abstract

In 1960, an area of about 180 square miles, situated about 15 miles west of Timagami, including the townships of Phyllis, Joan, Cynthia, LeRoche, and Belfast, was mapped on a scale of 4 inches to one mile. The geology, both general and economic, is briefly described.

All the consolidated rocks of the area are Precambrian and are divisible into three groups: a basement, probably of Archean age; the overlying Cobalt Group of Huronian age; and post-Huronian diabase masses. The basement complex consists of highly-folded acid and basic metavolcanics intruded by basic stocks, dikes, and sills, and by large granitic plutons.



Key map showing the location of the northwestern Timagami area. Scale, 1 inch to 50 miles.

The surface of the pre-Cobalt unconformity has a relief of about 1,000 feet. On it rests the Gowganda Formation, which consists of intertonguing units of greywacke, varved argillite, breccia, conglomerate (tillite?), and quartzite and has a maximum thickness of about 3,000 feet. The overlying Lorrain Formation, of which only the lower 2,000 feet is exposed in the map-area, consists of feldspathic quartzite and arkose. Quartz diabase and subordinate granophyre form large sills and discordant masses. Younger olivine diabase occurs in narrow dikes. The Cobalt sedimentary rocks were gently folded about north-south axes and were subsequently faulted.

Cu-Ni-Co-Ag-Au mineralization is associated with pre- and post-Cobalt basic intrusions. Magnetite occurs in the Archean rocks in banded iron formation and in replacement bodies associated with gabbro. In Phyllis township a high-grade copper deposit associated with pre-Cobalt diorite is being mined by Temagami Mining Company Limited.

Northwestern Timagami Area

by

P. S. Simony[1]

Introduction

The area mapped covers about 180 square miles and lies 15 miles west of the village of Timagami, which is on the Ontario Northland railway and highway No. 11. It lies within the Timagami Provincial Forest[2] and includes: the townships of Cynthia, Joan, and Phyllis on the east, which straddle Lake Timagami; and the townships of LeRoche and Belfast on the west, which lie between Lake Timagami and Obabika Lake.

The only producing mine in the area is operated by Temagami Mining Company Limited on a copper deposit on Timagami Island. Prospecting for copper and iron is being carried out, and a number of claims have been staked. Prospecting for copper, silver, iron, and gold has been carried out in the area since the turn of the century. After the discovery of copper on Timagami Island in 1951, large tracts of the map-area were staked and prospected.

The present survey was carried out during the field season of 1960. Pace-and-compass traverses spaced at intervals of approximately a quarter-mile were used in the preparation of the accompanying geological map. Topographic control was provided by vertical air photographs, on which the geological data were plotted in the field, and by the following National Topographic Series map-sheets:

Islands of Lake Timagami and Maple Mountain (41 P/SE.); Lake Timagami sheets (41 I/16 E. and 41 I/16 W.).

It should be understood that, owing to the scale on which the accompanying map is published, the areas marked as outcrop are not composed entirely of bedrock; the outcrops as shown are intended to outline areas in which bedrock exposure predominates, or is only lightly covered with overburden. In most cases, small rock outcrops in close proximity to each other were not mapped separately and are represented on the map as a single outcrop.

The area east of Kokoko Bay in Cynthia and Joan townships, and Timagami Island, had been mapped previously by W. W. Moorhouse (1946). Timagami Island has been remapped in detail by T. Patrick and other geologists at the Temagami mine. This information was transferred to the geological map accompanying this report (No. 2057, back pocket).

---

[1]Postgraduate student at McMaster University, Hamilton, Ontario.

[2]On 25 March 1964, by an Act of the Provincial Legislature, this area ceased to be a Provincial Forest.

ACKNOWLEDGMENTS

The author wishes to acknowledge the work of his assistants: G. G. Beacom, D. R. Clark, L. L. Davies, and K. G. Fenwick. Mr. Fenwick was responsible for part of the mapping, in particular the western part of Joan and the eastern part of Belfast townships. The author and his party are especially obligated to the staff of the Ontario Department of Lands and Forests, stationed at Timagami and Bear Island, for their generous co-operation on many occasions during the summer. Information concerning the area, particularly that concerning Temagami Mining Company Limited, was generously given to the author by: T. Patrick, consulting geologist for Temagami Mining Company Limited; W. S. Savage, resident geologist for the Ontario Department of Mines at Kirkland Lake; and D. Derosier of North Bay.

MEANS OF ACCESS

The map-area may be reached by air or water from the village of Timagami. A private road and ferry connect Timagami Island to highway No. 11. Good portages connect smaller lakes in the area to Lake Timagami, making all parts of the area accessible by canoe. Several lumber roads extend short distances inland from Lake Timagami and Obabika Lake.

PREVIOUS GEOLOGICAL WORK

The earliest geological mapping in the Lake Timagami area was carried out by A. E. Barlow of the Geological Survey of Canada. His work was completed in 1897. Map No. 138 and his final report were both published in 1907 (Barlow 1907).

In 1900, ten large parties were sent out to explore northern Ontario by the Ontario Bureau of Mines. Party No. 3, with J. L. R. Parsons as geologist, crossed the map-area en route to Sturgeon River, via Lake Timagami and Obabika Lake (Parsons 1900).

In 1899, W. G. Miller (1901, pp. 160–80) examined and reported on the Kokoko iron formation band.

In 1926, E. W. Todd (1926, pp. 79–104) mapped the Anima–Nipissing Lake area, northeast of Lake Timagami, and included in his study the east edge of Cynthia township.

In 1936, E. S. Moore (1937, pp. 38–48) mapped an area including part of Afton and Scholes townships, immediately west of Phyllis township.

In 1942, W. W. Moorhouse (1946) reported on the northeastern part of the Timagami Lake area and included in his study the east edge of Cynthia, Joan, and Phyllis townships, including Timagami Island and the islands adjacent to it.

In 1954, K. D. Lawton (1955) reported on the geology of Delhi township, which lies immediately west of LeRoche township.

The Obabika Lake and Lake Timagami aeromagnetic maps (G.S.C. 1956; 1957) published by the Department of Mines and Technical Surveys, cover Le Roche, Cynthia, Belfast, Joan, and Phyllis townships as well as areas to the west.

Since 1950 a number of private companies have carried out mapping, trenching, drilling, and geophysical work on various prospects in the area. In particular, Timagami Island has been remapped in great detail by T. Patrick and other geologists at the Temagami mine.

TOPOGRAPHY

Lake Timagami and its arms, covering about 15 percent of the map-area, lie at an altitude of about 970 feet. Obabika Lake, the second largest lake in the area lies at 940 feet. The highest hill, Mount Ferguson, has an altitude of 1,909 feet and overlooks Ferguson Bay on the Cynthia-Aston township boundary; on it is situated a forestry tower of the Ontario Department of Lands and Forests. The highest hills in the area, like Mount Ferguson, are usually underlain by Nipissing diabase and tend to be bordered by steep cliffs. Hills made of quartzite, greywacke, and conglomerate tend to be more rounded. Most of the hills rise 200–500 feet above the floors of the adjacent valleys. The area is drained fairly well. Swamps are restricted mostly to narrow valleys or to the shores of small lakes whose outlets are dammed by beaver. Except on cliffs and lake shores, outcrops tend to be small and scattered. Fire prevention has been very effective, and much of the area is covered by mature stands of pine mixed with poplar. As a result, even where the drift or soil cover is thin, it is held by the tree roots instead of being washed away to leave large areas of exposed rocks.

NATURAL RESOURCES

The main industries of the area are lumbering, the tourist trade, mining, and trapping. Lumbering is carried out in several parts of the map-area; red pine appears to be the principal timber cut. However, there are areas in southwest Belfast and northeast Cynthia townships, which are characterized by open bush with unusually large maple and birch trees.

Fishing is the main tourist attraction of the area, and there are numerous camps and private cottages on the many islands in Lake Timagami. Regular transportation and freight deliveries serve these camps during the summer. Supplies can be bought and canoes rented at a Hudson's Bay Company post situated on Bear Island. Some of the Indians living on Bear Island act as guides during the summer and trap during the winter.

General Geology

All the consolidated rocks of the area are Precambrian in age. They are covered by a thin veneer of Pleistocene glacial and glaciofluvial deposits and by Recent lake, swamp, and river deposits.

The Precambrian rocks are divisible into three main groups:

1. A group of deformed and metamorphosed rocks cut by basic and acid intrusions, which by analogy to adjacent areas is referred to the Archean.
2. Clastic sedimentary rocks of the Cobalt Group overlying the Archean with profound unconformity; they are gently folded and weakly metamorphosed.
3. Quartz diabase sills of Nipissing type and minor olivine diabase dikes, which cut all the older rocks.

The Archean rocks are exposed only along the east side of the map-area, and in one small inlier in southwestern Phyllis township. They consist of acid and basic volcanic rocks, and some iron formation, cut by dikes and sills of diorite. These rocks have been intensely folded, faulted, and metamorphosed to the epidote-amphibolite facies of regional metamorphism; they have also been intruded by granitic bodies, possibly of Algoman age.

The Archean era was closed by a period of erosion, during which a land surface was fashioned with a relief of about 1,000 feet. On this surface rest the boulder conglomerate, greywacke, and varved argillite constituting the Gowganda Formation. In the map-area, this formation has a maximum thickness of about 3,000 feet. The Gowganda Formation is overlain conformably by the Lorrain Formation, which consists of massive feldspathic quartzite and arkose. Only the lower 2,000 feet of the Lorrain Formation is exposed in the map-area, and it is almost entirely restricted to the township of LeRoche.

The rocks of the Cobalt Group were folded into gently north-plunging, open synclines and anticlines. Incipient metamorphism converted the clay minerals to chlorite and sericite. Folding was followed by faulting on steeply dipping or vertical planes, striking north-south and N.50°E., and by the intrusion of large sills and dikes of quartz diabase of Nipissing type. The latest rocks of the area are narrow dikes of olivine diabase. Their intrusion was followed by faulting on steeply dipping planes striking N.30°W.

ARCHEAN BASEMENT

In his report, *The Northeastern Portion of the Timagami Lake Area,* Moorhouse (1946, pp. 5–19) described in some detail the Archean rocks exposed in the eastern parts of Phyllis, Joan, and Cynthia townships. They will not be described again here.

In the southwest corner of Phyllis township, on the west side of the Southwest Arm of Lake Timagami, there is a small inlier of the Archean basement. It consists of rather strongly schisted acid rock with epidotitic streaks and patches. In the field, angular fragments, 1–6 inches across, can be recognized on ice-polished outcrops. The fragments are somewhat lighter in colour than the matrix. In thin section, the rock is seen to be an aggregate of fine-grained quartz, muscovite, chlorite, and epidote, cut by veinlets rich in epidote. On one outcrop, near the northern limit of the inlier, a small irregular dike, possibly of andesitic composition, cuts the acid volcanic rock.

In northeastern Cynthia township, a small area of granite is surrounded by a thick unit of Gowganda conglomerate. It is exposed on a ridge at least 200 feet higher than a valley immediately to the east of it, whose floor is underlain by conglomerate. The granite inlier must, therefore, represent a hill in the basement at least 200 feet high. All the granite exposed in Cynthia is rather coarse-grained, pink, and leucocratic. The most abundant feldspar present is albite.

HURONIAN

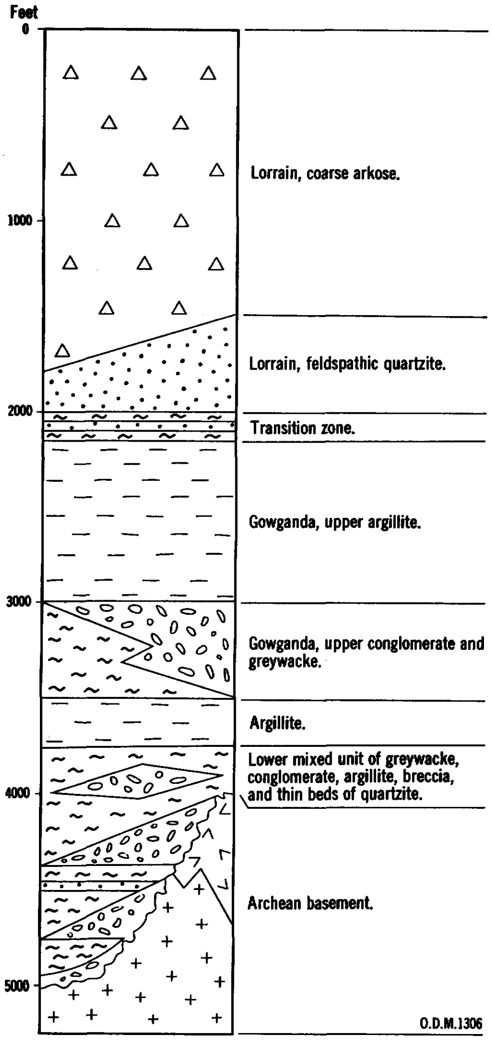
Cobalt Group

GOWGANDA FORMATION

In the map-area, the Gowganda Formation, which is the oldest formation of the Cobalt Group, rests directly on the Archean basement with profound unconformity. It consists of greywacke, argillite, conglomerate, breccia, and minor quartzite. The formation may be divided into a number of units. These are summarized in the figure on page 6. Because of rapid changes in lithology along the

TABLE OF FORMATIONS

CENOZOIC	
RECENT:	Swamp, lake, and stream deposits.
PLEISTOCENE:	Glacial and glaciofluvial deposits.
	Great Unconformity
PRECAMBRIAN	
KEWEENAWAN	Olivine diabase dikes.
	Intrusive Contact
	"Nipissing" quartz diabase, granophyre.
	Intrusive Contact
HURONIAN Cobalt Group:	Lorrain Formation: feldspathic quartzite, arkose.
	Gowganda Formation: argillite, slate, greywacke, breccia, conglomerate, quartzite.
	Great Unconformity
ALGOMAN	Soft greenstone dikes, amphibolite dikes.
	Intrusive Contact
	Granite, fine-grained siliceous granite, porphyritic granite.
	Intrusive Contact
PRE-ALGOMAN:	Massive and schistose diorite.
	Intrusive Contact
KEEWATIN	Acid volcanic: rhyolite, rhyolite breccia, agglomerate.
	Basic and intermediate volcanics: pillow lava, basalt, andesite, dioritic greenstone, amygdaloidal flow, tuff, pyroclastics, recrystallized greenstone, coarse amphibolite, schist.
	Iron formation.



Subdivisions of the Cobalt Group in the Map-area

strike, so typical of the Gowganda Formation, the figure presents a rather simplified picture.

The unit of conglomerate and greywacke forming High Rock Island rests directly on the Archean basement where it is exposed north of Shiningwood Bay, yet in the southwestern part of Phyllis township it is underlain by at least 1,000 feet of greywacke, conglomerate, and argillite. This thickening of the Gowganda Formation away from Timagami Island is confirmed by drilling done between Moore and Turner islands and near Denedus Island. At both localities the Archean basement was reached only after drilling more than 700 feet. These thickness variations of the lower part of the Gowganda Formation suggest that the basement on which it was laid down had a relief of at least 1,000 feet. Although the unconformity can be defined fairly well by outcrops near it, it is rarely well exposed, and the actual surface of unconformity could not be examined.

The upper 1,500 feet of the Gowganda Formation appears to be fairly uniform over the area, and the units comprising it (upper argillite, 1,000 feet, and upper conglomerate and greywacke, 500 feet) can be traced westward into Delhi township.

Greywacke

Greywacke is the most abundant rock type in the Gowganda Formation. Two major types can be recognized:

1. Massive greywacke, often pebble-bearing and transitional to conglomerate.
2. Bedded greywacke, locally graded, in many places interbedded with argillite.

Gowganda greywacke in graded beds; north tip of McLean Peninsula, Phyllis township.

Greywacke occurs at a number of stratigraphic levels within the Gowganda Formation but is more common in the lower 2,000 feet. Massive greywacke is particularly well developed on McLean Peninsula, south and west of Island Bay, in Phyllis township. Bedded greywacke is well developed in a band passing through Denedus Island and the northeastern part of High Rock Island in Phyllis township, also on the west shore of Obabika Lake in Belfast township, and on the west shore of Ferguson Bay in Cynthia township. Graded bedding can be observed on a small island west of Denedus Island and along the northeast shore of McLean Peninsula.

MODAL ANALYSES OF COBALT SEDIMENTARY ROCKS

	1	2	3	4	5
	percent	percent	percent	percent	percent
Quartz	21.0	36.2	72.8	69.8	54.7
Plagioclase	7.1	9.6	10.7	12.6	10.3
Potash feldspar	1.9	2.5	9.6	10.5	16.3
Chlorite	42.5	35.4	1.8	2.7	3.8
Sericite	16.6	9.9	2.0	2.9	14.6
Epidote	1.9	1.3	1.7	0.2	—
Rock fragments	8.3	3.8	0.4	0.3	—
Opaque minerals	0.4	0.8	0.8	0.5	0.2
Accessory minerals	0.3	0.5	0.2	0.5	0.1

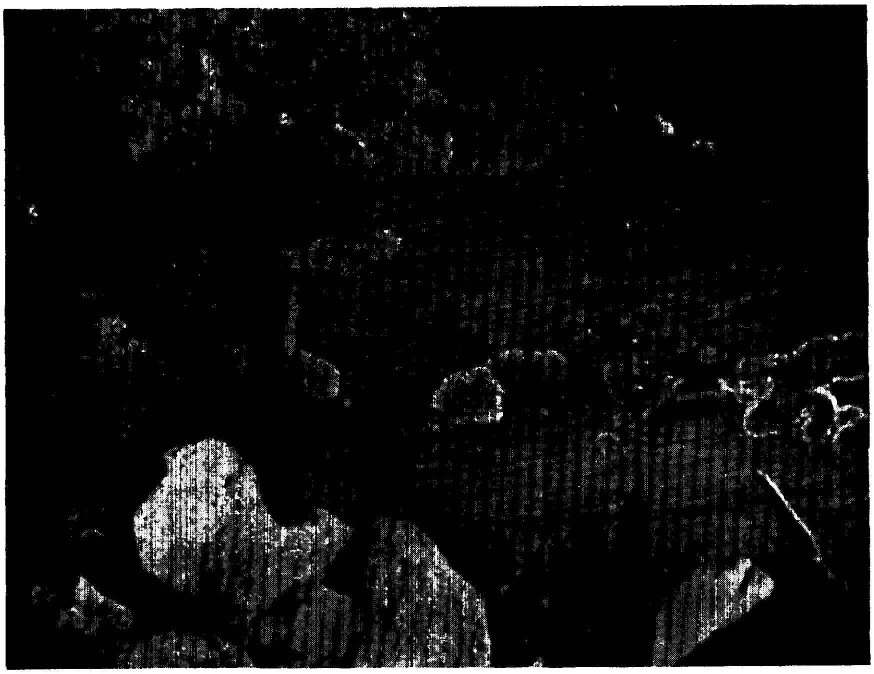
1—Average of five specimens of Gowganda conglomerate matrix.
2—Average of five specimens of Gowganda greywacke.
3—Average of two specimens of Gowganda quartzite.
4—Average of three specimens of Lorrain feldspathic quartzite.
5—Average of five specimens of Lorrain arkose.

The beds are 1–3 feet thick and consist of a base of coarse-grained, impure quartzite; a middle of medium-grained greywacke; and a top of argillite.

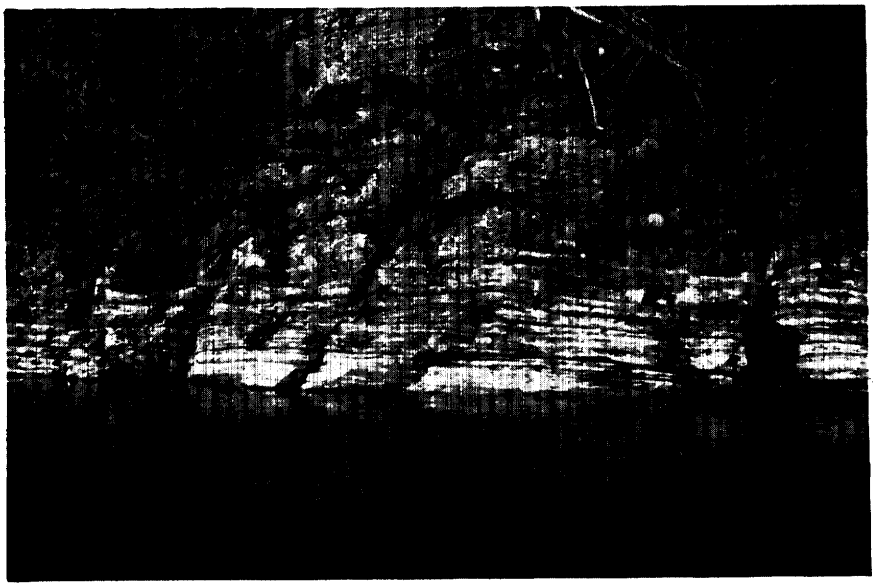
In hand specimens, the two types of greywacke are indistinguishable, and the description that follows is applicable to both. The greywacke ranges in colour from grey to nearly black and commonly has a greenish tinge. It consists of subangular, sand-size grains of quartz, feldspar, and rock fragments set in a matrix of chlorite, sericite, and finely ground quartz. Accessory epidote, muscovite, tourmaline, and pyrite are common. In some specimens the matrix is dominant, constituting up to 60 percent of the rock; in others there is no true matrix. The grains touch each other, and 10–20 percent chlorite and sericite are disseminated through the rock. Feldspar is fairly abundant, amounting to 30 percent in some specimens but averaging about 10 percent. The feldspar consists largely of twinned and untwinned plagioclase, and a little microcline, orthoclase, and microperthite. The average composition of five typical specimens is given in the table on this page.

Argillite

After greywacke, argillite is the most abundant rock type in the Gowganda Formation. It occurs at different stratigraphic levels throughout the formation but is particularly common in the upper part. The upper 1,000 feet consists almost exclusively of argillite. Units lower in the formation are not as extensive as the upper unit and cannot be traced for more than a few miles. In the map-area, the argillite is a varved rock consisting of alternating laminae of grey siltstone and black mudstone. Characteristically the siltstone layers are from 1/16 to 1/4 inch thick and the claystone layers from 1/4 to 1/2 inch thick. In most



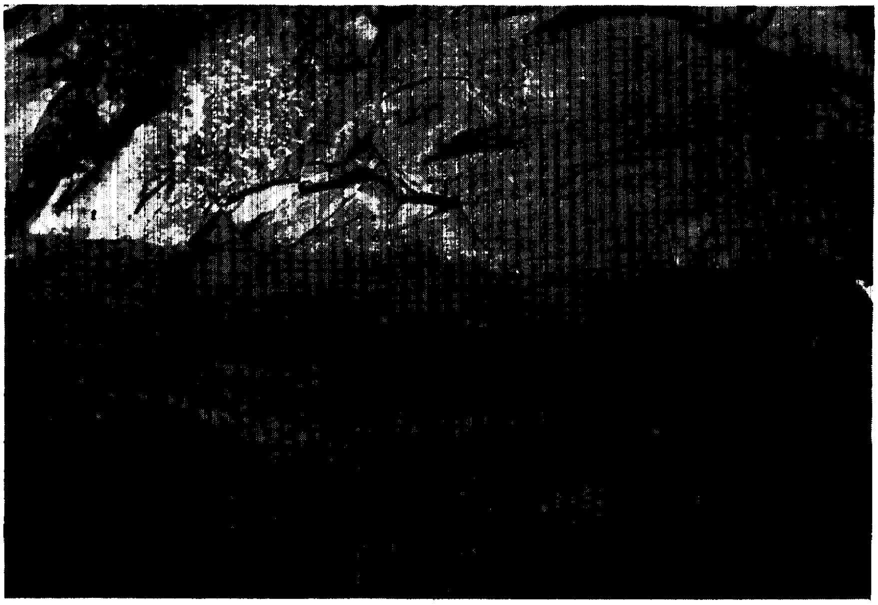
Thin beds of Gowganda greywacke and varved argillite; north shore of Devil Bay, Cynthia township.



Thinly bedded Gowganda greywacke; west shore of Ferguson Bay, Cynthia township.

of the map-area, the rock splits parallel to the varving. Only locally is a steeply dipping, slaty cleavage developed.

The claystone layers consist of a very fine-grained aggregate of chlorite and sericite. The silt layers consist of small angular quartz and feldspar grains, and a little chlorite, sericite, and epidote. The thicker silt layers are graded. Small porphyroblasts of chlorite, sericite, and pyrite were observed in most specimens. The chlorite and sericite tend to have their basal cleavage parallel to the bedding.



Varved Gowganda argillite; on a small island in Granny Bay, Cynthia township.

Locally, granite pebbles or even boulders are widely scattered in argillite. These pebbles are particularly common in the argillite unit immediately below the highest conglomerate unit. Pebble-bearing argillite is well exposed on the west shore of Obabika Lake in Belfast township, and on the peninsula between Lake Timagami and its Northwest Arm in Joan township. The argillite in which the pebbles occur is varved in the same manner as is argillite without pebbles, and the varves are bent around the pebbles. This suggests that the pebbles and boulders were dropped into fine sediment accumulating in still water. The most likely agents for the transport of these pebbles were icebergs, which released the debris they were carrying as they melted in a lake or sea bordering a glacier.

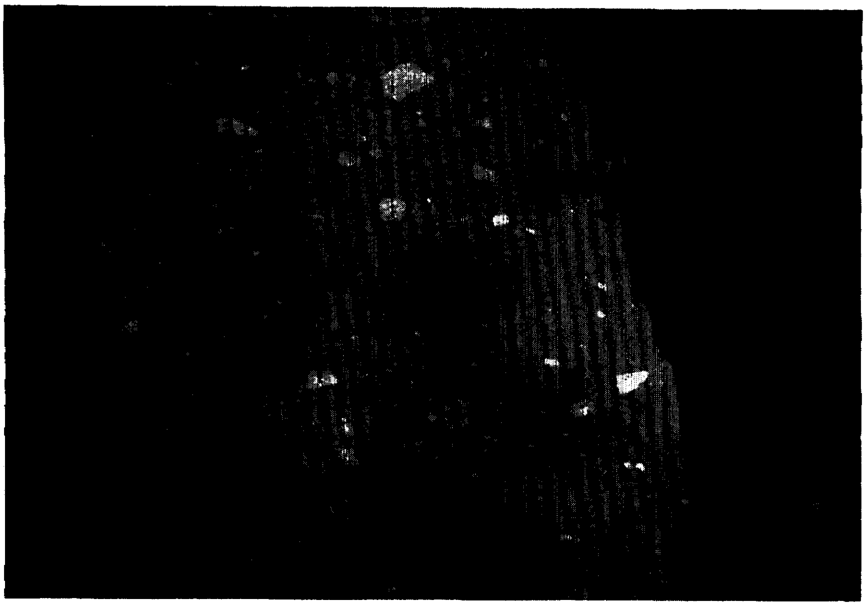
Conglomerate

Conglomerate is most abundant in the lower part of the Gowganda Formation. It does not form one continuous stratigraphic horizon but occurs in lens-shaped units at different stratigraphic levels. The highest conglomerate unit in the area occurs about 1,000 feet below the base of the Lorrain Formation.

Conglomerate units vary markedly in thickness and lithology along their strike and can seldom be traced for more than 5 miles. Some of them may have maximum thicknesses of 500 feet.

Two major types of conglomerate were recognized:

1. Massive polymictic boulder and pebble conglomerate with a greywacke matrix.
2. Stratified pebble conglomerate with little or no matrix.



Gowganda conglomerate; east shore of Lake Timagami, Joan township.

Nearly all the conglomerate in the map-area is of the first type. It consists of boulders and pebbles of all shapes and sizes scattered sparsely and wholly at random in an unstratified greywacke matrix. Boulders and pebbles constitute 10–50 percent of the rock and range in diameter from 1 inch to 4 feet. Some of the pebbles are rounded; others are highly angular. They include a great variety of rock types: red granite, grey granite, granite gneiss, diabase, diorite, greenstone, rhyolite, trachyte, mica schist, slate, and quartz; however, red granite is much the most common.

The matrix of the conglomerate is identical to the massive type of greywacke described earlier. By a reduction in the abundance of pebbles, conglomerate passes into greywacke with pebbles, mapped as "5b, d" on the geological map (No. 2057, back pocket). The average mineral composition of five specimens of the matrix of the conglomerate is given in the table on page 8.

The second type of conglomerate occurs in beds, up to 5 feet thick, in the southern part of the peninsula between Lake Timagami and its Northwest Arm in Joan township. It also occurs at the southern tip of Red Pine Island, and on the small island to the east, in Cynthia township. Characteristically the pebbles are closely packed together, with only a little silty matrix and calcite cement filling the interstices. The pebbles are rounded and rarely exceed an inch in diameter, and they include all the rock types found in the first type of conglomerate.

Quartzite

Gowganda quartzite is uncommon in the map-area. Thin beds of medium-grained, grey quartzite are interbedded with argillite and greywacke along the west shore of Kokoko Bay. A unit of massive pink quartzite can be traced for about 3 miles in the southwestern part of Belfast township; it is about 50 feet thick. Similar quartzite occurs on the east side of the inlet into Ferguson Bay in Cynthia township.

The quartzite is rather massive, pink or grey, and glassy. The rock has no matrix but consists of interlocking grains of quartz and feldspar. The grains are equant and subrounded, with diameters in the range $\frac{1}{4}$–$\frac{1}{8}$ millimetre. The average composition of two typical specimens is given in the table on page 8.

Breccia

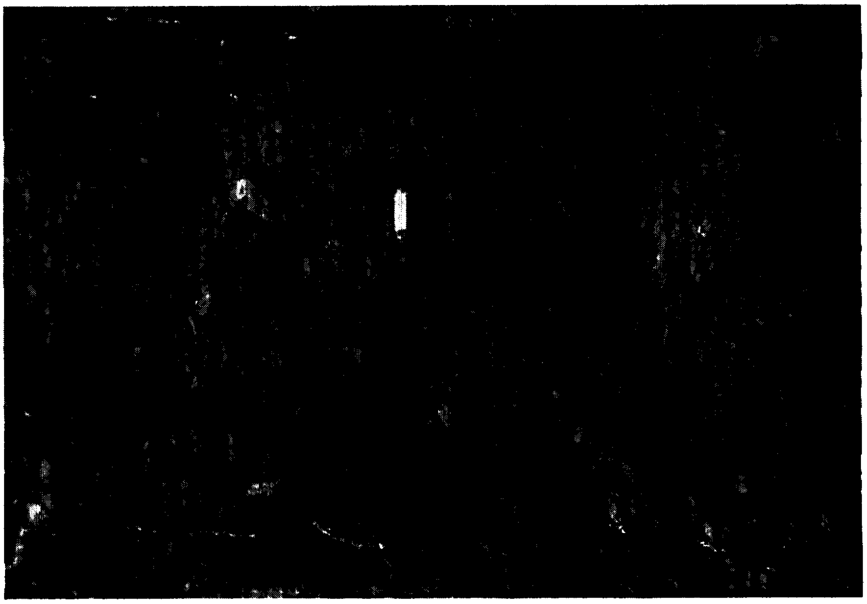
Breccia is a fairly common rock type in the Gowganda Formation. It is almost entirely restricted to units of interbedded greywacke and argillite in the lower 1,500 feet of the Gowganda Formation. Breccia is well exposed on the west shore of McLean Peninsula, on some small islands west of High Rock Island in Phyllis township, and on the west and south shores of the peninsula between Lake Timagami and its Northwest Arm in Joan township. On the map, "bx" after the rock symbol indicates that the rock is brecciated.

Characteristically, the breccia consists of fragments of greywacke and argillite set in a matrix of silty argillite. Locally, pebbles of granite are present. The fragments range in size from small pieces with a diameter of an inch, to large blocks several feet across. Some of the fragments are rounded; others, particularly the large ones, are angular. The matrix, although sometimes only a filling between the crowded fragments, in many places constitutes as much as a quarter of the rock by volume. Occasionally it exhibits structures suggesting it has flowed around the fragments. Some of the fragments are deformed; tabular pieces of argillite are bent or even rolled up, or fragments are fractured and injected by the matrix.

A number of features suggest that these breccias resulted from slumping of the rock while it was still in a poorly consolidated state, rather than from crushing of the rock by folding or faulting after consolidation:

1. The breccias occur only in interbedded greywacke and argillite. Brecciation was never found in conglomerate, massive greywacke, or quartzite as might be expected if the brecciation is tectonic.
2. The breccia occurrences are in no way related to folds or faults but appear to be confined to a certain part of the Cobalt succession (the lower half of the Gowganda Formation).
3. The nature of the deformation of the fragments suggests that they were deformed while still poorly consolidated.

4. In Cynthia township, on the southeast side of a small lake a mile northeast of Kokoko Lake, a breccia overlies argillite beds. The breccia consists of large fragments of argillite scattered in pebbly greywacke. These fragments are identical in their shape and mode of deformation to the fragments of other breccias in the area. There can be no doubt that at this locality, the fragments are derived from the underlying argillite beds and were incorporated in the pebbly greywacke when it was deposited.



Brecciated, varved argillite; south shore of Granny Bay, Joan township.

Pure argillite was found brecciated in three localities:

1. On a point of land south of Granny Bay in Joan township.
2. On a point of land on the west shore of the North Arm of Lake Timagami in Cynthia township.
3. In a creek bed 2 miles south of Upper Bass Lake in Belfast township.

These breccias are quite different in appearance from those described earlier. The fragments are all rather small, angular, and closely packed such that there is little room for matrix. The matrix is massive argillite; silt and sand grains in it are pressed into the fragments as if they had been soft at the time of brecciation. There is nothing in the rock suggesting flow or shearing. All these features suggest that this type of breccia is not tectonic.

It is very difficult to be certain of the origin of every breccia encountered, and it is probable that some bodies of breccia in the map-area result from crushing during faulting or folding. Brecciation on the small island east of Rabbit Nose Island in Joan township, and on a small island near the east shore of Obabika

Lake in the northern part of Belfast township, fit closely the description of Sudbury-type breccia in Delhi township (Lawton 1955, pp. 8–13).

LORRAIN FORMATION

In conformity with the classification used in adjacent areas, the thick unit of feldspathic quartzite and arkose conformably overlying the Gowganda Formation is called the Lorrain Formation. This formation is almost entirely confined to LeRoche township of which it underlies the greater part.

In LeRoche township it may be divided into three units:

1. Transition zone with the Gowganda Formation.
2. Unit of feldspathic quartzite.
3. Unit of coarse arkose.

The total thickness of the formation cannot be given since its top does not occur in the map-area. The three units recognized make up approximately its lower 2,000 feet.

The first unit, the transition zone, consists of siliceous greywacke interbedded with impure, fine- to medium-grained, grey, green, and pink quartzite. It ranges in thickness from 20 to 100 feet.

The second unit, the feldspathic quartzite, ranges in thickness from 200 to 500 feet and consists of grey, green, and pink, medium-grained, feldspathic quartzite and arkose. In some localities, notably along the west shore of the North Arm of Lake Timagami in Cynthia township, it is well-bedded and cross-bedded. In southern and western LeRoche township, it is usually massive, bedding only being visible in cliff sides. Beds of sericitic, yellowish-grey argillite, 6 inches to 2 feet thick, occur sporadically in the lower part of this unit. The feldspathic quartzite is well sorted, consisting of grains with diameters between ⅓ and ¼ millimetre. The grains are interlocking and, in some specimens, strained and granulated. Besides quartz, the rock contains as much as 20 percent feldspar, mostly sodic plagioclase, and a little chlorite, sericite, epidote, and pyrite. The average composition of three typical specimens is given in the table on page 8.

The third and highest unit of the Lorrain Formation found in the area consists of coarse, sericitic arkose. It is greyish-white on fresh surfaces and weathers to a cream colour. It is very massive; graded bedding and crossbedding being infrequently observed. Over large areas no bedding could be recognized. The quartz and feldspar grains have an average diameter of about 4 millimetres and are subangular. They are set in a matrix of sericite and a little chlorite constituting about 15 percent of the rock. In thin section it can be seen that most of the matrix results from the alteration of microcline and perthite to an aggregate of sericite and quartz. The average composition of five representative specimens is given in the table on page 8.

In twelve localities the attitude of crossbedding in the Lorrain Formation was determined. In all but one locality, on the west shore of the North Arm of Lake Timagami, the foreset beds dip in a southerly direction, suggesting that currents depositing the sands that constituted the Lorrain Formation were flowing from the north.

KEWEENAWAN
Nipissing Diabase

In the map-area, rocks of the Cobalt Group and older are intruded by large bodies of quartz diabase similar in composition and texture, and which have the same stratigraphic relation as diabase termed "Nipissing" throughout the area between Sudbury and Gowganda. As the diabase is post-Huronian in age, it is tentatively assigned to the Keweenawan, in conformity with the classification adopted in adjacent areas.

The most important masses of diabase are sheet-like in form and are in general concordant with the stratification of the Cobalt Group. Many, however, are not true sills over their entire extent, some of their contacts being clearly discordant.

The largest mass of diabase in the area extends from the south boundary of Phyllis township, along the west side of Lake Timagami to Obabika Inlet. In Phyllis township it appears to be a sill, gently dipping to the east. An offshoot, underlying Narrows Island and the peninsula south of it, is a large dike. In Joan and Belfast townships the contacts are highly involved, partly as a result of their discordant nature and partly as a result of erosion. The mass forming Devil Mountain in Cynthia township and extending southward along the east shore of Lake Timagami in Joan township is a simple sill, underlain both on the east and on the west by varved argillite. The mass occupying the southwest corner of Phyllis township has the same relations and may have been connected to the mass underlying Devil Mountain prior to erosion. The mass forming Mount Ferguson in Cynthia township is a west-dipping sill along the east side of Ferguson Bay. However, it breaks across the stratification and passes north of Roko Lake and eastward into Chambers township, where it cuts across the pre-Cobalt unconformity (Todd 1926, pp. 79–104).

The Nipissing diabase is generally medium- to coarse-grained except in chilled contact zones. In hand specimens the rock is black or dark grey with a green tinge and appears fresh. The ophitic texture, characteristic of diabase, is well developed and easily seen. The coarser varieties generally have spots of pink granophyre. Microscopic examination of a large number of samples from all the diabase masses in the area shows that the diabase is usually highly altered. This alteration involving the pyroxene and calcic plagioclase appears to be related to the acidity of the rock. A rough correlation was found to exist between the abundance of quartz and granophyre, the soda content of the calcic plagioclase, and the degree of alteration of the diabase. The average composition of four specimens of least altered diabase is given in the table on page 17. The pyroxene is subcalcic augite. There are two varieties of plagioclase: twinned calcic plagioclase ranging in composition from sodic labradorite to calcic andesine, and untwinned albite in micrographic intergrowth with quartz. Generally all the pyroxene is altered to uralitic hornblende and chlorite. The calcic plagioclase is largely altered to epidote and sericite. Pyrite, magnetite, leucoxene, and apatite are the common accessory minerals. The average composition of ten representative specimens is given in the table on page 17.

The contacts of the Nipissing diabase masses are usually clean, and contact metamorphism is negligible. The large dike forming Narrows Island and the peninsula south of it, as well as the mass in the northwest corner of Cynthia township, have many inclusions of brecciated Cobalt sedimentary rocks at their contacts. Small laths of albite are locally developed in these inclusions.

"Red Rock" or Granophyre

In all the large masses of Nipissing diabase, "red rock" or granophyre is developed either as patches with diffuse borders or as distinct veinlets. Both types can be seen along the west shore of Lake Timagami in Phyllis township. In Belfast township, a distinct body of granophyre underlies an area of about 2 square miles south of the west end of Obabika Inlet. The contact between diabase and granophyre is gradational. It is, therefore, a Nipissing granophyre rather than a separate, later intrusion. A complete transition exists between granophyric diabase with ophitic texture and a rock of granitic composition and texture. The altered pyroxene and calcic plagioclase are gradually displaced by quartz, albite, and a micrographic intergrowth of the two. In the end-product, the micrographic intergrowth is subordinate, and perthite is locally developed. The average composition of four specimens representative of the mass south of Obabika Inlet is given in the table on page 17.

Olivine Diabase

Olivine diabase occurs in the map-area as narrow dikes. It is similar in appearance to Nipissing diabase and may have been confused with it in some localities. The possible diagnostic features of olivine diabase are its brownish weathering colour and the length and prominence of plagioclase laths. Characteristically, Lorrain arkose is intensely reddened near its contacts with olivine diabase as a result of the introduction of hematite into the feldspars and the sericite matrix.

A dike of olivine diabase cuts a sill of Nipissing diabase in the southwest corner of Cynthia township. Olivine diabase is, therefore, considered younger than Nipissing diabase.

Olivine diabase is generally fresh and consists of labradorite, olivine, and augite. Biotite, chlorite, apatite, and magnetite are common accessories. The average composition of four specimens is given in the table on page 17.

MODAL ANALYSES OF KEWEENAWAN INTRUSIVE ROCKS

	1	2	3	4
	percent	percent	percent	percent
Olivine	0	0	0	20.2
Pyroxene	37.9	7.3	0	15.1
Calcic plagioclase	52.4	15.2	0	59.2
Albite	2.1	9.8	37.5	0
Microcline	0	0	2.5	0
Quartz	1.5	5.0	41.2	0
Hornblende	1.6	21.1	0.5	0
Chlorite	2.0	27.0	12.2	0.5
Epidote	1.0	11.9	5.3	0
Sericite	1.0	4.7	0.7	0
Opaque	0.3	1.0	0.1	2.5
Accessory	0.2	trace	—	0.5

1—Average of four specimens of least altered Nipissing diabase.
2—Average of ten specimens of typically altered Nipissing diabase.
3—Average of four specimens of granophyre.
4—Average of four specimens of olivine diabase.

PLEISTOCENE AND RECENT

The main areas of drift are indicated on the geological map (No. 2057, back pocket). Thick morainic deposits were not found, but erratic boulders are common. Glacial striae and chatter marks indicate ice movement from north to south. The most important Pleistocene deposits are eskers. Most of these have a north-south trend, and the manner in which "tributaries" join suggests that the streams depositing them were flowing in a southerly direction. The longest esker can be traced from Kokoko Lake, southward along the west side of Kokoko Bay to Mule Bay. The esker on the southeast side of Bear Island may be its continuation.

Where Pleistocene deposits form the shore of the present lakes, reworking of the Pleistocene material has resulted in the formation of beaches and other sand structures. This is well exemplified by the sand and gravel deposits at the north end of Kokoko Lake and on Obabika Lake, near the Belfast-LeRoche townships boundary. On the west side of Obabika Lake there is a thick sand and gravel deposit being eroded by the lake. Currents are redepositing this material to build a sand and gravel spit, which at present almost cuts the lake in two.

Structural Geology

FOLDING

The structures in the Archean rocks of the eastern part of the map-area have been described by Moorhouse (1946) and will not be described again here.

West of Kokoko Bay the Cobalt sedimentary rocks are folded into a series of open anticlines and synclines, which plunge northward at about 5 degrees. The beds have dips rarely exceeding 30 degrees and average about 20 degrees. Because of the low dip and the massive nature of many of the rock types, the exact position of the fold axes is very difficult to determine. In the northeastern part of Cynthia township, dip and strike data are so scant that the structure of that area could not be determined.

In the southeastern part of Phyllis township, the beds strike north-northwest and dip gently eastward. Just south of Pelican Point, the strike changes to the northeast, and the conglomerate band forming the peninsula west of Portage Bay is curved to pass through High Rock Island and northeastward, parallel to the unconformity along the north shore of Shiningwood Bay. This structure is not in conformity with the folding about north-south axes prevalent in the rest of the area and probably results from the interference of the topographic high in the Archean basement, forming Timagami Island, with the regional fold pattern.

In the northern part of the peninsula between the Northwest Arm and Lake Timagami, a band of conglomerate, underlain and overlain by argillite, outlines the crest of a large syncline plunging north. The axial trace of the syncline can be traced northward along the boundary between Cynthia and LeRoche townships. It has been drawn in two segments north and south of Devil Bay. It is possible that the southern segment has been shifted eastward with respect to the northern segment along a fault passing from Obabika Inlet into Devil Bay.

The most important fold in the western part of the map-area is a syncline whose axial trace passes west of LeRoche Lake and Upper Bass Lake. Two smaller folds on its west flank in Belfast township die out north of the common corner of Belfast and Delhi townships.

FAULTING, SHEARING, JOINTING

Because of the scarcity of distinct key horizons in the Cobalt succession, faulting is in many cases difficult to prove, and some faults may have been overlooked. Only those for which there is evidence other than the existence of linear valleys have been recorded on the map.

Three main trends of faulting have been recognized in the area. These are north-south, N.50°E., and N.30°W. As a result of the mining on Timagami Island, faults have been found that were not recognized earlier. The three most important ones are shown on the geological map (No. 2057, back pocket). The others are marked on the more detailed plan of the mine given in Economic Geology (*facing* p. 25).

Kokoko Bay is a pronounced linear feature, and some shearing has been found near it. A definite fault plane or zone could not be recognized north of Kokoko Lake. It is possible, therefore, that the shearing results from movement along the pre-Cobalt unconformity during folding.

Intense shearing has been found along the length of the East Arm (Moorhouse 1946). Two faults with the same strike were recognized in the map-area; one passes through the peninsula between the Northwest Arm and Lake Timagami, the other passes through Devil Bay and Obabika Inlet. Both strike about N.50°E. and have an apparent left-hand movement. It should be noted that the fault passing through Devil Bay was nowhere observed; it is included on the map to explain the displacement of the axial traces of the folds that it cuts.

Two faults with an approximately north-south strike pass through the eastern part of Le Roche township. The Lorrain quartzite is sheared near them, and they offset the Lorrain-Gowganda contact. Both have an apparent left-hand movement. They could not be traced south of Obabika Inlet.

A fault striking N.30°W. was traced from the centre of LeRoche Lake. It is situated in a very pronounced lineament. The Lorrain Formation is sheared near it, and it displaces the Lorrain-Gowganda contact with an apparent right-hand movement. There is a well-defined lineament with the same N.30°W. strike, which passes through Greyowl Lake and can be traced northwestward into Shelburne township. However, no shearing was found in the rocks near the lineament, nor is the Lorrain-Gowganda contact displaced where it crosses the lineament.

The relationship between faults, folds, and diabase permits the recognition of a succession of events. The faults, which strike N.50°E., displace fold axes and are, therefore, later than the folding. Where they meet quartz diabase bodies, they cannot be traced through them and are presumably older than the Nipissing diabase. Furthermore, two thick dikes of Nipissing diabase in Cynthia and Joan townships have the N.50°E. strike, suggesting that fracturing in that direction is earlier than the injection of Nipissing diabase. The north-south fault passing through Eye Lake in LeRoche township intensely fractures the Lorrain Formation west of it. However, the sill of Nipissing diabase north of Devil Bay is not sheared on the east shore of Eye Lake. The diabase mass stops against the fault but is not cut by it, suggesting the north-south fault planes existed before the diabase was intruded. The fault northwest of LeRoche Lake, having a strike of N.30°W., is parallel to a fault in Delhi township, which displaces an olivine diabase dike (Lawton 1955, p. 14). This suggests that the fault northwest of LeRoche Lake is younger than the injection of olivine diabase, the intrusion of Nipissing diabase and the faulting on planes striking north-south and N.50°E.

Economic Geology

The two metals of economic importance in the map-area are copper and iron. Nickel, cobalt, silver, and gold are locally associated with copper. Small deposits of sand and gravel may be of economic interest if construction requiring these materials is undertaken in the area.

As some of the mineral deposits are localized in the Archean basement, the areas most promising in prospecting for such deposits are those in which the basement is exposed, or buried by only a thin cover of Cobalt sedimentary rocks. Where the Cobalt rocks are thin, geophysical methods have been successfully used to find mineral concentrations in the basement.

In the areas south and east of the Lorrain-Gowganda contact, the basement is probably less than 3,000 feet below the surface. From the available drilling data and from knowledge of the stratigraphy of the Gowganda Formation, it appears that, south of a line passing through Upper Bass Lake, Allan Lake, Jumping Cat Lake, Sand Point, and Bear Island, the basement is probably less than 1,000 feet below the surface. This line may be drawn northward from Bear Island and probably extends through Spout Lake, Side Rock Lake, Roko Lake, and Coppersand Lake.

COPPER

Copper occurs primarily as the mineral chalcopyrite and is concentrated in two distinct geological settings:

1. In shear zones, veins, and pods in Archean volcanic rocks, in association with pre-Algoman diorite.
2. In quartz-carbonate veins associated with Nipissing diabase.

The deposits mentioned in (2) are usually found near the contacts of the diabase masses, as irregular, low-dipping veins, in which the sulphides are distributed in patches.

IRON

Iron was only found concentrated in the pre-Huronian rocks; it occurs largely as magnetite. Aeromagnetic maps are, therefore, very useful in prospecting for iron deposits. Such maps are available from the Geological Survey of Canada. Two types of magnetite deposits have been recognized in the map-area:

1. Keewatin-type banded iron formation.
2. Magnetite replacement bodies associated with pre-Algoman basic intrusive rocks.

SAND AND GRAVEL

If sand and gravel should be required in the region, the most promising deposits seem to be those along the west side of Kokoko Bay, on the northwest side of Gull Lake, and on the west side of Obabika Lake, near the Belfast-LeRoche township boundary. The clay content in these deposits appears to be low, and large boulders are not abundant.

DESCRIPTION OF PROPERTIES

Andover Mining

The property consists of two groups of unsurveyed claims in the southwest corner of Joan township:

Group No. 1—nine claims, east of Redbark Lake.

Group No. 2—four claims, north of Longbow Lake.

Another group of twelve claims along the Joan-Belfast township line north of Redbark Lake was dropped after eight holes had been drilled and encouraging mineralization had not been encountered.

Groups Nos. 1 and 2 are easily accessible by bush roads leading from a prominent bay in Lake Timagami about 1 mile south of Sand Point.

The claims are all on the large Nipissing diabase mass occupying the west side of Lake Timagami in Phyllis and Joan townships. The eight holes drilled on the claim group north of Redbark Lake all indicate the diabase to be about 50 feet thick in that area and to be separated from the Archean basement by 100–200 feet of Cobalt sedimentary rocks. The log of a hole, drilled in the southwest corner of claim group No. 1 to investigate a magnetic anomaly, may be summarized as follows:

Footage	Description
0–5	Casing.
5–555	Nipissing diabase.
555 –1,014	Cobalt sedimentary rocks.
1,014–1,017.5	Keewatin andesite; epidotized.
1,017.5–1,076	Diabase with epidotization and shattering.

The log of another hole, drilled in the southwest corner of claim group No. 2, may be summarized as follows:

Footage	Description
0–5	Casing.
5–307.5	Nipissing diabase.
307.5–315	Cobalt sedimentary rocks.
315–322.5	Diorite (Nipissing?).
322.5–1,062.5	Cobalt sedimentary rocks with 1-inch quartz vein at 1,045 feet.
Core lost to the end of hole.	

Both holes were completed in the summer of 1958.

Gull Lake Property

The property consists of a group of unsurveyed claims, nineteen of which are in Phyllis township, largely in Gull Lake. The five southeasterly claims are held by Mining Geophysical Company Limited and the remainder by Abex Mines Limited.

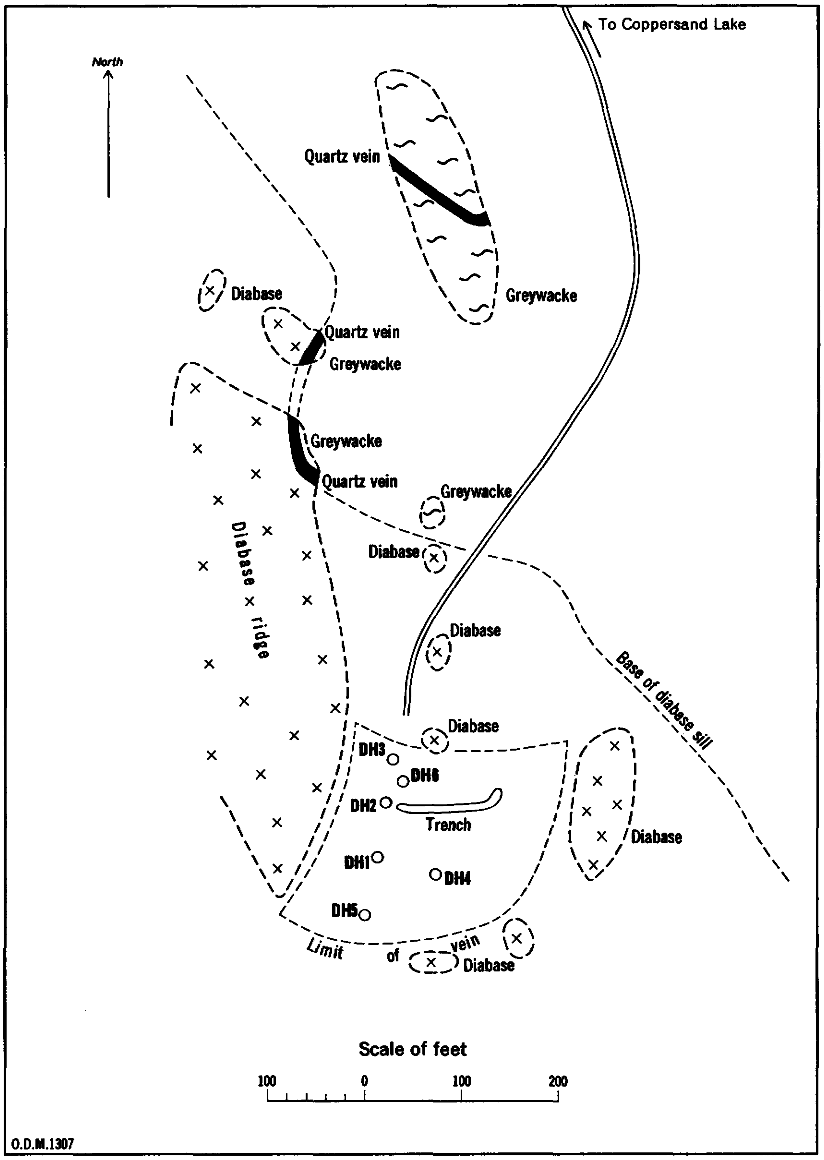
A portage connects Gull Lake and Lake Timagami.

In 1953, a geomagnetic survey led to the discovery of two anomalies. In 1956, an electrical restivity survey indicated an anomaly with a north-south trend, in the lake along the township boundary. Four holes were drilled on the anomaly through the ice in Phyllis township, and two of the holes intersected disseminated chalcopyrite,' pyrite, and pyrrhotite mineralization in the Cobalt sedimentary rocks.

Coppersand Lake

The property consists of a group of unsurveyed claims, six of which are in Cynthia township, just south of the Cynthia-Aston townships line, on the east shore of Ferguson Bay. The property may be reached either by boat or aircraft from Timagami. A trail and drill-road lead from a small dock on the south side of Sandy Inlet, north of the map-area, to the main showings south of Coppersand Lake.

There are several old pits and trenches exposing irregular quartz-carbonate veins along the eastern base of Mount Ferguson. These pits are said to have been put down more than 45 years ago and to be the work of Father Paradis of Porcupine. D. Derosier of North Bay, who staked the claims, had carried out



Sketch map of the Coppersand Lake showings; Cynthia and Aston townships.

some trenching and had drilled one short, vertical hole when the property was examined by D. Burk in May 1957. In 1960 three claims, around Coppersand Lake, were optioned to Mayer Mining Company Limited. When the property was examined by the author in July 1960, six short, vertical holes had been drilled on a flat-lying quartz vein, ¼ mile south of Coppersand Lake.

The showings lie in a small valley that runs in a northeasterly direction to join a larger northwest-trending valley in which the Coppersand Lake is situated. This larger valley lies along the eastern and lower contact of the diabase mass forming Mount Ferguson. In this area, the diabase mass is coarse-grained, granophyric, and has the structure of a sill. It is underlain by argillite, greywacke, and conglomerate of the Gowganda Formation. Near the lower contact of the sill, quartz-carbonate veins are found both in the diabase and the adjacent varved argillite.

There are three main showings, all in a small area about ¼ mile south of Coppersand Lake. Beginning in the south, there is a flat-lying quartz-carbonate vein containing pyrite, chalcopyrite, pyrrhotite, and galena in stringers and patches. This vein lies in the diabase, near its lower contact, and has inclusions of sheared diabase and argillite. Core from six short holes drilled through the vein shows that it ranges in thickness between 10 and 30 feet and that the mineralization is spottily distributed. Grab samples taken by Derosier gave the following results upon assay: copper, 1.36–10 percent; silver, up to 5.32 ounces per ton; lead, up to 3.59 percent. A chip sample collected by the author along a shallow trench 100 feet long was assayed by the Provincial Assayer and was found to contain: 0.02 ounces per ton of gold, 1.42 percent copper, and traces of cobalt, nickel, and silver.

To the north, at the diabase-argillite contact, there is a conformable vein of quartz and carbonate. It has a rolling strike and dips 20 degrees to the west and southwest. It ranges in thickness from 6 inches to 6 feet and is strongly mineralized at the base with chalcopyrite. Samples taken by Derosier contained: 9.22 percent copper, 0.13 percent nickel, 0.09 percent cobalt, and 8.56 percent silver.

About 200 feet to the north, on the west slope of the valley in which Coppersand Lake is situated, and about 100 feet below the lower contact of the diabase sill, an 8-foot-thick quartz vein cuts interbedded conglomerate and greywacke. This vein strikes N.30°W. and has a dip of 10°–40°NE. The vein is exposed in a northeast-trending cliff, and near the base of the cliff chalcopyrite is concentrated in patches.

International Cobalt and Silver[1]

The property consists of a group of 18 unsurveyed claims in Lake Timagami between Narrows Island and the claims held by Temagami Mining Company Limited.

An electro-resistivity survey was carried out during the winters of 1955–56 and 1956–57. Six holes were drilled through the ice. The thickness of the Cobalt sedimentary rocks overlying the Archean basement is 400–700 feet. In one hole, drilled between the first and second islands due east of Narrows Island, the Archean basement consisting of fragmental rhyolite was intersected at 412 feet. At 444 feet, a one-inch calcite vein with chalcopyrite mineralization was intersected.

[1]In May 1958, International Cobalt and Silver Mining Company Limited was renamed, International Copper and Cobalt Mines Limited.

Kokoko Iron Range

In Cynthia township, the property consists of a group of eleven claims around Ferrim Lake and is part of a larger group of claims staked along an iron formation band that extends from the east shore of Kokoko Lake, just south of Ferrim Lake, into Chambers township. Some work has been done on the iron range since the turn of the century. In 1942 it was described by Moorhouse (1946). In 1951 the iron formation was investigated by Dominion Gulf Company, which staked the claims during December 1951 and January 1952. The claims are now held by Jalore Mining Company Limited, a Canadian subsidiary of Jones and Laughlin Steel Corporation, Pittsburgh, Pa., U.S.A.

North-south lines have been cut at 400-foot intervals, and occasionally at 200-foot intervals, for magnetometer surveys and detailed mapping. During the summer of 1952, an extensive surface program was carried out, including 2,927 feet of earth trenching and 1,339 feet of rock trenching. This was followed by a diamond-drilling program.

The iron formation occurs in a ridge trending in a general northwest-southeast direction and ranges in breadth from 300 to 1,000 feet. Outcrops of iron formation occur as shoals in Kokoko Lake southwest of Ferrim Lake, and ground magnetometer work suggests that Ferrim Lake is underlain by iron formation.

The iron formation consists of alternating bands of magnetite, silica, and jasper. Some martite is associated with magnetite. There are lenses in which magnetite is interbedded with jasper alone, and others in which magnetite is interbedded only with silica in the form of fine-grained quartz or chert. The magnetite-jasper lenses are said to have a higher grade and to be fairly common. The banding ranges in thickness from very fine to 2 inches and averages about ¼–½ inch. Locally the iron formation is brecciated, the fragments being cemented by silica. Dragfolding is common, and in some outcrops it can be observed that the chert and jasper bands have broken, and magnetite was injected into the cracks. Two prominent directions of faulting have been recognized: one striking N.35°E., and the other N.50°E. Both left-hand and right-hand movement has taken place.

Magnetite forms 10–50 percent of the rock by volume, and the magnetite grains have a diameter averaging about 0.18 millimetres. Preliminary sampling indicates a grade of 25–40 percent iron over a width of 500 feet.

Myteque Mines Limited

Two groups of claims are held by the company. The Spawning Bay group in Joan township consists of twelve unpatented claims lying immediately north of Timagami Island and east of Bear Island. The Shiningwood Bay group lies in Shiningwood Bay between Denedus Island and Denedus Point. All claims in the latter group had been dropped by 1960.

In 1956 a vertical hole was drilled 832 feet through interbedded conglomerate and quartzite north of Denedus Island. In 1957 logs of two holes drilled through the ice on the Spawning Bay group were submitted to the Ontario Department of Mines as assessment work. The holes are about a ¼ mile apart on an east-west line about ¼ mile north of Timagami Island. The more westerly hole was drilled to a depth of 1,163 feet, with 105 feet of casing. The rock encountered above 778 feet is described as rhyolite cut by diorite dikes and interbedded with grit. Between 778 and 813 feet, the rock encountered was highly shattered, and chalcopyrite was disseminated through it. The hole was stopped in amygdaloidal lava. The second hole was drilled to a depth of 1,550 feet; rocks similar to those encountered in the first hole were intersected, but no mineralization was found.

Temagami Mining Company Limited

The mine is located on the isthmus joining the northern and southern halves of Timagami Island, in the eastern part of Phyllis township. In 1960 the property holdings consisted of a mineral lease on the central part of Timagami Island, leases on 11 other islands, 81 surveyed claims, and 92 mining claims held by location. The extent of the holdings in Phyllis and Joan townships is shown on the map.

The mine may be reached by boat or aircraft from Timagami. A road was built by the company, with government assistance, from a point on the mainland opposite the mine to join highway No. 11 south of Timagami. The company operates a ferry between the mine and the west end of the road.

In 1942, Moorhouse (1946, p. 42) suggested further prospecting on sphalerite, chalcopyrite, and pyrite showings on Timagami Island; in 1951 the Ontario Department of Mines granted D. Derosier of North Bay Licence of Occupation No. 12036 to carry out further work on two of these showings. This was optioned to H. W. Knight, Jr., in the fall of 1951. Eight holes were drilled, and sulphide zones were intersected. Several assays indicated interesting nickel and copper values over mineable width.

In 1952, Derosier Nickel and Copper Mines Limited was incorporated, and L. O. 12092 was added to the property. It was then optioned to Frontenac Exploration and Development Corporation, which made a geophysical survey of the property and drilled 77 holes (35,841 feet) before dropping the option in 1953.

In 1954, Temagami Mining Company Limited was incorporated to consolidate the holdings, in the area, of several companies of which N. B. Keevil was president. The Derosier property was acquired by amalgamation, and lease No. 11446 was obtained in lieu of the two licences of occupation. Two high-grade, massive, sulphide bodies had been discovered by drilling on two small, but distinct, electrical anomalies. The ore was mined by open-pit method and shipped by barge to Timagami. It is estimated that these two orebodies contained 30,000 tons of 22-percent copper ore, and 5,000 tons of 7-percent copper ore.

In January 1956 a contract was given to Patrick Harrison and Company Limited, of Noranda, Que., to sink a shaft 550 feet and do 4,000 feet of lateral work. At that time three different types of ore were recognized:

1. Low-grade, pyritic, Cu-Ni-Co ore.
2. "Open pit" high-grade, massive, sulphide copper ore.
3. Fissure-filling veins and disseminated chalcopyrite ore.

By the end of 1957 world copper prices had dropped by 40 percent, and low-grade Cu-Ni-Co "ore" was no longer ore. However, more of types 2 and 3 ore was found, and in 1958 a small mill was built on Timagami Island and is at present operating at 150 tons per day.

Open-pit mining of No. 2 orebody may be completed in the spring of 1961. The lower parts of Nos. 1, 2, and 3 orebodies were reached from sublevels at about 300 and 200 feet below the shaft collar. Underground mining is otherwise being carried out on three levels: at 400, 525, and 825 feet. A program of exploratory drilling down to 1,800 feet from the 825-foot level is underway.

On 30 June 1960, the company estimated that its ore reserves were 113,668 tons averaging 8.4 percent copper, and that it had shipped, since start of production, 36,406 tons of concentrates and development ore, averaging 24.2 percent copper, 0.10 ounces gold per ton, and 1.26 ounces silver per ton.

The general geology of Timagami Island and the mainland to the east is described by Moorhouse (1946). On his map (No. 51e) the contact between the acid and basic volcanic rocks passes through Timagami Island. The detailed work around the mine has shown that the basic rock north of the contact is a metadiorite sill having a width of about 800 feet. This is shown on the map. North of the main metadiorite sill there is a complex of greenstone flows and sill-like basic intrusions some of which are gabbroic in composition, and this is overlain to the north by Gowganda conglomerate. Along its south contact, the metadiorite is intensely chloritized, and base metal mineralization occurs intermittently along it for a distance of 5 miles from the southwestern part of Briggs township to an area southwest of Timagami Island. Three main lenticular zones of Cu-Ni-Co mineralization occur along this line, but their grade is too low to be economic at present.

The acid volcanic band south of the sill consists of rhyolite breccia and tuff lenses. In it two major types of ore deposits are found:

1. Lenses of high-grade copper ore—massive chalcopyrite.
2. Steeply dipping, fissure-filling, quartz, carbonate, chalcopyrite veins with extensive replacement of the wallrock.

These are approximately parallel in strike and dip to the metadiorite-rhyolite contact.

The ore milled in the year ending 30 June 1960 contained, in addition to copper, 0.02 ounces per ton of gold and 0.40 ounces per ton of silver.

There are two main fault sets: one set of thrust faults striking nearly east-west and dipping about 60°S.; and a set of nearly vertical normal faults, striking a little west of north. It appears that the intersection of these two fault sets controls the localization of high-grade sulphide lenses to some extent.

The orebodies are characteristically surrounded by a zone in which the host rock is either sericitized, carbonatized, and tourmalinized as is the case for orebodies Nos. 1, 2, 3, 4, 7, 8, and 10, or chloritized as is the case for orebodies Nos. 5, 6, 9, and 11.

Four types of dikes may be recognized in the mine area:

1. Lamprophyre, with or without mafic phenocrysts, and locally altered.
2. Diorite, fresh to moderately altered, massive and medium- to fine-grained.
3. Gabbro, coarse- to fine-grained and altered to chlorite, carbonate, amphibole rock, or amphibolite.
4. Diabase of Nipissing type.

The first three types are all pre-ore. It is not certain whether or not the diabase is post-ore.

The detailed map of the mine area (*facing* p. 25) was compiled by W. S. Savage, resident geologist of the Ontario Department of Mines at Kirkland Lake, from his own observations and from information supplied by Temagami Mining Company Limited. The map shows the generalized geology and the location of the orebodies and mine workings. The schematic vertical section of the mine, shown on the map, indicates the relationship of the orebodies to the mine levels.

Skunk Lake Property

The property consists of a group of thirteen patented claims in Phyllis and Scholes townships, on the north side of Skunk Lake, held by Temagami Mining Company Limited.

Skunk Lake is connected to Lake Timagami by a good portage about ¼ mile long.

The only rocks found exposed in the claim group are Nipissing diabase and Gowganda conglomerate. The diabase is part of the large mass occupying the western parts of Phyllis and Joan townships, and at one point, near the Phyllis-Scholes township boundary, the diabase was found in concordant contact with underlying Gowganda conglomerate. Near its lower contact the diabase is medium- to fine-grained and appears fresh.

Twelve holes in all, amounting to 6,646.5 feet, were drilled, and a detailed magnetometer survey was carried out to investigate a magnetic anomaly near the northwest tip of Skunk Lake. The last nine holes were drilled in 1957.

The author's account of the subsurface geology of the property is based on a report prepared for Temagami Mining Company Limited by C. G. McIntosh of Geophysical Engineering and Surveys Limited of North Bay. In the Skunk Lake area the Archean basement is overlain by only a thin cover of nearly flat-lying Gowganda conglomerate, greywacke, and a little argillite. The Archean basement consists of rhyolite and rhyolite breccia intruded by gabbro, apparently pre-Cobalt in age. Seven of the drillholes intersected carbonate bodies.

The rhyolite is medium- to fine-grained and grey; in the breccia the fragments are up to 1½ inches in diameter and slightly darker than the matrix.

The gabbro is fine- to coarse-grained; the coarser facies resembles Nipissing diabase superficially, but the gabbro is lighter in colour and more highly altered. Contacts between gabbro and rhyolite are indistinct in drill core as a result of reaction between the two. The contact between gabbro and the overlying Cobalt sedimentary rocks is sharp, without any change in the grain size of the gabbro as the contact is approached. The preponderance of evidence suggests a pre-Cobalt age for the gabbro.

The carbonate bodies are medium-grained, grey to dark bluish grey in some sections, and fine-grained, light grey and vuggy in others. In three holes intensive carbonatization was found in the volcanic rocks adjacent to the carbonate masses.

Magnetite occurs in fine-grained, dark-brown, fairly massive replacement bodies and banded disseminations associated with the gabbroic intrusions. As the magnetite bodies are approached, the degree of alteration in the gabbro increases until the original rock is converted to an aggregate of fine-grained, dark-green amphibole and chlorite. The magnetite masses are believed to be roughly lenticular bodies dipping at 65–70 degrees and having long axes trending in an east-west direction.

Associated with the magnetite are carbonate, amphibole, and garnet, and minor amounts of pyrite, chalcopyrite, pyrrhotite, and apatite. Zones of sparsely disseminated pyrite, chalcopyrite, and pyrrhotite occur within the magnetite bodies, and minor amounts of pyrite and chalcopyrite occur in the highly altered zones surrounding them.

Fairly massive magnetite bodies were found to a depth of 350 feet below the pre-Cobalt unconformity and from a consideration of geophysical and drilling data, it is roughly estimated that 2,000,000 tons is the maximum amount of magnetite ore to be expected to that depth.

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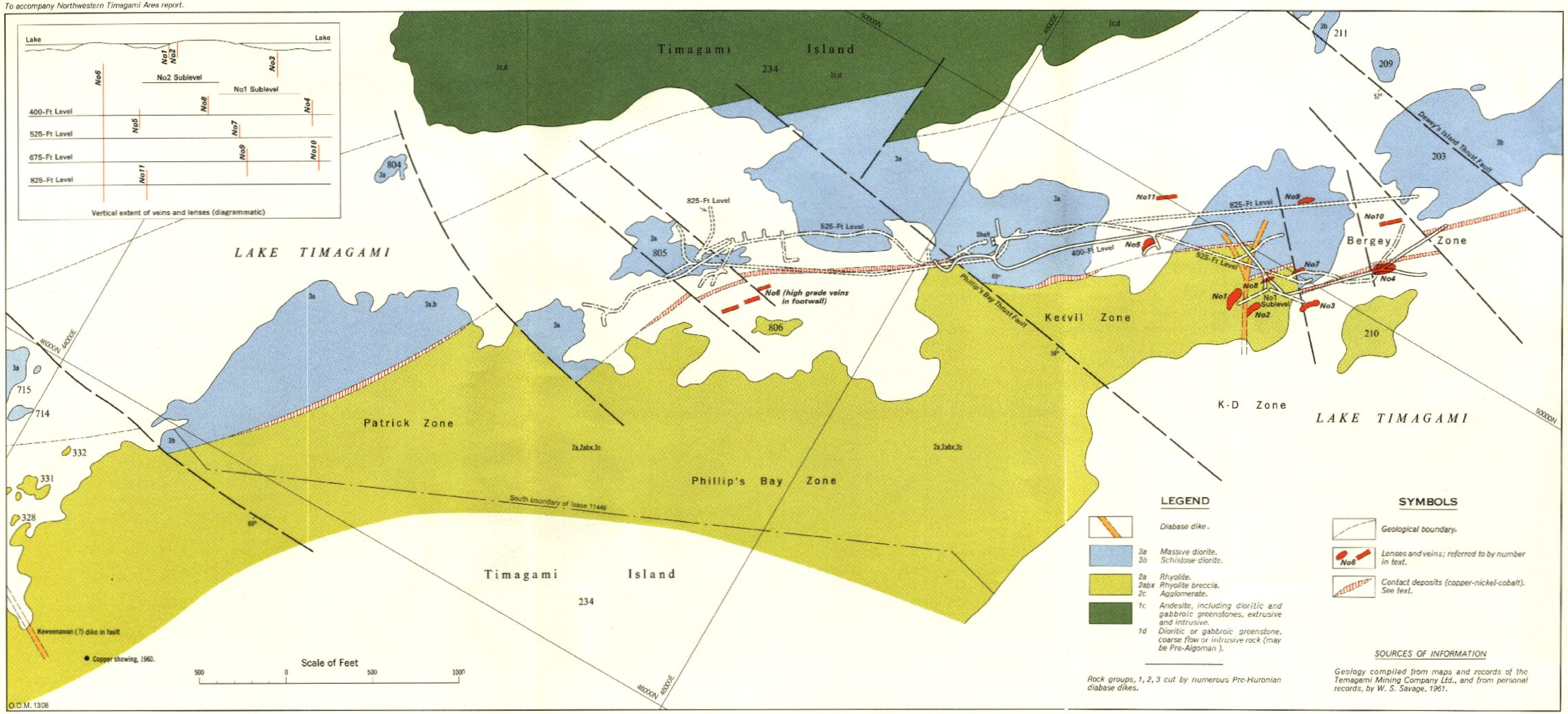
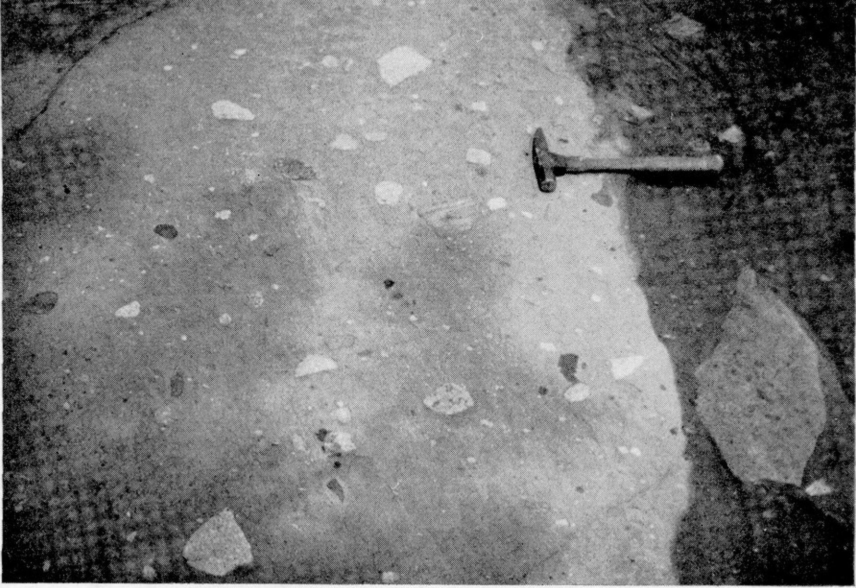
To accompany Northwestern Timagami Area report.



Geology and underground workings; Temagami Mining Company Limited, Timagami Island, Phyllis Township.



Map 2057
Northwestern Timagami Area